STRATIGRAPHIC NOMENCLATURE OF THE MIOCENE SUPERSTITION VOLCANIC FIELD, CENTRAL ARIZONA

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Introduction

The Superstition volcanic field is defined as all area within the outcrop belt of the Apache Leap Tuff. This definition follows that of Sheridan (1978) who defined the Superstition - Superior field as the area within the areal extent of the Apache Leap Tuff and the Superstition Tuff. Before Sheridan (1978) coined the term Superstition – Superior volcanic field, the field was referred to as the Superior volcanic field (e.g. Ransome, 1903; Sheridan et al., 1969). Since it has become apparent that the Apache Leap Tuff and Superstition Tuff are part of the same major regional ash-flow tuff sheet (Ferguson et al., 1998; McIntosh and Ferguson, 1999), and because it is clear that volcanoes in the Superstition Mountains were the source of most of the region's Mid-Tertiary volcanic rocks, shortening the name to the Superstition volcanic field seems appropriate.

Until recently, a unified stratigraphic framework consistent with modern high-precision dating techniques has not been possible for the Superstition volcanic field. Recent mapping by the Arizona Geological Survey in the western and southern parts of the volcanic field (Ferguson and Skotnicki, 1995; Ferguson and Skotnicki, 1996; Ferguson and Gilbert, 1977; Gilbert and Ferguson, 1997; Richard and Spencer, 1997; Skotnicki and Ferguson, 1995; Skotnicki and Ferguson, 1996; Skotnicki and Leighty, 1997; Spencer and Richard, 1995a) integrated with previous maps (Ransome, 1903; 1904; 1919; 1923; N. P. Peterson et al., 1953; N. P. Peterson, 1954; 1963; D. W. Peterson, 1960; 1969; Nelson, 1966; Cornwall et al., 1971; Cornwall and Krieger, 1975a; 1975b; Suneson, 1976; Banks and Krieger, 1977; Theodore et al., 1978; Creasy et al., 1983; Peterson and Jinks, 1983; Prowell, 1984; Faulds, 1986) has produced a series of comprehensive maps of the region (Spencer and Richard, 1995b; Richard and Spencer, 1998; Spencer et al., 1998a; 1998b; Richard, 1998). This body of work, complemented by an extensive, high-precision, sanidine, single-crystal, laser-fusion $^{40}Ar/^{39}Ar$ dating program in collaboration with the New Mexico Geochronological Research Laboratory (McIntosh and Ferguson, 1998), is the basis for the new stratigraphic framework.

Our work shows that only one regional ash-flow tuff is present (the 18.58 ± 0.03 Ma Apache Leap Tuff), and that this tuff was probably derived from only one major source cauldron (the Superstition Cauldron). The Apache Leap Tuff occurs in the middle of a relatively simple sequence of lava and sedimentary units that span the interval of time 20.5 – 16.0 Ma. Previously, 4 major ash-flow tuff units and at least 4 major source cauldrons had been identified, along with a complex sequence of interbedded lava, non-welded tuff, and sedimentary units that spanned a much longer (27-14 Ma) interval of time (Stuckless and Sheridan, 1971).

Purpose

The purpose of this report is to list, describe, and classify all previously named Mid-Tertiary stratigraphic units of the Superstition volcanic field and to correlate them with the various units of the new stratigraphic framework.

Justification

Over the past 100 years, an extremely large and confusing set of informal and formal stratigraphic names have been proposed in the Superstition volcanic field. Unfortunately, adherence to the Code of Stratigraphic Nomenclature (American Commission on Stratigraphic Nomenclature, 1970) has been slight to nonexistent. Most names were introduced in graduate theses and dissertations, guidebook articles, and open-file reports, but some also appeared in a series of peer-reviewed journal articles. A great wealth of petrographic and analytical data is contained in these works, but without a

detailed understanding of the history of stratigraphic nomenclature it is very difficult to use this data in the context of relative and absolute geologic time. Since knowing the true stratigraphic position of volcanic units is of vital importance to the interpretation of the magmatic, volcanic, and structural evolution of the Superstition volcanic field, we feel that the creation of this lengthy document is warranted, and we hope that it will be used by future researchers.

Defining stratigraphic units

Formally defined rock-stratigraphic units are recognized based on a set of criteria established in the Code of Stratigraphic Nomenclature (American Commission on Stratigraphic Nomenclature, 1970). For a unit to merit formal designation, objective criteria for recognition must be described, a type area or section must be established, and all of this information must be presented in a formally reviewed, easily accessible publication.

Formal units are given names according to Article 10 of the Code of Stratigraphic Nomenclature (American Commission on Stratigraphic Nomenclature, 1970). A formal name, regardless of rank is binomial, consisting first of a geographic name, and second of a descriptive lithologic term or appropriate rank term such as member, formation or group. Capitalization of the initial letters of all words used in forming a formal name is recommended. A unit that consists entirely of shale may receive a name such as Mancos Shale, but if the unit consists of several lithologies, the name should only indicate its rank (for example San Rafael Group, Kayenta Formation, or Brushy Basin Member).

Informal units can be defined for practically any reason and introduced in open-file reports, guidebook articles, unpublished industry geologic reports, and graduate student theses or dissertations. The informal unit can later be elevated to formal status by publication of the aforementioned descriptions and definitions in a formally reviewed journal article, map, or stratigraphic chart. Although not necessary, informal units may use a geographic location as part of the name, but the geographic name should appear at the end of the name, such as "unit of Apache Gap" or "rhyodacite of Apache Gap". Introducing the informal name "Apache Gap rhyodacite" is not recommended since verbal transmission of the name can not convey the essential lower case nature of the word "rhyodacite".

Categories for the classification of unit names

All stratigraphic units in this report are classified into six categories: 1) New, 2) Retained, 3) Renamed, 4) Redefined, 5) Obsolete, or 6) Generic. The classifications are described below.

[NEW]
These are units whose names are introduced for the first time as part of this report. The type area or section for each of the new formal units is described in Part I of this report.

[RETAINED]
These are previously named formal and informal units whose names and definitions are unchanged. Many of these are informal units that are recognized as viable subdivisions of recently defined or redefined formal and informal units.

[RENAMED]
These are previously named units whose lithologic definitions have not changed, but whose names are changed in accordance with the rules of the Code of Stratigraphic Nomenclature. Most of these are informal units that were incorrectly given formal names, either because they were introduced in

unpublished graduate student theses or dissertations or because they were introduced without proper identification of type section, type area, or defining characteristics. Also, in some cases, we rename units because their lithologic name was inappropriate. For example, the breccia of Mesquite Flat was renamed unit of Mesquite Flat because breccia is a very minor lithologic component of the unit. This category also includes units that are renamed because they were referred to by more than one name in the same publication, or renamed because the unit had previously been named using a different type locality.

[REDEFINED]
These are previously named units whose definition required modification based on information gathered since the unit was originally defined. An example is the Apache Leap Tuff, originally defined for exposures of the outflow sheet in the eastern and southern parts of the field (D.W. Peterson, 1969). Since then, it has been shown that the Superstition Tuff of Stuckless and Sheridan (1971) is part of the same ash-flow tuff sheet, and for reasons discussed in its redefinition, Apache Leap Tuff is now considered the name for the entire unit.

[OBSOLETE]
This category includes formal and informal names that are abandoned to avoid confusion, because of precedence, or because the unit had to be redefined and renamed. An example of obsolescence due to precedence is the Superstition Tuff (Stuckless and Sheridan, 1971) which is abandoned because it has been shown that it is the same as the Apache Leap Tuff (D.W. Peterson, 1969). An example of abandoning a unit name to avoid confusion is the breccia of First Water (Sheridan, 1978) and the rhyolite of First Water (Sheridan and Prowell, 1986) because both units use the same place name for type areas. An example of a unit that is obsolete because it had to be both redefined and renamed is the Geronimo Head Formation (Stuckless and Sheridan, 1971) which was later shown (Prowell, 1984; Ferguson and Gilbert, 1997) to include two distinct and separate units of differing age and composition.

[GENERIC]
A generic unit is defined simply in terms of its general lithology and with little regard to its stratigraphic position. For example, the "unwelded bedded tuff" unit of Ferguson and Skotnicki (1995) is associated with several lava units in the Whitlow Canyon area. There are, however, some unit names that may appear to be generic because they consist simply of a lithologic name such as "basalt" or "older basalt". However, if the unit has stratigraphic relevance (i.e. it fits into a stratigraphic framework) it is not considered a generic unit.

Structure of this report

The report is divided into three parts. Part I summarizes the details of the new stratigraphic framework. Parts II and III are lengthy cross-referenced lists of all known stratigraphic names ever used in the Superstition volcanic field.

Part II is indexed according to stratigraphic names. Each currently recognized stratigraphic division is given a heading followed by a chronologic list (based on first appearance in the literature) of all previously used unit names that are included in any way as part of that division. Each listing also gives all reference(s) to publication(s) that use the name.

Part III is indexed according to publication, alphabetically. For each publication all stratigraphic units recognized by that work are listed in stratigraphic order (youngest to oldest), followed by a

description of how and why the unit was originally named, and how it fits into the new stratigraphic framework.

For all of the unit names listed in this report, we follow a standard format in which the older name is listed exactly as it appears in the original publication followed by its classification in brackets, and then its new name or names in terms of the new stratigraphic framework. In all cases, the new name or names are followed by a complete breakdown of its new stratigraphic hierarchy.

Example:

old name (map symbol if any) [CLASSIFICATION] new name - larger division – largest division

There are many instances where a unit is referred to by slightly different names in the original publication. In some instances it is clear that the different names are merely variations of the same unit, but in others, it seems that the different names were intended to signify slight differences in the nature of the unit. In both cases we list all of the original names to the left of the **[CLASSIFICATION]**, and separate each of the names with an upper case AND.

We classified many older units as obsolete because they cross unit boundaries within the new stratigraphic framework. In this case, all new units that include parts of the old unit are listed to the right of the classification and separated by an upper case OR. Several examples of these notations are shown and described below.

Examples:

basalt of Willow Springs (Twsb) [RETAINED] basalt of Willow Springs - Gila Group
This is an informal unit whose definition and name has not changed, except that it is now considered part of the Gila Group

upper basalt (Tbu) [RENAMED] basalt of Black Mesa – Gila Group
This unit's definition has not changed, but since it is the same as a previously described unit, its name is changed.

upper ash-flow tuff (Tafu) [OBSOLETE] Apache Leap Tuff OR **tuff - Coffee Flat Mountain Formation – Gila Group**
This informal unit correlates with two different formal units of the new stratigraphic framework.

Geronimo Head formation AND **Geronimo Head Formation (Tg) [OBSOLETE] Tule Canyon Formation - Superstition Group** OR **Whitlow Canyon Formation - Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group**
This unit was inadvertently referred to by slightly different names in the original publication. For reasons described in the actual text of Part II, it is considered obsolete.

Willow Creek Rhyolites (text) AND **Willow Creek Rhyolite tuff (Twrt)** AND **Willow Creek Rhyolite lavas (Twrl) [OBSOLETE] Tule Canyon Formation - Superstition Group** OR **Whitlow Canyon Formation - Superstition Group** OR **monolithic avalanche breccia - Gila Group**
This unit was originally divided into three different subdivisions based on composition, but the differences between each are so slight that separate entries for each name are not given. The units are

considered obsolete for two reasons. First, although never formally defined, this unit was given a formal name. Second, the unit's definition and map pattern is such that it correlates with three different units of the new stratigraphic framework, two of which are formally defined.

PART I

STRATIGRAPHIC FRAMEWORK OF THE SUPERSTITION VOLCANIC FIELD: A SUMMARY

The laterally persistent and petrographically distinctive Apache Leap Tuff is the most important regional rock-stratigraphic marker unit of the Superstition Volcanic Field, and it forms the basis for the new stratigraphic framework. Apart from the Apache Leap Tuff, three other main stratigraphic divisions are recognized: the pre-volcanic Whitetail Formation, the pre-Apache Leap Tuff Superstition Group which comprises three volcanic formations, and the Gila Group (post-Apache Leap Tuff) which comprises two volcanic formations contained within a thick, and heterogeneous succession of volcaniclastic sedimentary rocks. The Apache Leap Tuff represents a regional time-line that separates the Superstition Group and the Whitetail Formation from the Gila Group, whereas the contact between the Superstition Group and the Whitetail Formation is time-transgressive. Two problematic informal units (because their age relationship to the Apache Leap Tuff is unknown) of probable formation rank are also recognized, and tentatively assigned as subdivisions of the Superstition Group.

Following are descriptions of the principal stratigraphic units of the Superstition Volcanic Field, listed from youngest to oldest. There are five numbered divisions used throughout this report, representing the major divisions of the stratigraphic section according to the stratigraphic framework described above: 1) Gila Group; 2) Apache Leap Tuff; 3) Superstition Group; 4) San Manuel Formation; and 5) Whitetail Formation. Note that the numbered divisions are not equal in rank. Table 1 summarizes some important characteristics of the major stratigraphic divisions. Table 2 shows the hierarchy of the stratigraphic framework presented in this report and lists the currently accepted stratigraphic subdivisions of each principal unit.

[1. GILA GROUP]

Gila Group [REDEFINED] (18.6 - ~15 Ma)

The post-volcanic conglomerates of the Superstition volcanic field were referred to as Gila conglomerate or Gila Conglomerate by early workers (Ransome, 1903; 1904; 1919; 1923; N. P. Peterson, 1954; 1961; 1963; N. P. Peterson et al., 1954; D. W. Peterson, 1960; Nelson, 1966) who correlated these deposits with the Gila conglomerate of Gilbert (1875). In the Superstition volcanic field, the Gila Group is redefined to encompass all volcanic and volcaniclastic rocks that overlie the Apache Leap Tuff. As redefined, the Gila Group includes two new volcanic formations that interfinger with multiple units of locally derived, basin-filling, lithified to unlithified conglomeratic units. In Gilbert's (1875) type area in eastern Arizona, the Gila Conglomerate is currently defined as "unlithified to lithified, dominantly clastic sediments deposited in closed basins" by Richter et al., 1983; Houser et al. (1985). Richter et al. (1983), and Houser et al. (1985) defined the base of the Gila Conglomerate as the top the conglomerate of Bonita Creek, a distinctive volcanic and volcaniclastic unit, and the uppermost flow of this unit has been dated at 18.2 ± 0.05 Ma (Enders, 2000; Ferguson et al., 2000). Although referred to as a "Conglomerate" in its type area by Richter et al. (1983), and Houser et al. (1985) other workers refer to this unit as the Gila Group (e.g. Heindl, 1962; 1963; Cather et al., 1994). We prefer the term group since, as we define it, the Gila Group

includes abundant volcanic rocks. The upper contact of the group is defined as the transition from closed basin sedimentation to incision related to the onset of through-going drainage of the ancestral Gila River system.

As we define it in the Superstition volcanic field, the Gila Group includes post-cauldron breccias within Superstition Cauldron, and many other sequences of sedimentary rocks within half-graben basins throughout the volcanic field. Many of these sedimentary sequences preserve fanning dip sequences in the Basin and Range portion of the volcanic field. In two areas, felsic volcanic rocks dominate the Gila Group, and these successions are formally defined as the Coffee Flat Mountain and Picketpost Mountain formations.

In areas where older volcanic rocks are absent, sedimentary rocks of the Gila Group can be distinguished from the older, pre-volcanic Whitetail Formation because the younger rocks are volcaniclastic. At the southern edge of the Superstition volcanic field, the formal unit Big Dome Formation (Cornwall and Krieger, 1975a), herein defined as part of the Gila Group, contains abundant clasts of the Apache Leap Tuff.

Picketpost Mountain Formation – Gila Group [NEW] (approximately 17 - 16 Ma)

This is a new formal unit consisting of numerous felsic lavas and nonwelded tuffs that interfinger with the volcaniclastic rocks of the Gila Group in the southernmost part of the Superstition volcanic field. The unit ranges in thickness from 0 – 400 meters. The unit is significantly younger than any of the felsic volcanic rocks in the central part of the volcanic field including the Coffee Flat Mountain Formation and it was probably derived from a completely different magmatic system. It is included as part of the Superstition volcanic field because it overlies the southern outflow sheet of the Apache Leap Tuff. The formation is divided into several informal units and four redefined formal members some of which were originally defined as formations: Roadrunner Rhyolite, Sleeping Buffalo Rhyolite, Arnett Rhyolite Member, and Heliograph Member. The most complete section of the Picketpost Mountain Formation is at Picketpost Mountain near Superior. A type section is proposed along cross-section line B-B'-B" of Nelson (1966) through the middle of the mountain. The section consists of 150 meters of the Arnett Rhyolite Member (a lava flow with a thin underlying non-welded tuff unit) overlain by 105-190 meters of tuffaceous sandstone and non-welded tuff, and is capped by 225 meters of the Heliograph Member (a lava flow derived from a nearby vent that makes up the northern part of the mountain).

Coffee Flat Mountain Formation – Gila Group [NEW] (18.6 - 17.9 Ma)

The Coffee Flat Mountain Formation consists of the felsic lavas and nonwelded tuffs that accumulated within or near the margins of the Superstition Cauldron. The unit ranges in thickness from 0 to 600 meters and is concentrated within a northwest-striking graben that transects the eastern half of the Superstition Cauldron. The unit is defined based on location (proximity to the Superstition Cauldron) and stratigraphic position (overlying the Apache Leap Tuff). The unit is heterogeneous, consisting of a wide variety of crystal-poor and crystal-rich felsic and intermediate lava, lava breccia and related tuffs. The type area is at Coffee Flat Mountain in the southeast corner of the Superstition Cauldron. The unit does not include post-cauldron basaltic lavas or significant accumulations of volcaniclastic sedimentary rocks that are included as informal units within the Gila Group. Since the Coffee Flat Mountain Formation is such a heterogeneous unit, no type section is proposed. Instead, a type area at Coffee Flat Mountain in the southern Superstition Mountains is proposed. A pair of reference sections that characterize the unit are suggested. In the northern Superstition Mountains a composite section through two overlapping lava domes of crystal-rich rhyolite (the Geronimo Head and Malapais domes of Prowell, 1984) attains a probable

thickness of 580 meters. To the south, a thickness of 400 meters consisting of two flow units of crystal-rich rhyolite lava is present at Coffee Flat Mountain (Ferguson and Skotnicki, 1995).

[2. Apache Leap Tuff]

Apache Leap Tuff [REDEFINED] (18.58 ± 0.03 Ma)

The Apache Leap Tuff is a crystal-rich (25-55% phenocryst), plagioclase-, sanidine-, quartz-, biotite-phyric quartz latite ash-flow tuff. It was originally defined by D. W. Peterson (1969) in the eastern part of the volcanic field and originally, it was restricted to this area. It is redefined to include the Superstition Tuff (Stuckless and Sheridan, 1971), tuff of Comet Peak (Ferguson and Skotnicki, 1995), and the San Tan Tuff (Balla, 1972) or welded tuff (Ferguson and Skotnicki, 1996) in the Santan Mountains. The tuff includes a number of informal flow-unit, and syn-cauldron breccia units within the Superstition Cauldron. The tuff is at least 800 meters thick inside the Superstition Cauldron. In its outflow sheet the tuff ranges in thickness from 0 to 600 meters, with the greatest thickness occurring at its type section, the Apache Leap near Superior.

[3.Superstition Group]

Superstition Group [NEW] (~20 – 18.6 Ma)

The Superstition Group is a new term used to describe the main mass of volcanics that underlies the Apache Leap Tuff throughout the Superstition volcanic field. The group has a lower contact that is demonstrably time-transgressive and an isochronous upper contact in areas where the Apache Leap Tuff is present. In the main part of the volcanic field Superstition Group encompasses three formations: Government Well Formation, Tule Canyon Formation, and Whitlow Canyon Formation, and possibly two other informal units. Towards the margins of the field the Superstition Group is either undivided or divided into informal units of limited extent. The type area of the Superstition Group is the Superstition Mountains. It ranges in thickness from 0-2,000 meters.

Whitlow Canyon Formation – Superstition Group [NEW] (18.75 - 18.55 Ma)

The Whitlow Canyon Formation consists of a distinctive suite of crystal-poor to moderately crystal-rich (2-15% phenocrysts), lavender-colored, rhyodacitic lava and lesser amounts of non-welded tuff. It ranges in thickness from 0 to 300 meters. The formation appears to have a slightly time-transgressive lower contact and an isochronous upper contact. Its lower and upper contacts are defined as the first and last appearance of lava with the distinctive phenocryst assemblage: plagioclase, sanidine, embayed quartz, biotite. The type section, near the confluence of Tule Canyon and Whitlow Canyon in the southern Superstition Mountains, consists of massive coherent facies lava 210 meters thick.

Tule Canyon Formation – Superstition Group [NEW] (19.0 - 18.7 Ma)

The Tule Canyon Formation consists of a distinctive sequence of crystal-poor (0-10% phenocrysts) rhyolite lava and non-welded tuff that ranges in thickness from 0 to 800 meters. The unit replaces several previously described units, principally the rhyolite of First Water (Sheridan and Prowell, 1986) and parts of the Geronimo Head Formation (Stuckless and Sheridan, 1971). The formation's upper and lower contacts are defined as the last and first appearance of crystal-poor rhyolite lava or tuff, and these contacts appear to be nearly isochronous. The formation also contains rare, thin basaltic lava flows. The type section, near the headwaters of Tule Canyon in the

southern Superstition Mountains, is 535 meters thick. The section consists of three tuff units interleaved with three lava flows.

Government Well Formation – Superstition Group [NEW] (~20 - 19.0 Ma)

The Government Well Formation is a rock-stratigraphic unit consisting of mafic and intermediate lava, and associated non-welded tuff, tuff breccia, and volcaniclastic rocks that ranges in thickness from 0 to 1,500 meters. The Government Well Formation overlies and locally interfingers with non-volcaniclastic sedimentary rocks of the Whitetail Formation and is overlain by rhyolitic lava and tuff of the Tule Canyon Formation. The lower contact is defined as the first appearance of volcanic rocks that dominate (>70%) the stratigraphic sequence, and in most areas, these rocks are basaltic. The upper contact is defined as the first appearance of crystal-poor rhyolite lava or tuff, and this contact appears to be isochronous throughout the main part of the field. The formation is divided into informal lower and upper divisions with the first appearance of dacitic lava defining the base of the upper division. The lower division consists of basaltic lava, but basalt is also present sparingly in the upper division. The upper division of the Government Well Formation is characterized by crystal-rich dacitic lava containing phenocrysts of plagioclase and biotite, ± hornblende, pyroxene, and quartz. Sanidine phenocrysts are notably absent throughout the formation. The upper division is further subdivided into suites of lava based on distinctive phenocryst assemblages. At its type section along the Apache Trail near Government Well in the northern Superstition Mountains, the formation is 1570 meters thick (280 meters of lower division and 1290 meters of upper division).

[units probably affiliated with the Superstition Group]

Unit of Buzzards Roost – Superstition Group ? [RENAMED] (18.6 Ma)

The unit of Buzzards Roost (previously the dacite of Buzzards Roost (Ferguson and Skotnicki, 1995) is a distinctive rock-stratigraphic unit that directly overlies the Whitlow Canyon Formation over an approximately 10 km^2 area near the southern edge of the Superstition Cauldron, but its upper contact is not preserved anywhere. The unit is up to 150 meters thick, and it has no known age-relationship with the Apache Leap Tuff. The unit is tentatively placed within the Superstition Group. This is because it seems highly improbable that, being so close to the Superstition Cauldron, no Apache Leap Tuff would have been preserved along its lower contact.

Unit of Pass Mountain – Superstition Group ? [NEW] (age unknown)

The unit of Pass Mountain is a crystal-rich, plagioclase-, biotite-, ± hornblende-phyric, lava unit preserved only in the western Goldfield Mountains. It directly overlies the Tule Canyon Formation, but there is no preserved age relationship with the Apache Leap Tuff. The preserved maximum thickness is less than 100 meters. Since the Apache Leap Tuff may not have been deposited in this area, it is not known if this unit is part of the Superstition Group or the Gila Group.

[4. San Manuel Formation]

San Manuel Formation [RETAINED] (>18.6Ma)

Originally defined by Heindl (1963) in the Mammoth area about 75 km southeast of the Superstition volcanic field, this unit is included in this report because it borders the southern boundary of the Superstition volcanic field, and the absence of Apache Leap Tuff clasts is used as one of the criteria for its identification (Cornwall and Krieger, 1975a;1975b; Banks and

Krieger, 1977; and Keith, 1983). The formation consists of nonvolcaniclastic sandstone and conglomerate, plus other finer grained sedimentary rocks interbedded with minor nonwelded felsic tuffs. Heindl (1963) places the San Manuel Formation within the Gila Group, but in a discussion (p. E15) indicates that this assignment may be open to question since it was deposited in a valley antedating the structural trough that forms the San Pedro Valley.

Since we define the Gila Group as being younger than the Apache Leap Tuff, we do not view the San Manuel as part of the Gila Group. It is clearly shown by Cornwall and Krieger (1975a;1975b), Banks and Krieger (1977), and Keith (1983) that the San Manuel Formation predates emplacement of the Apache Leap Tuff, and none of these workers indicate that it is a subdivision of the Gila Group. We consider the San Manuel Formation to be the southerly equivalent of the Whitetail Formation.

[5. Whitetail Formation]

Whitetail Formation [REDEFINED] (>21 – 18.6 Ma)

The Whitetail Formation is a term applied to the dominantly non-volcaniclastic, sedimentary sequence that underlies and locally intertongues with the volcanic rocks of the Superstition volcanic field. Its upper contact is widely time-transgressive and the unit ranges in thickness from 0 to 500 meters. Originally defined by Ransome (1903) as a formation, the unit has subsequently been referred to most frequently as Whitetail Conglomerate. The name Whitetail Formation is preferred, because the unit contains many different lithologies besides conglomerate, including rare, thin volcanic flows in some areas. One of these, a thin rhyolite lava and tuff derived from two isolated domes in the central Goldfield Mountains has been dated at 20.5 Ma (McIntosh and Ferguson, 1998). The moniker "Whitetail" has been applied to many pre-volcanic sedimentary sequences well beyond the boundaries of the Superstition volcanic field (e.g. Scarborough, 1989), but we discourage this application of the name. We suggest that the name Whitetail Formation be applied only to sequences of rock within the Superstition volcanic field. Beyond the limits of the volcanic field the Whitetail Formation can be shown to be time-equivalent to sedimentary sequences that are clearly post-volcanic with respect to older volcanic fields. For example, Whitetail Formation merges into the San Manuel Formation beyond the southern pinch-out of the Apache Leap Tuff. In this area, both formations contain abundant volcanic detritus derived from the Oligocene-early Miocene Galiuro volcanic field.

Table 1. Age range and characteristic features of some stratigraphic units of the Superstition volcanic field

Unit name	Age	Composition and characteristics
Gila Group	~15-18.6 Ma	Includes a wide variety of volcaniclastic conglomerate, sandstone, and lesser mudstone interbedded locally with thin basalt flows (~20 km^3) and felsic, nonwelded tuffs. The group also includes two formations consisting of felsic volcanic rocks in two different areas: the 15-17 Ma Picketpost Mountain Formation present in the south, and the 17.9-18.6 Ma Coffee Flat Mountain Formation present in the north.
Picketpost Mountain Formation – Gila Group	~15-17 Ma	Crystal-poor and crystal-rich rhyolite and rhyodacite lava flows, domes, and associated nonwelded tuff concentrated in a north-south striking belt between Superior and the Gila River. Approximate volume: 50 km^3
Coffee Flat Mountain Formation – Gila Group	17.9-18.6 Ma	Mostly crystal-rich rhyodacite lava and associated nonwelded tuff containing 25% to 60% phenocrysts of plagioclase, sanidine, quartz, biotite ± hornblende. About 20% of the formation consists of crystal-rich dacite (plagioclase, biotite, ± quartz), or crystal-poor, high-silica rhyolite lava. Approximate volume: 80 km^3
Apache Leap Tuff	18.58 ± 0.03 Ma	Rhyodacite ash-flow tuff containing 25% to 55% phenocrysts of plagioclase, quartz, sanidine, and biotite. Approximate volume: 800 km^3
Superstition Group	18.6-20.5 Ma	Lava flows that predate emplacement of the Apache Leap Tuff are grouped together in this division. The unit is prominently exposed throughout the Superstition Mountains where it is divided into three formally defined units of formation rank; the Whitlow Canyon Formation, Tule Canyon Formation, and Government Well Formation. Two other informal units of formation rank and dubious stratigraphic affinity are tentatively assigned to this group; the dacite of Pass Mountain, and the unit of Buzzards Roost. Sedimentary rocks are a very minor component of the Superstition Group. Approximate volume: 650 km^3
Whitlow Canyon Formation – Superstition Group	18.7-18.6 Ma	Rhyodacite lava and associated nonwelded tuff containing 5 to 15% phenocrysts of plagioclase, quartz, sanidine, and biotite in a distinctive, dark red to lavender matrix. Approximate volume: 75 km^3
Tule Canyon Formation – Superstition Group	18.7-19.0 Ma	Crystal-poor (0-10% phenocrysts), rhyolite to high-silica rhyolite lava and nonwelded tuff containing phenocrysts of plagioclase, sanidine, biotite, ± hornblende and quartz. Approximate volume: 200 km^3

Table 1 (continued) Age range and characteristic features of some stratigraphic units of the Superstition volcanic field.

Unit name	Age	Composition and characteristics
Government Well Formation – Superstition Group	19.0-20.5 Ma	Divided into two informal divisions. The upper Government Well Formation consists of dacitic, latitic, and rhyodacitic lavas and nonwelded tuffs containing 15-50% phenocrysts of plagioclase and biotite, ± hornblende, pyroxene, and quartz. The lower Government Well Formation consists of basalt, basaltic andesite, and andesite lavas containing phenocrysts of plagioclase, olivine, pyroxene, biotite, and hornblende. The formation is characterized by the lack of sanidine phenocrysts throughout. Approximate volume: 360 km^3
unit of Buzzards Roost – Superstition Group ?	18.6 Ma	Moderately crystal-rich rhyodacite lava containing sanidine, plagioclase and biotite phenocrysts. Present only just outside the southeast margin of the Superstition Cauldron where it overlies Whitlow Canyon Formation. No age relationship is preserved with Apache Leap Tuff. Approximate volume: 15 km^3
unit of Pass Mountain – Superstition Group ?	~18.6 Ma	Moderately crystal-rich dacitic lava flows containing plagioclase, biotite, and hornblende phenocrysts. Present only in the western Goldfield Mountains where it overlies the Tule Canyon Formation, but no age relationship is preserved with Apache Leap Tuff. Approximate volume: 10 km^3
Whitetail Formation	18.6-22 Ma	Non-volcaniclastic conglomerate, sandstone, and lesser amounts of avalanche breccia, mudstone and minor volcanic flows including thin basalt lavas in the Santan Mountains and a pair of isolated rhyolite lava domes in the Goldfield Mountains (rhyolite of Bulldog Canyon).
rhyolite of Bulldog Canyon – Whitetail Formation	20.5 Ma	A pair of high-silica, crystal-poor rhyolite lava domes containing phenocrysts of plagioclase, sanidine, biotite, ± quartz present in the central Goldfield Mountains. Nonwelded tuff associated with the domes interfinger with Whitetail Formation conglomerate. Approximate volume: 5 km^3

Table 2. Hierarchy of valid stratigraphic unit names, Superstition Volcanic Field (formal units in bold type). All names are listed exactly as they appear in Parts II and III of this report. Generic units are not included.

Group

Formation

Member

Submember

[1. Gila Group]

Gila Group

(informal units of the Gila Group)

conglomerate
- rhyolite clast conglomerate
- volcanic lithic facies
- granite clast conglomerate
- Paleozoic clast conglomerate
- tuff

basalt
tuffaceous sandstone and tuff
olivine basalt
basalt of Willow Springs
gravel and conglomerate
basalt of Canyon Lake
basalt of Black Mesa (Superstition Mts.)
- upper flow unit
- lower flow unit

angular igneous clast conglomerate
carbonate clast conglomerate
rhyolite ash-fall tuff
rhyolite conglomerate
unit of Mesquite Flat
- tuffaceous sandstone
- upper unit
  - unit A
  - unit B
  - unit C
- lower unit
- ash-flow tuff A
- ash-flow tuff B
- ash-flow tuff C

volcaniclastic sandstone
volcaniclastic conglomerate
gravel of Walnut Canyon

Table 2. informal units of the Gila Group (continued)

Group

Formation

Member

Submember

sedimentary breccia
sedimentary breccia, granite clast
pebbly granule sandstone
quartz blowout
monolithic avalanche breccia
unit of Willow Springs
upper unit
lower unit
plugs of rhyodacite to dacite
breccia pipes within rhyodacite/dacite plugs
lapilli breccia and agglomerate associated with felsic plugs
hornblende andesite plug
plugs and dikes of basalt
lapilli breccia and agglomerate associated with basaltic intrusions
unit of Chalk Creek
basalts of Black Mesa (Rockingstraw Mt area)
basalt, undivided
bedded breccia
unit of Queen Valley
basalt lava
lithic tuff
sandstone
hypabyssal intrusive rocks
volcanic and sedimentary rocks, undivided
clastic sedimentary rocks
volcanic lithic sandstones and bedded pyroclastic rocks
tuff and bedded pyroclastic deposits
felsic to intermediate volcanic rocks
younger sedimentary rocks
younger basalt
younger sedimentary deposits
volcanic and epiclastic breccia, conglomerate and unwelded tuff
younger sedimentary deposits
crystal-rich nonwelded tuff
weakly indurated conglomerate, sandy conglomerate, and pebbly sandstone
volcanic and epiclastic monolithic to heterolithic breccia, conglomerate, and bedded unwelded tuff
rock avalanche breccia
basalt of Donnelly Wash
sandstone and conglomerate
basalt lava
breccia

Table 2. informal units of the Gila Group (continued)

Group

Formation

Member

Submember

younger sedimentary basin-fill deposits
basaltic rocks
basalt, upper unit
tuff and volcanic-lithic sandstone
bedded tuff and sedimentary rocks
lamproite of Elephant Butte

Picketpost Mountain Formation – Gila Group

lower dacite tuff
tuff
tuff I
tuffaceous sandstone
tuff II
tuff III
tuff of the Tower
rhyodacite
intrusive rhyolite
tuff of White Canyon
volcanogenic breccia
perlitic aphyric rhyolite
dacite of North Butte
North Butte rhyolite complex
volcanogenic breccia of South Butte
vitrophyre of South Butte
tuff, undivided
felsite-lithic tuff, undivided
tuff and tuffaceous sediments, undivided
tuffaceous sediments, upper
felsite-lithic tuff, upper
Pinal Schist-clast tuff
biotite crystal tuff
tuffaceous sediments, lower
felsite-lithic tuff, lower
felsic volcanic rocks
felsic intrusive rocks
Arnett Rhyolite Member - Picketpost Mountain Formation - Gila Group
Heliograph Member - Picketpost Mountain Formation - Gila Group
Roadrunner Rhyolite Member - Picketpost Mountain Formation - Gila Group
Sleeping Buffalo Rhyolite Member - Picketpost Mountain Formation - Gila Group
Obsidian

Coffee Flat Mountain Formation – Gila Group

quartz latite lava

Table 2. Gila Group Coffee Flat Mountain Formation (continued)

Group

Formation

Member

Submember

tuff
ash-flow tuff
unit of Peters Canyon
lower dome pyroclastic deposits
lower dome vitrophyre
lower dome lava
Malapais dome pyroclastic deposits
Malapais dome vitrophyre
Malapais dome lava
Geronimo Head dome pyroclastic deposits
Geronimo Head dome vitrophyre
Geronimo Head dome lava
Tortilla dome surge
Tortilla dome pumice breccia
Tortilla dome vitrophyre
Tortilla dome lava
upper dome pyroclastic deposits
upper dome vitrophyre
lava
tuff
upper rhyodacite lava
lower flow unit of the upper rhyodacite lava
intrusive dacite
lower ryhodacite lava and intrusions
fine-grained intrusive rhyodacite
lithic tuff
rhyolite lava
crystal-rich quartz latite lava
nonwelded tuffs of Fish Creek Peak
rhyolite lavas of Fish Creek Peak
crystal-rich quartz latite lava vitrophyre
crystal-rich quartz latite lava breccia
intrusive bodies of the quartz latite lava
brecciated quartz latite lava
nonwelded rhyolite tuff associated with the quartz latite lava

Big Dome Formation – Gila Group

[2. Apache Leap Tuff]

Apache Leap Tuff

mesobreccia
megabreccia

Table 2. Apache Leap Tuff (continued)

Group

Formation

Member

Submember

monolithic megabreccia
breccia
bedded breccia
poorly welded interval
vitrophyre
upper Flatiron unit
lower Flatiron unit
unit of Peralta Canyon
unit of Miners Needle
unit of Hieroglyphic Canyon
upper Apache Leap Tuff
lower Apache Leap Tuff

[3. Superstition Group]

Superstition Group

(informal units of the Superstition Group)

lower dacite tuff
basaltic plugs and dikes
basaltic flows and agglomerate
redbeds and local andesites
basalt of Mud Springs
crystal poor felsic volcanic rocks
spherulitic rhyolite
bedded basaltic scoria
massive tuff
bedded tuff

(units probably associated with the Superstition Group)

unit of Buzzards Roost
    lava breccia
    vitrophyre
unit of Pass Mountain
    massive lithic tuff

Whitlow Canyon Formation - Superstition Group

tuff
lava

Table 2. Superstition Group Whitlow Canyon Formation (continued)

Group

Formation

Member

Submember

lava breccia
vitrophyre
intrusive plugs

Tule Canyon Formation - Superstition Group

tuff
bedded tuff
lithic tuff
lava
lava breccia
nonwelded tuff
rhyolite
rhyolite lava
rhyolite lava undifferentiated
intrusive rhyolite
basalt
unit of Black Cross Butte
vitrophyre of Black Cross Butte
lava flow of Black Cross Butte
aphyric rhyolite lava
crystal-poor rhyolite
crystal-poor rhyolite lava
crystal-poor rhyolitic nonwelded tuff
crystal-rich rhyolite lava
brecciated crystal-poor rhyolite lava
brecciated crystal-rich rhyolite lava
brecciated rhyolite lava
volcaniclastic conglomerate and sandstone interbedded with nonwelded tuff
nonwelded tuff and conglomerate
unwelded bedded lapilli tuff undifferentiated
tuff of North Butte
sandstone and conglomerate

Government Well Formation - Superstition Group

upper Government Well Formation
rhyodacite of Apache Gap
lava
vitrophyre
pyroclastic deposits
unit of Bronco Butte
latite-andesite
latite
dacite breccia

Table 2. Superstition Group upper Government Well Formation (continued)

Group

Formation

Member

Submember

rhyodacite
obsidian
quartz phyric dacite
andesitic-latite lava
rhyodacite welded tuff
rhyodacite breccia
latite tuff-breccia
latite breccia
latite lava
rhyodacite
basalt of Apache Gap
crystal-rich dacite
gray latite, unit 'b'
gray latite, unit 'a'
green latite
latite with xenoliths
red latite
basal latite
tuff of Quarter Circle U Ranch
upper andesite lava
lower andesite lava
dacite of San Mateo Castro Ranch
dacite
intrusive dacite
quartz-phyric basaltic andesite
andesite
fine-grained, hornblende-rich dacite
dacite lava breccia
dacitic crystal-rich tuff
bedded tuff

lower Government Well Formation
basalt
basalt of Apache Lake
andesite flows, flow breccias, and agglomerates
andesite
basalt of Weekes Wash
tuff of Saddle Rock
basalt of Cottonwood Spring
tuff of Blue Ridge
basalt lava
coarse-grained basalt
andesitic volcanic rocks
lithic tuff
basaltic sandstone and pyroclastic rocks

Table 2. Superstition Group lower Government Well Formation (continued)

Group

Formation

Member

Submember

intrusive basalt

[4. San Manuel Formation]

San Manuel Formation

[5. Whitetail Formation]

Whitetail Formation

basalt
epiclastic and volcanic breccia
rhyolite of Bulldog Canyon
- massive tuff
- rhyolite
- tuffaceous conglomerate

arkosic conglomerate
redbeds and local andesites
monolithologic breccia
breccia
conglomerate and sandstone, undivided
sandstone
conglomerate
rock avalanche or talus breccia
rock avalanche breccia
clastic sedimentary rocks
sandstone and conglomerate
sedimentary breccia
granite breccia
arkosic conglomerate, pebbly sandstone, and sandstone
conglomerate, carbonate clast
conglomerate, Pinal Schist-clast
gypsum and mudstone
fine-grained unit

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PART II

LISTING OF UNIT NAMES

There are five numbered divisions in this part, representing the major divisions of the stratigraphic section according to the stratigraphic framework described above: 1) Gila Group; 2) Apache Leap Tuff; 3) Superstition Group; 4) San Manuel Formation; and 5) Whitetail Formation. Note that the numbered divisions are not equal in rank. When necessary, these numbered divisions are further divided into subdivisions that reflect the stratigraphic units of that numbered major division; in some cases the subdivisions are further divided. The subdivision for each stratigraphic unit contains all the previously used unit names now considered to be included in that stratigraphic unit. Within each subdivision, the previously used unit names are listed (in bold type) in chronological order (beginning with oldest) according to first usage of the unit name. The previously used unit name is followed by a term contained in bold brackets **[ ]** which indicates the status of the old name or names (e.g., **[RETAINED]** or **[OBSOLETE]**). To the right of the bold brackets are listed the name and stratigraphic hierarchy (in bold type) that conforms to the stratigraphic framework described in this report. Finally (in regular type), the author(s) and date of the publication in which the unit name was used are listed. If one unit name or a group of similar unit names has been used by multiple authors with the same general meaning, then that unit name or group of unit names is listed once and the multiple authors are listed to the right.

[1. Gila Group]

Gila Group [REDEFINED] In the Superstition volcanic field, the Gila Group is redefined to encompass all volcanic and volcaniclastic rocks that overlie the Apache Leap Tuff. As redefined, the Gila Group includes two new volcanic formations that interfinger with multiple informal units of locally derived, basin-filling, lithified to unlithified conglomeratic units. Although referred to as a "Conglomerate" in its type area by Richter et al. (1983), and Houser et al. (1985) other workers refer to this unit as the Gila Group (e.g. Heindl, 1962; 1963; Cather et al., 1994). We prefer the term group since, as we define it, the Gila Group includes abundant volcanic rocks. The upper contact of the group is defined as the transition from closed basin sedimentation to incision related to the onset of through-going drainage of the ancestral Gila River system.

The Gila Group includes post-cauldron breccias within Superstition Cauldron, and many other sequences of sedimentary rocks within half-graben basins throughout the volcanic field. Many of these sedimentary sequences preserve fanning dip sequences in the Basin and Range portion of the volcanic field. In two areas, felsic volcanic rocks dominate the Gila Group, and these succession are formally defined as the Coffee Flat Mountain and Picketpost Mountain formations.

In areas where older volcanic rocks are absent, sedimentary rocks of the Gila Group can be distinguished from the older, pre-volcanic Whitetail Formation because the younger rocks are volcaniclastic. At the southern edge of the Superstition volcanic field, the formal unit Big Dome Formation (Cornwall and Krieger, 1975a), herein defined as part of the Gila Group, contains abundant clasts of the Apache Leap Tuff.

Undivided Gila Group and informal units:

Gila conglomerate AND **Gila Conglomerate [REDEFINED] Gila Group** Ransome (1903), Ransome (1904), Ransome (1919), Ransome (1923), N.P. Peterson and others (1953), N.P. Peterson (1954), D.W. Peterson (1960), N.P. Peterson (1961), N.P. Peterson (1963), Nelson (1966)

basalt AND **Basalt [RETAINED] basalt – Gila Group** Ransome (1903), Ransome (1904), N.P. Peterson and others (1953), D.W. Peterson (1960), N.P. Peterson (1961), N.P. Peterson (1963), Nelson (1966), D.W. Peterson

(1966), D.W. Peterson (1969), Creasey and others (1983), Spencer and Richard (1995a) , Spencer and Richard (1995b)

interbedded tuffaceous sandstone [RENAMED] tuffaceous sandstone and tuff – Gila Group N.P. Peterson (1961), N.P. Peterson (1963)

Olivine basalt [RETAINED] olivine basalt – Gila Group Nelson (1966)

younger basalt [RENAMED] basalt of Willow Springs – Gila Group Damon (1969)

gravel and conglomerate [RETAINED] gravel and conglomerate – Gila Group D.W. Peterson (1969)

Willow Springs basalt AND **basalt of Willow Springs** AND **alkali olivine basalt of Willow Springs** AND **basalt [RENAMED] basalt of Willow Springs – Gila Group** Stuckless (1969), Stuckless (1971), Stuckless and Sheridan (1971), Suneson (1976), Sheridan (1978), Rettenmaier (1984)

Black Mesa basanite AND **basanite of Black Mesa** AND **basanite** AND **basanite lava, Black Mesa [RENAMED] basalt of Black Mesa (Superstition Mts.) – Gila Group** Stuckless (1969), Stuckless (1971), Stuckless and Sheridan (1971)

Canyon Lake basalt AND **basalt of Canyon Lake** AND **basalt [RENAMED] basalt of Canyon Lake – Gila Group** Stuckless (1969), Stuckless (1971), Suneson (1976), Sheridan (1978), Prowell (1984), Rettenmaier (1984)

epiclastic breccias [RENAMED] unit of Mesquite Flat – Gila Group Stuckless (1969)

airfall tuff AND **rhyolitic airfall tuff [RENAMED] rhyolite ash-fall tuff – Gila Group** Cornwall and others (1971)

conglomerate with angular igneous clasts [RENAMED] angular igneous clast conglomerate – Gila Group Cornwall and others (1971)

conglomerate with mainly carbonate clasts [RENAMED] carbonate clast conglomerate – Gila Group Cornwall and others (1971)

conglomerate with diverse types of clasts [RENAMED] conglomerate – Gila Group Cornwall and others (1971)

basalt and basanite lavas AND **basanite lavas** AND **basanite lava [RENAMED] basalt – Gila Group** Sheridan and others (1971)

epiclastic breccia unit [RENAMED] unit of Mesquite Flat – Gila Group Stuckless (1971)

rhyolite conglomerate [RETAINED] rhyolite conglomerate – Gila Group Stuckless (1971)

younger basaltic lavas AND **younger mafic lavas** AND **basalt [GENERIC] basalt of Canyon Lake – Gila Group** OR **basalt of Willow Springs – Gila Group** OR **basalt of Black Mesa (Superstition Mts.) – Gila Group** Stuckless (1971)

quartz latite domes and lavas [OBSOLETE] Superstition Group OR **Gila Group** Stuckless (1971)

younger rhyolite gravels [RENAMED] unit of Mesquite Flat – Gila Group Stuckless and Sheridan (1971)

basanite no 1, Black Mesa AND **basanite no. 2, Black Mesa [RENAMED] lower and upper flow units – basalt of Black Mesa (Superstition Mts.) – Gila Group** Stuckless and O'Neil (1973)

younger basalt AND **younger basalts [RENAMED] basalt – Gila Group** Suneson (1976)

epiclastic breccia of Mesquite Flat [RENAMED] unit of Mesquite Flat – Gila Group Suneson (1976)

breccia of Mesquite Flat AND **Mesquite Flat breccia** AND **Mesquite Flat Breccia [RENAMED] unit of Mesquite Flat – Gila Group** Sheridan (1978), Isagholian (1983), Prowell (1984), Rettenmaier (1984), Sheridan and Prowell (1986), Sheridan (1987)

basalt of Black Mesa AND **Black Mesa basalt [RENAMED] basalt of Black Mesa (Superstition Mts.) – Gila Group** Sheridan (1978), Prowell (1984)

breccia of First Water [OBSOLETE] volcaniclastic sandstone – Gila Group OR **megabreccia – Apache Leap Tuff** Sheridan (1978)

conglomerate [RETAINED] conglomerate – Gila Group Theodore and others (1978), Spencer and Richard (1995a), Spencer and Richard (1995b)

water-laid tuff and sedimentary rocks [RENAMED] bedded tuff and sedimentary rocks – Gila Group Theodore and others (1978)

olivine basalt [RETAINED] olivine basalt – Gila Group Theodore and others (1978)

quartz blowout [RETAINED] quartz blowout – Gila Group Theodore and others (1978)

pebbly grit [RENAMED] pebbly granule sandstone – Gila Group Theodore and others (1978)

older gravel [RENAMED] gravel of Walnut Canyon – Gila Group Theodore and others (1978), Keith (1983)

fanglomerate of Mesquite Flat [RENAMED] unit of Mesquite Flat – Gila Group Scarborough (1981a), Scarborough (1981b)

basin fill [RENAMED] Gila Group Scarborough (1981b)

basalt of Hackberry Mesa [OBSOLETE] basalt of Black Mesa (Superstition Mts.) – Gila Group Scarborough (1981b)
younger gravel [RENAMED] conglomerate – Gila Group Creasey and others (1983)
older gravel [RENAMED] gravel of Walnut Canyon – Gila Group Creasey and others (1983)
sedimentary breccia [RETAINED] sedimentary breccia – gravel of Walnut Canyon – Gila Group Creasey and others (1983)
fanglomerate [RENAMED] conglomerate – Gila Group D.W. Peterson and Jinks (1983)
upper tuff [OBSOLETE] unit of Mesquite Flat – Gila Group D.W. Peterson and Jinks (1983)
upper basalt [RENAMED] basalt of Black Mesa (Superstition Mts.) – Gila Group D.W. Peterson and Jinks (1983)
Black Mesa lahar [RENAMED] conglomerate – Gila Group Prowell (1984)
upper member of the Mesquite Flat Breccia [RENAMED] upper unit of Mesquite Flat – Gila Group Prowell (1984)
lower member of the Mesquite Flat Breccia [RENAMED] lower unit of Mesquite Flat – Gila Group Prowell (1984)
Willow Creek Rhyolites AND **Willow Creek Rhyolite tuff** AND **Willow Creek Rhyolite lavas [OBSOLETE] Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **monolithic avalanche breccia – Gila Group** Prowell (1984)
tuffaceous sandstone [RETAINED] tuffaceous sandstone – unit of Mesquite Flat – Gila Group Rettenmaier (1984)
upper Mesquite Flat breccia [RENAMED] upper unit of Mesquite Flat – Gila Group Rettenmaier (1984). Subdivided into three units:
  member A, upper Mesquite Flat breccia [RENAMED] unit A – upper unit of Mesquite Flat – Gila Group Rettenmaier (1984)
  member B, upper Mesquite Flat breccia [RENAMED] unit B – upper unit of Mesquite Flat – Gila Group Rettenmaier (1984)
  member C, upper Mesquite Flat breccia [RENAMED] unit C – upper unit of Mesquite Flat – Gila Group Rettenmaier (1984)
lower Mesquite Flat breccia [RENAMED] lower unit of Mesquite Flat – Gila Group Rettenmaier (1984)
ash-flow tuff A [RETAINED] ash-flow tuff A – unit of Mesquite Flat – Gila Group Rettenmaier (1984)
ash-flow tuff B [RETAINED] ash-flow tuff B – unit of Mesquite Flat – Gila Group Rettenmaier (1984)
ash-flow tuff C [RETAINED] ash-flow tuff C – unit of Mesquite Flat – Gila Group Rettenmaier (1984)
Willow Springs breccia [RENAMED] unit of Willow Springs – Gila Group Rettenmaier (1984). Subdivided into two units:
  upper Willow Springs breccia [RENAMED] upper unit of Willow Springs – Gila Group Rettenmaier (1984)
  lower Willow Springs breccia [RENAMED] lower unit of Willow Springs – Gila Group Rettenmaier (1984)
Black Mesa basalts [RENAMED] basalts of Black Mesa (Rockinstraw Mtn. Area) – Gila Group Faulds (1986)
Chalk Creek Formation [RENAMED] unit of Chalk Creek – Gila Group Faulds (1986)
plugs of rhyodacite to dacite [RETAINED] plugs of rhyodacite to dacite – Gila Group Faulds (1986)
breccia pipes within rhyodacite/dacite plugs [RETAINED] breccia pipes within rhyodacite/dacite plugs – Gila Group Faulds (1986)
lapilli breccia and agglomerate associated with felsic plugs [RETAINED] lapilli breccia and agglomerate associated with felsic plugs – Gila Group Faulds (1986)
hornblende andesite plug [RETAINED] hornblende andesite plug – Gila Group Faulds (1986)
plugs and dikes of basalt [RETAINED] plugs and dikes of basalt – Gila Group Faulds (1986)
lapilli breccia and agglomerate associated with basaltic intrusions [RETAINED] lapilli breccia and agglomerate associated with basaltic intrusions – Gila Group Faulds (1986)
Hackberry Mesa basalt [OBSOLETE] basalt of Black Mesa (Superstition Mts.) – Gila Group Reynolds and others (1986)
Superstition volcanics [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Gila Group** Reynolds and others (1986). Includes the following units:
  15.53 Ma basaltic andesite [RENAMED] basalt – Gila Group Reynolds and others (1986)

18.26 Ma basalt [RENAMED] basalt of Willow Springs – Gila Group Reynolds and others (1986)
22.60 Ma basalt [RENAMED] basalt of Canyon Lake – Gila Group Reynolds and others (1986)
Younger basalt lava [RENAMED] basalt, undivided – Gila Group Sheridan and Prowell (1986), Sheridan (1987)
"breccia" of Mesquite Flat in the Superstition Mountains [RENAMED] unit of Mesquite Flat – Gila Group Scarborough (1989)
gravel of Walnut Canyon [RETAINED] gravel of Walnut Canyon – Gila Group Dickinson (1995)
unit of Queen Valley [RETAINED] unit of Queen Valley – Gila Group Ferguson and Skotnicki (1995)
basalt lava [RETAINED] basalt lava – unit of Queen Valley – Gila Group Ferguson and Skotnicki (1995), Ferguson and Skotnicki (1996)
lamproite of Elephant Butte [RETAINED] lamproite of Elephant Butte – Gila Group Ferguson and Skotnicki (1995)
bedded breccia [OBSOLETE] bedded breccia – Gila Group OR **bedded breccia – Apache Leap Tuff** Ferguson and Skotnicki (1995)
Nepheline basalt [RENAMED] basalt of Black Mesa (Superstition Mts.) – Gila Group Skotnicki and Ferguson (1995)
Volcaniclastic sandstone [RETAINED] volcaniclastic sandstone – Gila Group Skotnicki and Ferguson (1995)
Lithic tuff [RETAINED] lithic tuff – Gila Group Skotnicki and Ferguson (1995)
Rhyodacite [RENAMED] monolithic avalanche breccia – Gila Group Skotnicki and Ferguson (1995)
Younger basalt [RETAINED] younger basalt – Gila Group Spencer and Richard (1995b)
Younger sediments [RENAMED] younger sedimentary rocks – Gila Group Spencer and Richard (1995b)
Basalt, upper unit [RENAMED] basalt – Gila Group Spencer and Richard (1995b)
sandstone [RETAINED] sandstone – Gila Group Spencer and Richard (1995a), Spencer and Richard (1995b)
Felsic to intermediate volcanic rocks [GENERIC] felsic to intermediate volcanic rocks – Superstition Group OR **felsic to intermediate volcanic rocks – Gila Group** Spencer and Richard (1995b)
Tuff and bedded pyroclastic deposits [GENERIC] tuff and bedded pyroclastic deposits – Superstition Group OR **Apache Leap Tuff** OR **tuff and bedded pyroclastic deposits – Gila Group** Spencer and Richard (1995b)
Volcanic lithic sandstones and bedded pyroclastic rocks [RETAINED] volcanic lithic sandstones and bedded pyroclastic rocks – Gila Group Spencer and Richard (1995b)
Clastic sedimentary rocks [GENERIC] clastic sedimentary rocks – Superstition Group OR **clastic sedimentary rocks – Gila Group** Spencer and Richard (1995b)
Volcanic and sedimentary rocks, undivided [GENERIC] volcanic and sedimentary rocks, undivided – Superstition Group OR **volcanic and sedimentary rocks, undivided – Gila Group** Spencer and Richard (1995b)
Mafic to intermediate volcanic rocks, lower unit [OBSOLETE] lower Government Well Formation – Superstition Group OR **Gila Group** Spencer and Richard (1995b)
Hypabyssal intrusive rocks [GENERIC] hypabyssal intrusive rocks – Superstition Group OR **hypabyssal intrusive rocks – Gila Group** Spencer and Richard (1995b)
younger sedimentary deposits [RENAMED] conglomerate – Gila Group Ferguson and Skotnicki (1996)
younger sedimentary deposits AND **younger sedimentary basin-fill deposits [RETAINED] younger sedimentary deposits – Gila Group** Skotnicki and Ferguson (1996), Skotnicki and Leighty (1997)
weakly indurated conglomerate, sandy conglomerate and pebbly sandstone [RETAINED] weakly indurated conglomerate, sandy conglomerate and pebbly sandstone – Gila Group Ferguson and Gilbert (1997), Gilbert and Ferguson (1997)
younger basalt [RENAMED] basalt – Gila Group Ferguson and Gilbert (1997)
crystal-rich unwelded tuff [RENAMED] crystal-rich nonwelded tuff – Gila Group Ferguson and Gilbert (1997)
volcaniclastic conglomerate, pebbly sandstone, sandstone, silty mudstone, and sedimentary breccia AND **volcaniclastic conglomerate, sandstone, silty mudstone, and sedimentary breccia [RENAMED] volcaniclastic conglomerate – Gila Group** Ferguson and Gilbert (1997)
generic unwelded bedded or massive crystal-poor rhyolitic tuff AND **younger crystal-poor bedded unwelded rhyolitic tuff [OBSOLETE] Gila Group** OR **Tule Canyon Formation – Superstition Group** Ferguson and Gilbert (1997)
quartz-phyric 5-10% phenocryst rhyolite lava breccia [RENAMED] monolithic avalanche breccia– Gila Group Ferguson and Gilbert (1997)

volcanic and epiclastic breccia, conglomerate, and unwelded tuff [RETAINED] volcanic and epiclastic breccia, conglomerate, and unwelded tuff – Gila Group Ferguson and Gilbert (1997)
volcaniclastic conglomerate, pebbly sandstone, sandstone, and breccia [RENAMED] volcaniclastic conglomerate – Gila Group Gilbert and Ferguson (1997)
volcanic and epiclastic monolithic to heterolithic breccia, conglomerate, and bedded unwelded tuff [RETAINED] volcanic and epiclastic monolithic to heterolithic breccia, conglomerate, and bedded unwelded tuff – Apache Leap Tuff OR **volcanic and epiclastic monolithic to heterolithic breccia, conglomerate, and bedded unwelded tuff - Gila Group** Gilbert and Ferguson (1997)
basalt lava AND **basalt [RENAMED] basalt lava – Gila Group** Richard and Spencer (1997)
sandstone and conglomerate [RETAINED] sandstone and conglomerate – Gila Group Richard and Spencer (1997)
conglomerate [RETAINED] conglomerate – Gila Group Richard and Spencer (1997). Subdivided into two units:
- **rhyolite clast conglomerate** AND **conglomerate, rhyolite-lithic facies [RENAMED] rhyolite clast conglomerate – conglomerate – Gila Group** Richard and Spencer (1997)
- **conglomerate, volcanic lithic facies [RENAMED] volcanic lithic facies – conglomerate – Gila Group** Richard and Spencer (1997)

basalt of Donnelly Wash [RETAINED] basalt of Donnelly Wash – Gila Group Richard and Spencer (1997)
rock avalanche breccia [RETAINED] rock avalanche breccia – Gila Group Richard and Spencer (1997)
monolithic breccia [RENAMED] breccia – Gila Group Skotnicki and Leighty (1997)
basalt [GENERIC] basalt – lower Government Well Formation – Superstition Group OR **basalt – Gila Group** Skotnicki and Leighty (1997)
conglomerate [RETAINED] conglomerate – Gila Group Richard and Spencer (1998). Subdivided into three units:
- **granite clast facies** AND **conglomerate, granite clast [RENAMED] granite clast conglomerate – conglomerate – Gila Group** Richard and Spencer (1998)
- **Paleozoic carbonate clast facies** AND **conglomerate, Paleozoic carbonate clast [RENAMED] Paleozoic clast conglomerate – conglomerate – Gila Group** Richard and Spencer (1998)
- **tuff [RETAINED] tuff – conglomerate – Gila Group** Richard and Spencer (1998)

tuff and volcanic-lithic sandstone [RETAINED] tuff and volcanic-lithic sandstone – Gila Group Richard and Spencer (1998)
basalt, upper unit [RETAINED] basalt, upper unit – Gila Group Richard and Spencer (1998)
basaltic rocks [RETAINED] basaltic rocks – Gila Group Richard and Spencer (1998)
gravel of Walnut Canyon [RETAINED] gravel of Walnut Canyon – Gila Group Richard and Spencer (1998). Subdivided into two units:
- **sedimentary breccia [RETAINED] sedimentary breccia – gravel of Walnut Canyon – Gila Group** Richard and Spencer (1998)
- **sedimentary breccia, granite clast [RETAINED] sedimentary breccia, granite clast – gravel of Walnut Canyon – Gila Group** Richard and Spencer (1998)

younger post-cauldron units [OBSOLETE] Gila Group McIntosh and Ferguson (1998)

Formations of the Gila Group:

Big Dome Formation – Gila Group [RETAINED] Alluvial unit with rare tuff beds to the south of the volcanic field. Divided into members based on sedimentology and clast types. The conglomerates contain clasts of Apache Leap Tuff and the formation includes tuff beds that have been dated at 14 and 17 Ma. Because the formation contains clasts of Apache Leap Tuff, we formally place it within the Gila Group.

Big Dome Formation [RETAINED] Big Dome Formation – Gila Group Cornwall and Krieger (1975a), Banks and Krieger (1977), Keith (1983)

Picketpost Mountain Formation – Gila Group [NEW] The Picketpost Mountain Formation is a new formal name based on the Picketpost Mountain Volcanics of Keith (1983) and Richard and Spencer (1998). The formation includes approximately 17-15 Ma felsic lava, hypabyssal rocks, tuff, and minor volcaniclastic rocks

that occur in a north-south striking belt between Superior and the Gila River. The formation is distinguished from the older Coffee Flat Mountain Formation (18.6-17.9 Ma) by its age and location. The formation is subdivided into several informal units and four formal units at the member level. The most complete section of the Picketpost Mountain Formation is at Picketpost Mountain near Superior. A type section is proposed along cross-section line B-B'-B" of Nelson (1966) through the middle of the mountain. The section consists of 150 meters of the Arnett Rhyolite Member (a lava flow with a thin underlying non-welded tuff unit) overlain by 105-190 meters of tuffaceous sandstone and non-welded tuff, and is capped by 225 meters of the Heliograph Member (a lava flow derived from a nearby vent that makes up the northern part of the mountain).

Undivided Picketpost Mountain Formation and informal units:

Tower Tuff [RENAMED] tuff of The Tower– Picketpost Mountain Formation – Gila Group Nelson (1966)
Tuff III [RETAINED] tuff III – Picketpost Mountain Formation – Gila Group Nelson (1966)
Tuff II [RETAINED] tuff II – Picketpost Mountain Formation – Gila Group Nelson (1966)
Tuffaceous sandstone [RETAINED] tuffaceous sandstone – Picketpost Mountain Formation – Gila Group Nelson (1966)
Tuff I [RETAINED] tuff I – Picketpost Mountain Formation – Gila Group Nelson (1966)
Arnett Tuff [RENAMED] tuff – Picketpost Mountain Formation – Gila Group Nelson (1966)
Lower dacite tuff [RETAINED] lower dacite tuff – Superstition Group(?) OR **lower dacite tuff – Picketpost Mountain Formation – Gila Group(?)** Nelson (1966)
tuff [RETAINED] tuff – Picketpost Mountain Formation – Gila Group D.W. Peterson (1966)
breccia [RENAMED] tuff of The Tower – Picketpost Mountain Formation – Gila Group D.W. Peterson (1966)
volcanic rocks, *tuff* [RENAMED] tuff – Picketpost Mountain Formation- Gila Group D.W. Peterson (1969)
intrusive rhyolite [RETAINED] intrusive rhyolite – Picketpost Mountain Formation – Gila Group Theodore and others (1978)
rhyodacite [RETAINED] rhyodacite – Picketpost Mountain Formation – Gila Group Theodore and others (1978)
tuff member – Sleeping Buffalo Rhyolite [REDEFINED] tuff – Picketpost Mountain Formation – Gila Group Creasey and others (1983)
older tuff [RENAMED] tuff of White Canyon – Picketpost Mountain Formation – Gila Group Creasey and others (1983)
Picketpost Mountain Volcanics [REDEFINED] Picketpost Mountain Formation – Gila Group Keith (1983)
tuff of White Canyon [RETAINED] tuff of White Canyon – Picketpost Mountain Formation – Gila Group Dickinson (1995)
volcanogenic breccia [RETAINED] volcanogenic breccia – Picketpost Mountain Formation – Gila Group Spencer and Richard (1995a)
perlitic aphyric rhyolite [RETAINED] perlitic aphyric rhyolite – Picketpost Mountain Formation – Gila Group Spencer and Richard (1995a)
tuff, undivided [RETAINED] tuff, undivided – Picketpost Mountain Formation – Gila Group Richard and Spencer (1997). Subdivided locally into eight units (ordered according to map legend):
- **felsite-lithic tuff, undivided** AND **felsite-lithic tuff [RENAMED] felsite-lithic tuff, undivided – Picketpost Mountain Formation – Gila Group** Richard and Spencer (1997)
- **tuff and tuffaceous sediments, undivided [RETAINED] tuff and tuffaceous sediments, undivided – Picketpost Mountain Formation – Gila Group** Richard and Spencer (1997)
- **tuffaceous sediments, upper** AND **upper tuff and tuffaceous sediment [RENAMED] tuffaceous sediments, upper – Picketpost Mountain Formation – Gila Group** Richard and Spencer (1997)
- **felsite-lithic tuff, upper** AND **upper felsite-lithic tuff [RENAMED] felsite-lithic tuff, upper – Picketpost Mountain Formation – Gila Group** Richard and Spencer (1997)
- **Pinal Schist-clast tuff [RETAINED] Pinal Schist-clast tuff – Picketpost Mountain Formation – Gila Group** Richard and Spencer (1997)

biotite crystal tuff AND **biotite-rich crystal tuff [RENAMED] biotite crystal tuff – Picketpost Mountain Formation – Gila Group** Richard and Spencer (1997)
tuffaceous sediments, lower AND **lower tuff and tuffaceous sediments [RENAMED] tuffaceous sediments, lower – Picketpost Mountain Formation – Gila Group** Richard and Spencer (1997)
felsite-lithic tuff, lower AND **lower felsite lithic tuff [RENAMED] felsite-lithic tuff, lower – Picketpost Mountain Formation – Gila Group** Richard and Spencer (1997)

vitrophyre of South Butte [RETAINED] vitrophyre of South Butte – Picketpost Mountain Formation – Gila Group Richard and Spencer (1997)

volcanogenic breccia of South Butte [RETAINED] volcanogenic breccia of South Butte – Picketpost Mountain Formation – Gila Group Richard and Spencer (1997)

North Butte rhyolite complex [RETAINED] North Butte rhyolite complex – Picketpost Mountain Formation – Gila Group Richard and Spencer (1997)

dacite of North Butte [RETAINED] dacite of North Butte – Picketpost Mountain Formation – Gila Group Richard and Spencer (1997)

Picketpost Mountain Volcanics AND **volcanic rocks of Picketpost Mountain [REDEFINED] Picketpost Mountain Formation – Gila Group** Richard and Spencer (1998). Subdivided into four units:
felsic intrusive rocks [RETAINED] felsic intrusive rocks – Picketpost Mountain Formation – Gila Group Richard and Spencer (1998)
felsic volcanic rocks [RETAINED] felsic volcanic rocks – Picketpost Mountain Formation – Gila Group Richard and Spencer (1998)
Pinal Schist-clast tuff [RETAINED] Pinal Schist-clast tuff – Picketpost Mountain Formation – Gila Group Richard and Spencer (1998)
tuff of White Canyon [RETAINED] tuff of White Canyon – Picketpost Mountain Formation – Gila Group Richard and Spencer (1998)

younger post-cauldron units [OBSOLETE] Picketpost Mountain Formation - Gila Group McIntosh and Ferguson (1998)

Formal members of the Picketpost Mountain Formation:

Arnett Rhyolite Member

Arnett Rhyolite [RENAMED] Arnett Rhyolite Member – Picketpost Mountain Formation –Gila Group Nelson (1966)

rhyolite [RENAMED] Arnett Rhyolite Member – Picketpost Mountain Formation – Gila Group D.W. Peterson (1966)

volcanic rocks, *lava* [RENAMED] Arnett Rhyolite Member – Picketpost Mountain Formation – Gila Group D.W. Peterson (1969)

Arnett Member – Sleeping Buffalo Rhyolite [REDEFINED] Arnett Rhyolite Member – Picketpost Mountain Formation – Gila Group Creasey and others (1983)

Heliograph Member

Heliograph Formation [RENAMED] Heliograph Member – Picketpost Mountain Formation – Gila Group Nelson (1966)

quartz latite [RENAMED] Heliograph Member – Picketpost Mountain Formation – Gila Group D.W. Peterson (1966), Spencer and Richard (1995a)

Picketpost Mountain dacite [RENAMED] Heliograph Member – Picketpost Mountain Formation – Gila Group Reynolds and others (1986)

Road Runner Rhyolite Member

quartz latite [RENAMED] Roadrunner Rhyolite Member – Picketpost Mountain Formation – Gila Group Theodore and others (1978)

Road Runner Rhyolite [REDEFINED] Road Runner Rhyolite Member– Picketpost Mountain Formation – Gila Group Creasey and others (1983)

Sleeping Buffalo Member

rhyolite flows and intrusive rocks [RENAMED] Sleeping Buffalo Rhyolite Member – Picketpost Mountain Formation – Gila Group Theodore and others (1978)
rhyolitic obsidian [RENAMED] obsidian – Sleeping Buffalo Rhyolite Member – Picketpost Mountain Formation – Gila Group Theodore and others (1978)
Sleeping Buffalo Rhyolite [REDEFINED] Sleeping Buffalo Rhyolite Member – Picketpost Mountain Formation – Gila Group Creasey and others (1983)
Sleeping Buffalo Rhyolite [REDEFINED] Sleeping Buffalo Rhyolite Member – Picketpost Mountain Formation – Gila Group Dickinson (1995)

Coffee Flat Mountain Formation – Gila Group [NEW] The Coffee Flat Mountain Formation is a new formal name based on the rhyodacite of Coffee Flat Mountain, a prominent informal unit named by Ferguson and Skotnicki (1995) along the southeastern margin of the Superstition Cauldron. The formation consists primarily of voluminous (80 km^3) 18.6 – 17.9 Ma intracauldron felsic lavas which can be distinguished from the younger (17-15 Ma) Picketpost Mountain Formation by their age and proximity to the Superstition Cauldron. Since the Coffee Flat Mountain Formation is such a heterogeneous unit, no type section is proposed. Instead, a type area at Coffee Flat Mountain in the southern Superstition Mountains is proposed. A pair of reference sections that characterize the unit are suggested. In the northern Superstition Mountains a composite section through two overlapping lava domes of crystal-rich rhyolite (the Geronimo Head and Malapais domes of Prowell, 1984) attains a probable thickness of 580 meters. To the south, a minimum thickness of 400 meters consisting of two flow units of crystal-rich rhyolite lava is present at Coffee Flat Mountain (Ferguson and Skotnicki, 1995).

Undivided Coffee Flat Mountain Formation and informal units:

glassy quartz latite [OBSOLETE] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1969)
late stage domes and lavas [OBSOLETE] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1969)
Geronimo Head formation AND **Geronimo Head Formation** AND **lavas of Geronimo Head Formation** AND **tuffs of Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1969), Stuckless (1971), Stuckless and Sheridan (1971), Suneson (1976), Sheridan (1978)
quartz latite and rhyolite domes and lavas AND **rhyolite and quartz latite domes and lavas [OBSOLETE] Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1971)
rhyolite and quartz latite lavas, domes, and dikes [RENAMED] Coffee Flat Mountain Formation – Gila Group Stuckless and Sheridan (1971)
glassy quartz latite dome [?] *possibly* **Coffee Flat Mountain Formation – Gila Group** *No location given* Stuckless and O'Neil (1973)
devitrified quartz latite dome [?] *possibly* **Coffee Flat Mountain Formation – Gila Group** *No location given* Stuckless and O'Neil (1973)
devitrified quartz latite lava [RENAMED] quartz latite lava – Coffee Flat Mountain Formation – Gila Group Stuckless and O'Neil (1973)
ash flow, Geronimo Head Formation [OBSOLETE] tuff – Coffee Flat Mountain Formation – Gila Group Stuckless and O'Neil (1973)
interbedded pyroclastics and flows [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Coffee Flat Mountain Formation – Gila Group** Scarborough (1981b)
older dacite tuffs and vitrophyres [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Coffee Flat Mountain Formation – Gila Group** Scarborough (1981b)

upper ash-flow tuff [OBSOLETE] Apache Leap Tuff OR **tuff – Coffee Flat Mountain Formation – Gila Group** D.W. Peterson and Jinks (1983)

middle ash-flow tuff [RENAMED] ash-flow tuff – Coffee Flat Mountain Formation – Gila Group D.W. Peterson and Jinks (1983)

rhyodacite [OBSOLETE] Coffee Flat Mountain Formation – Gila Group OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost** D.W. Peterson and Jinks (1983). Subdivided into two units:

- **zeolitized rhyodacite [OBSOLETE] Coffee Flat Mountain Formation – Gila Group** OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost** D.W. Peterson and Jinks (1983)
- **rhyodacite vents [OBSOLETE] Coffee Flat Mountain Formation – Gila Group** OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost** D.W. Peterson and Jinks (1983)

middle tuff [RENAMED] tuff – Coffee Flat Mountain Formation – Gila Group D.W. Peterson and Jinks (1983)

upper rhyolite [OBSOLETE] unit of Buzzards Roost OR **Coffee Flat Mountain Formation – Gila Group** D.W. Peterson and Jinks (1983). Subdivided into two units:

- **zeolitized rhyolite [OBSOLETE] unit of Buzzards Roost** OR **Coffee Flat Mountain Formation – Gila Group** D.W. Peterson and Jinks (1983)
- **rhyolite vents [OBSOLETE] unit of Buzzards Roost** OR **Coffee Flat Mountain Formation – Gila Group** D.W. Peterson and Jinks (1983)

mixed volcanic rocks [OBSOLETE] upper Government Well Formation – Superstition Group OR **Coffee Flat Mountain Formation – Gila Group** D.W. Peterson and Jinks (1983)

Peters Canyon dome complex [RENAMED] unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group Prowell (1984). Subdivided into fifteen units:

- **upper dome vitrophyre, Peters Canyon dome complex [RENAMED] upper dome vitrophyre – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **upper dome pyroclastic deposits, Peters Canyon dome complex [RENAMED] upper dome pyroclastic deposits – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **Tortilla dome lava, Peters Canyon dome complex [RENAMED] Tortilla dome lava – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **Tortilla dome vitrophyre, Peters Canyon dome complex [RENAMED] Tortilla dome vitrophyre – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **Tortilla dome pumice breccia, Peters Canyon dome complex [RENAMED] Tortilla dome pumice breccia – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **Tortilla dome surge deposits, Peters Canyon dome complex [RENAMED] Tortilla dome surge deposits – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **Geronimo Head dome lava, Peters Canyon dome complex [RENAMED] Geronimo Head dome lava – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **Geronimo Head dome vitrophyre, Peters Canyon dome complex [RENAMED] Geronimo Head dome vitrophyre – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **Geronimo Head dome pyroclastic deposits, Peters Canyon dome complex [RENAMED] Geronimo Head dome pyroclastic deposits – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **Malapais dome lava, Peters Canyon dome complex [RENAMED] Malapais dome lava – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **Malapais dome vitrophyre, Peters Canyon dome complex [RENAMED] Malapais dome vitrophyre – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **Malapais dome pyroclastic deposits, Peters Canyon dome complex [RENAMED] Malapais dome pyroclastic deposits – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **lower dome lava, Peters Canyon dome complex [RENAMED] lower dome lava – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **lower dome vitrophyre, Peters Canyon dome complex [RENAMED] lower dome vitrophyre – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group** Prowell (1984)
- **lower dome pyroclastic deposits, Peters Canyon dome complex [RENAMED] lower dome pyroclastic**

deposits – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group Prowell (1984)

Peters Canyon dome complex [RENAMED] unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group Rettenmaier (1984). Subdivided into two units:

lavas [RENAMED] lava – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group Rettenmaier (1984)

tuffs [RENAMED] tuff – unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group Rettenmaier (1984)

Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Apache Leap Tuff** OR **Coffee Flat Mountain Formation – Gila Group** Reynolds and others (1986). Includes the following units:

16.60 Ma quartz latite [RENAMED] Coffee Flat Mountain Formation – Gila Group Reynolds and others (1986) report two analyses (zircon and sphene fission track) for this unit.

16.68 Ma rhyolite tuff [RENAMED] tuff – Coffee Flat Mountain Formation – Gila Group Reynolds and others (1986)

Geronimo Head Formation [OBSOLETE] unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group Sheridan and Prowell (1986)

upper rhyodacite lava of Coffee Flat Mountain [RENAMED] upper rhyodacite lava – Coffee Flat Mountain Formation – Gila Group Ferguson and Skotnicki (1995)

older flow unit of the upper rhyodacite lava of Coffee Flat Mountain AND **lower flow unit of the upper rhyodacite lava of Coffee Flat Mountain [RENAMED] lower flow unit of the upper rhyodacite lava – Coffee Flat Mountain Formation – Gila Group** Ferguson and Skotnicki (1995)

crystal rich dacite lava (dacite of Randolph Canyon) [OBSOLETE] upper Government Well Formation – Superstition Group OR **crystal rich dacite – Coffee Flat Mountain Formation – Gila Group** Ferguson and Skotnicki (1995)

upper rhyolite lava [RENAMED] rhyolite lava – Coffee Flat Mountain Formation – Gila Group Ferguson and Skotnicki (1995)

lithic tuff [RETAINED] lithic tuff – Coffee Flat Mountain Formation – Gila Group Ferguson and Skotnicki (1995)

fine-grained intrusive rhyodacite [RETAINED] fine-grained intrusive rhyodacite – Coffee Flat Mountain Formation – Gila Group Ferguson and Skotnicki (1995)

lower rhyodacite lava and intrusions of Coffee Flat Mountain [RENAMED] lower rhyodacite lava and intrusions – Coffee Flat Mountain Formation – Gila Group Ferguson and Skotnicki (1995)

lower dacite lava [OBSOLETE] intrusive dacite – Coffee Flat Mountain Formation – Gila Group (east) OR **dacite of San Mateo Castro Ranch – Government Well Formation- Superstition Group** (west) Ferguson and Skotnicki (1995)

bedded tuff [GENERIC] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Skotnicki and Ferguson (1995)

quartz latite lava AND **crystal-rich quartz latite lava [RENAMED] crystal-rich quartz latite lava – Coffee Flat Mountain Formation – Gila Group** Ferguson and Gilbert (1997), Gilbert and Ferguson (1997)

brecciated quartz latite lava [RETAINED] brecciated quartz latite lava – Coffee Flat Mountain Formation – Gila Group Ferguson and Gilbert (1997)

younger unwelded rhyolite tuff associated with the quartz latite lava AND **unwelded rhyolite tuff associated with the quartz latite lava [RENAMED] nonwelded rhyolite tuff associated with the quartz latite lava – Coffee Flat Mountain Formation – Gila Group** Gilbert and Ferguson (1997)

intrusions of crystal-rich quartz latite lava AND **intrusive bodies of the quartz latite lava [RENAMED] intrusive bodies of the quartz latite lava – Coffee Flat Mountain Formation – Gila Group** Gilbert and Ferguson (1997)

crystal-rich quartz latite lava breccia [RETAINED] crystal-rich quartz latite lava breccia – Coffee Flat Mountain Formation – Gila Group Gilbert and Ferguson (1997)

crystal-rich quartz latite lava vitrophyre [RETAINED] crystal-rich quartz latite lava vitrophyre – Coffee Flat Mountain Formation – Gila Group Gilbert and Ferguson (1997)

rhyolite lavas of Fish Creek Peak [REDEFINED] rhyolite lavas of Fish Creek Peak – Coffee Flat Mountain Formation – Gila Group Gilbert and Ferguson (1997)

unwelded rhyolite tuff associated with the rhyolite lavas of Fish Creek Peak [REDEFINED] nonwelded tuffs of Fish Creek Peak – Coffee Flat Mountain Formation – Gila Group Gilbert and Ferguson (1997)
Coffee Flat Mountain Formation [RETAINED] Coffee Flat Mountain Formation – Gila Group McIntosh and Ferguson (1998)

[2. Apache Leap Tuff]

Apache Leap Tuff [REDEFINED] This unit was formally defined by D.W. Peterson (1969) who named it for Apache Leap, a prominent west-facing cliff east of Superior. The type section is in Queen Creek Canyon and Oak Flat, also east of Superior. The name was used by later workers for the outflow sheet in the southeastern and northeastern part of the volcanic field (Suneson, 1976; Cornwall and others, 1971; Theodore and others, 1978; Creasey and others, 1983; Faulds, 1984). As redefined, the unit includes all exposures of tuff previously referred to as Superstition Tuff (and its subdivisions; Canyon Lake, Dogie Spring, and Siphon Draw members), San Tan Tuff, tuff of Comet Peak, tuff of Goat Mountain, and welded tuff (in the Santan Mountains). The name Apache Leap Tuff was chosen to represent the entire ash-flow tuff sheet for three reasons: 1) The type section of D.W. Peterson (1969) includes a complete section, 2) the phenocryst modes as described by D.W. Peterson (1969) are reproducible, and 3) precedence. The obsolete Superstition Tuff (Stuckless and Sheridan, 1971) has been abandoned for the same three reasons: 1) none of the type sections for the Superstition Tuff are complete, 2) the phenocryst modes of the Superstition Tuff as defined by Stuckless and Sheridan (1971) are not reproducible, and 3) precedence. A number of valid subdivisions of the Apache Leap Tuff have been recognized in the Superstition Mountains, chiefly within its source cauldron. Many of these names are redefined or renamed because they included "Superstition Tuff" as part of their name. Some of the informally defined units were originally referred to as "members", and these are changed to "units".

Undivided Apache Leap Tuff and informal units:

Dacite AND **dacite [OBSOLETE] Apache Leap Tuff** Ransome (1903), Ransome (1904), Ransome (1919), Ransome (1923), N.P. Peterson and others (1953), N.P. Peterson (1954), N.P. Peterson (1961), N.P. Peterson (1963), Sell (1968)
later volcanic rocks *principally dacite* [OBSOLETE] Apache Leap Tuff D.W. Peterson (1960)
Superior dacite [OBSOLETE] Apache Leap Tuff Damon and Bikerman (1964), Sheridan and others (1971)
"dacite" [OBSOLETE] Apache Leap Tuff D.W. Peterson (1968)
welded tuff [RENAMED] unit of Hieroglyphic Canyon – Apache Leap Tuff sample PED-18-68 of Damon (1969)
Apache Leap quartz latite [OBSOLETE] Apache Leap Tuff Fodor (1969)
Apache Leap Tuff AND **Apache Leap tuff [REDEFINED] Apache Leap Tuff** D.W. Peterson (1969), Cornwall and others (1971), Stuckless and Sheridan (1971), Stuckless and O'Neil (1973), Sedgeley (1976), Theodore and others (1978), Creasey and others (1983), Keith (1983), Faulds, 1986, Dickinson (1995), Spencer and Richard (1995a), Spencer and Richard (1995b), Reynolds and others (1986), McIntosh and Ferguson (1998), Richard and Spencer (1998)
Apache Leap Formation [OBSOLETE] Apache Leap Tuff Sheridan and Stuckless (1969), Stuckless (1969), Stuckless (1971), Sheridan and others (1971), Isagholian (1983)
latite flows and pyroclastics [RENAMED] Apache Leap Tuff Wilson (1969)
quartz latite welded tuff [OBSOLETE] Apache Leap Tuff Sheridan and others (1971)
Canyon Lake Member (Superstition Tuff) AND **Canyon Lake Member of the Superstition Tuff** AND **Canyon Lake member, Superstition Tuff** AND **Canyon Lake Member, Superstition Tuff** AND **Superstition Tuff, Canyon Lake Member [OBSOLETE] Apache Leap Tuff** Stuckless (1971), Stuckless and Sheridan (1971), Stuckless and O'Neil (1973), Sedgeley (1976), Suneson (1976), Sheridan (1978), Rettenmaier (1984)
Superstition Tuff AND **Superstition Formation [OBSOLETE] Apache Leap Tuff** Stuckless (1971),

Stuckless and Sheridan (1971), Suneson (1976), Sheridan (1978), Sheridan and Prowell (1986), Ferguson and Skotnicki (1995), Spencer and Richard (1995b), Ferguson and Gilbert (1997), Gilbert and Ferguson (1997)

Dogie Spring Member of the Superstition Formation AND **Dogie Spring Member of the Superstition Tuff** AND **Superstition Tuff, Dogie Spring Member** AND **Dogie Spring Member, Superstition Tuff [OBSOLETE] Apache Leap Tuff** Stuckless (1971), Stuckless and Sheridan (1971), Stuckless and O'Neil (1973)

Siphon Draw Member (Superstition Tuff) AND **Siphon Draw member, Superstition Tuff** AND **Siphon Draw Member, Superstition Tuff** AND **Siphon Draw Member of the Superstition Formation** AND **Siphon Draw Member of the Superstition Tuff** AND **Superstition Tuff, Siphon Draw Member [OBSOLETE] Apache Leap Tuff** Stuckless (1971), Stuckless and Sheridan (1971), Stuckless and O'Neil (1973), Sedgeley (1976), Suneson (1976), Sheridan (1978)

San Tan Tuff [OBSOLETE] Apache Leap Tuff Balla (1972)

tuff of Goat Mountain AND **tuff on Goat Mountain [OBSOLETE] Apache Leap Tuff** Suneson and Sheridan (1975), Suneson (1976)

Siphon Draw welded tuff AND **Siphon Draw Tuff** AND **Siphon Draw Rhyodacite Tuff [OBSOLETE] Apache Leap Tuff** Suneson and Sheridan (1975), Prowell (1984), Kilbey (1986)

Canyon Lake welded tuff [OBSOLETE] Apache Leap Tuff Suneson (1976), Prowell (1984)

older rhyolite complex [RENAMED] Apache Leap Tuff Suneson (1976)

breccia of First Water [OBSOLETE] volcaniclastic sandstone – Gila Group OR **megabreccia – Apache Leap Tuff** Sheridan (1978)

upper capping rhyodacite flows [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Apache Leap Tuff** Scarborough (1981b)

interbedded pyroclastics and flows [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Coffee Flat Mountain Formation – Gila Group** Scarborough (1981b)

older dacite tuffs and vitrophyres [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Coffee Flat Mountain Formation – Gila Group** Scarborough (1981b)

vitrophyric zone of the Canyon Lake Tuff [OBSOLETE] vitrophyre - Apache Leap Tuff Isagholian (1983)

upper ash-flow tuff [OBSOLETE] Apache Leap Tuff OR **tuff – Coffee Flat Mountain Formation – Gila Group** Peterson and Jinks (1983)

lower ash-flow tuff [RENAMED] Apache Leap Tuff Peterson and Jinks (1983)

dacite [OBSOLETE] upper Government Well Formation – Superstition Group OR **breccia – Apache Leap Tuff** Peterson and Jinks (1983)

Canyon Lake vitrophyre [OBSOLETE] vitrophyre – Apache Leap Tuff Prowell (1984)

Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Apache Leap Tuff** OR **Coffee Flat Mountain Formation – Gila Group** Reynolds and others (1986). Includes the following unit:

18.85 Ma quartz latite tuff [RENAMED] Apache Leap Tuff Reynolds and others (1986)

Superstition Tuff [OBSOLETE] Apache Leap Tuff Reynolds and others (1986). Includes the following units:

15.40 Ma ash-flow tuff [RENAMED] Apache Leap Tuff Reynolds and others (1986)
15.90 Ma ash-flow tuff [RENAMED] Apache Leap Tuff Reynolds and others (1986)
24.10 Ma tuff [RENAMED] Apache Leap Tuff Reynolds and others (1986)
25.00 Ma tuff [RENAMED] Apache Leap Tuff Reynolds and others (1986)
25.30 Ma tuff [RENAMED] Apache Leap Tuff Reynolds and others (1986)
25.60 Ma tuff [RENAMED] Apache Leap Tuff Reynolds and others (1986)
26.20 Ma tuff [RENAMED] Apache Leap Tuff Reynolds and others (1986)

Superstition volcanics [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Gila Group** Reynolds and others (1986). Includes the following unit:

23.13 Ma welded tuff [RENAMED] Apache Leap Tuff Reynolds and others (1986)

Canyon Lake Tuff [OBSOLETE] Apache Leap Tuff Sheridan and Prowell (1986), Sheridan (1987)

tuff of Comet Peak AND **Comet Peak Welded Tuff** AND **Tuff of Comet Peak [OBSOLETE] Apache Leap Tuff** Ferguson and Skotnicki (1995), Skotnicki and Ferguson (1995), Spencer and Richard (1995b)

tuff of Comet Peak, poorly welded interval AND **Comet Peak Tuff, poorly welded interval [OBSOLETE] poorly welded interval – Apache Leap Tuff** Ferguson and Skotnicki (1995), Skotnicki and Ferguson (1995)

bedded breccia [OBSOLETE] bedded breccia – Gila Group OR **bedded breccia – Apache Leap Tuff** Ferguson and Skotnicki (1995)
Superstition Tuff, upper Flatiron member AND **upper Flatiron member of the Superstition Welded Tuff [OBSOLETE] upper Flatiron unit – Apache Leap Tuff** Ferguson and Skotnicki (1995), Skotnicki and Ferguson (1995)
Superstition Tuff, lower Flatiron member AND **lower Flatiron member of the Superstition Welded Tuff [OBSOLETE] lower Flatiron unit – Apache Leap Tuff** Ferguson and Skotnicki (1995), Skotnicki and Ferguson (1995)
Superstition Tuff, Peralta Canyon member AND **Peralta member of the Superstition Welded Tuff [OBSOLETE] unit of Peralta Canyon – Apache Leap Tuff** Ferguson and Skotnicki (1995), Skotnicki and Ferguson (1995)
Superstition Tuff, Miners Needle member AND **Miners Needle break of the Superstition Welded Tuff [OBSOLETE] unit of Miners Needle – Apache Leap Tuff** Ferguson and Skotnicki (1995), Skotnicki and Ferguson (1995)
Superstition Tuff, Hieroglyphic member AND **Hieroglyphic member of the Superstition Welded Tuff [OBSOLETE] unit of Hieroglyphic Canyon – Apache Leap Tuff** Ferguson and Skotnicki (1995), Skotnicki and Ferguson (1995)
Superstition Tuff mesobreccia AND **Superstition Tuff heterolithic mesobreccia [OBSOLETE] mesobreccia – Apache Leap Tuff** Ferguson and Skotnicki (1995), Ferguson and Gilbert (1997)
Superstition Tuff megabreccia [OBSOLETE] megabreccia – Apache Leap Tuff Ferguson and Skotnicki (1995)
rhyolite lava breccia [OBSOLETE] monolithic megabreccia – Apache Leap Tuff Ferguson and Skotnicki (1995)
Superstition Tuff (or Siphon Draw Tuff) [OBSOLETE] Apache Leap Tuff Skotnicki and Ferguson (1995)
Mesobreccia [RETAINED] mesobreccia – Apache Leap Tuff Skotnicki and Ferguson (1995)
Megabreccia [RETAINED] megabreccia – Apache Leap Tuff Skotnicki and Ferguson (1995)
Tuff and bedded pyroclastic deposits [GENERIC] tuff and bedded pyroclastic deposits – Superstition Group OR **Apache Leap Tuff** OR **tuff and bedded pyroclastic deposits – Gila Group** Spencer and Richard (1995b)
Breccia associated with the Superstition tuff [OBSOLETE] breccia – Apache Leap Tuff Spencer and Richard (1995b)
welded tuff [RENAMED] Apache Leap Tuff Ferguson and Skotnicki (1996)
volcanic and epiclastic monolithic to heterolithic breccia, conglomerate, and bedded unwelded tuff [RETAINED] volcanic and epiclastic monolithic to heterolithic breccia, conglomerate, and bedded unwelded tuff – Apache Leap Tuff OR **volcanic and epiclastic monolithic to heterolithic breccia, conglomerate, and bedded unwelded tuff - Gila Group** Gilbert and Ferguson (1997)
upper Superstition Tuff [OBSOLETE] upper Apache Leap Tuff Gilbert and Ferguson (1997)
lower Superstition Tuff [OBSOLETE] lower Apache Leap Tuff Gilbert and Ferguson (1997)

[3. Superstition Group]

Superstition Group [NEW] Defined as all volcanic rocks overlying Whitetail Formation and underlying the Apache Leap Tuff throughout the Superstition volcanic field. The Superstition Group includes three new formations, from oldest to youngest: Government Well Formation, Tule Canyon Formation, and Whitlow Canyon Formation. The type area is the Superstition Mountains.

Undivided Superstition Group and informal units:

earlier volcanics [RENAMED] Superstition Group D.W. Peterson (1960)
Lower dacite tuff [RETAINED] lower dacite tuff – Superstition Group(?) OR **lower dacite tuff – Picketpost**

Mountain Formation – Gila Group(?) Nelson (1966)
Goldfield volcanics [OBSOLETE] Superstition Group Durand (1967)
rhyolite [RENAMED] Superstition Group D.W. Peterson (1969)
basalt flows and agglomerate [RETAINED] basalt flows and agglomerate – Superstition Group Wilson (1969)
basaltic plugs and dikes [RETAINED] basaltic plugs and dikes – Superstition Group Wilson (1969)
quartz latite and rhyolite domes and lavas AND **rhyolite and quartz latite domes and lavas [OBSOLETE] Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1971)
quartz latite domes and lavas [OBSOLETE] Superstition Group OR **Gila Group** Stuckless (1971)
redbeds and local andesites [RETAINED] redbeds and local andesites – Whitetail Formation OR **redbeds and local andesites – Superstition Group** Scarborough (1981b)
interbedded pyroclastics and flows [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Coffee Flat Mountain Formation – Gila Group** Scarborough (1981b)
older dacite tuffs and vitrophyres [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Coffee Flat Mountain Formation – Gila Group** Scarborough (1981b)
lower tuff [OBSOLETE] Superstition Group Peterson and Jinks (1983)
lower rhyolite [OBSOLETE] Superstition Group Peterson and Jinks (1983)
Mud Springs basalt [RENAMED] basalt of Mud Springs – Superstition Group Faulds (1986)
spherulitic rhyolite [RETAINED] spherulitic rhyolite – Superstition Group Spencer and Richard (1995a)
crystal poor felsic volcanic rocks [RETAINED] crystal poor felsic volcanic rocks – Superstition Group Spencer and Richard (1995a)
Felsic to intermediate volcanic rocks [GENERIC] felsic to intermediate volcanic rocks – Superstition Group OR **felsic to intermediate volcanic rocks – Gila Group** Spencer and Richard (1995b)
Tuff and bedded pyroclastic deposits [GENERIC] tuff and bedded pyroclastic deposits – Superstition Group OR **Apache Leap Tuff** OR **tuff and bedded pyroclastic deposits – Gila Group** Spencer and Richard (1995b)
Basalt [GENERIC] basalt – Superstition Group OR **basalt – Gila Group** Spencer and Richard (1995b)
Clastic sedimentary rocks [GENERIC] clastic sedimentary rocks – Superstition Group OR **clastic sedimentary rocks – Gila Group** Spencer and Richard (1995b)
Volcanic and sedimentary rocks, undivided [GENERIC] volcanic and sedimentary rocks, undivided – Superstition Group OR **volcanic and sedimentary rocks, undivided – Gila Group** Spencer and Richard (1995b)
Hypabyssal intrusive rocks [GENERIC] hypabyssal intrusive rocks – Superstition Group OR **hypabyssal intrusive rocks – Gila Group** Spencer and Richard (1995b)
basalt lava [OBSOLETE] basalt lava – Whitetail Formation (east) OR **basalt lava – Superstition Group** (west) Ferguson and Skotnicki (1996)
bedded basaltic scoria [RETAINED] bedded basaltic scoria – Superstition Group Ferguson and Skotnicki (1996)
massive tuff [RETAINED] massive tuff – Superstition Group Skotnicki and Leighty (1997)
bedded tuff (Tt_1) [RETAINED] bedded tuff – Superstition Group Skotnicki and Leighty (1997)

Formations of the Superstition Group:

Whitlow Canyon Formation – Superstition Group [RENAMED] This new formal unit is named for the "rhyodacite of Whitlow Canyon" an informal unit named by Ferguson and Skotnicki (1995) in the southern part of the volcanic field. The unit is elevated to formation status because of its lateral continuity (occurrence on both sides of the Superstition Cauldron) and utility as a time-stratigraphic marker unit. The lava contains a distinctive assemblage of phenocrysts with the total phenocryst assemblage ranging in abundance between 1% and 15%. Listed in decreasing order of abundance these are; plagioclase, sanidine, large embayed quartz, and biotite. The type section is in the vicinity of the confluence of Tule Canyon and Whitlow Canyon to the south of the Superstition Cauldron. This section, which is 210 meters thick, consists entirely of massive, coherent facies lava.

Undivided Whitlow Canyon Formation and informal units:

flow-banded rhyolites [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Whitlow Canyon Formation – Superstition Group** Stuckless (1969)

glassy quartz latite [OBSOLETE] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1969)

Geronimo Head formation AND **Geronimo Head Formation** AND **lavas of Geronimo Head Formation** AND **tuffs of Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1969), Stuckless (1971), Stuckless and Sheridan (1971), Suneson (1976), Sheridan (1978)

rhyodacite [OBSOLETE] Coffee Flat Mountain Formation – Gila Group OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost** Peterson and Jinks (1983). Subdivided into two units:

- **zeolitized rhyodacite [OBSOLETE] Coffee Flat Mountain Formation – Gila Group** OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost** Peterson and Jinks (1983)
- **rhyodacite vents [OBSOLETE] Coffee Flat Mountain Formation – Gila Group** OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost** Peterson and Jinks (1983)

Willow Creek Rhyolites AND **Willow Creek Rhyolite tuff** AND **Willow Creek Rhyolite lavas [OBSOLETE] Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **monolithic avalanche breccia – Gila Group** Prowell (1984)

Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Whitlow Canyon Formation – Superstition Group** Rettenmaier (1984). Subdivided into three units:

- **Tuffs [OBSOLETE] tuff – Tule Canyon Formation – Superstition Group** OR **tuff – Whitlow Canyon Formation – Superstition Group** Rettenmaier (1984)
- **Lavas [OBSOLETE] lava – Tule Canyon Formation – Superstition Group** OR **lava – Whitlow Canyon Formation – Superstition Group** Rettenmaier (1984)
- **Vitrophyre [OBSOLETE] vitrophyre – Tule Canyon Formation – Superstition Group** OR **vitrophyre – Whitlow Canyon Formation – Superstition Group** Rettenmaier (1984)

rhyodacite lava (rhyodacite of Whitlow Canyon) [RENAMED] Whitlow Canyon Formation – Superstition Group Ferguson and Skotnicki (1995)

Whitlow Canyon type rhyodacite lava [RENAMED] lava - Whitlow Canyon Formation – Superstition Group Ferguson and Gilbert (1997)

Whitlow Canyon type rhyodacite lava breccia AND **monolithic breccia composed of Whitlow Canyon type rhyodacite lava [RENAMED] lava breccia – Whitlow Canyon Formation – Superstition Group** Ferguson and Gilbert (1997), Gilbert and Ferguson (1997)

intrusive plugs of Whitlow Canyon type rhyodacite lava [RENAMED] intrusive plugs – Whitlow Canyon Formation – Superstition Group Ferguson and Gilbert (1997)

mixed crystal-poor rhyolite and Whitlow Canyon type rhyodacite lava [RENAMED] Tule Canyon Formation and Whitlow Canyon Formation (undifferentiated) – Superstition Group Ferguson and Gilbert (1997)

Whitlow Canyon type rhyodacite lava [RENAMED] lava – Whitlow Canyon Formation – Superstition Group Gilbert and Ferguson (1997)

Whitlow Canyon Formation [RETAINED] Whitlow Canyon Formation – Superstition Group McIntosh and Ferguson (1998)

Tule Canyon Formation – Superstition Group [RENAMED] This new formal unit is named for the "rhyolite lavas of Tule Canyon", an informal unit that was defined in the southern part of the volcanic field by Ferguson and Skotnicki (1995). The formation consists of crystal-poor to aphyric rhyolite lava and associated non-welded tuff. The rhyolite is characterized by crystal-poor (typically < 5% phenocrysts) texture, and phenocryst assemblages dominated by small plagioclase, sanidine, biotite, and rare hornblende phenocrysts. Quartz phenocrysts are rare to absent. Locally, the rhyolite is interbedded with basaltic lava or rare volcaniclastic sandstone intervals. Towards the edge of the volcanic field, the formation consists exclusively of non-welded, bedded, crystal-poor tuff. Some of the tuff extends as far south as the Gila River area. Based on

multiple age dates, an age range of 19.0 – 18.7 Ma (McIntosh and Ferguson, 1998) is well constrained. The type section is located on the west slope of the large mountain that forms the headwaters of Tule Canyon. The section is 535 meters thick and includes three lava units interbedded with three non-welded tuffs, with the lower tuff overlying dacite or andesite lavas of the Government Well Formation. The unit replaces a number of older unit names from the northwestern part of the volcanic field; principally Geronimo Head Formation, Willow Creek Rhyolite, and rhyolite of First Water.

Undivided Tule Canyon Formation and informal units:

Ash-flow tuffs (andesites) [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Government Well Formation – Superstition Group** Durand (1967)

ash-flow tuff and lava sequence [OBSOLETE] (mostly) **Tule Canyon Formation – Superstition Group** Fodor (1969). Subdivided into six units:

- **member A [RENAMED] nonwelded tuff – Tule Canyon Formation – Superstition Group** Fodor (1969)
- **member B (rhyolite) [RENAMED] rhyolite lava – Tule Canyon Formation – Superstition Group** Fodor (1969)
- **member C [RENAMED] nonwelded tuff – Tule Canyon Formation – Superstition Group** Fodor (1969)
- **member D [RENAMED] rhyolite lava – Tule Canyon Formation – Superstition Group** Fodor (1969)
- **member E [RENAMED] nonwelded tuff – Tule Canyon Formation – Superstition Group** Fodor (1969)
- **member F [RENAMED] rhyolite lava – Tule Canyon Formation – Superstition Group** Fodor (1969)

flow-banded rhyolites [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Whitlow Canyon Formation – Superstition Group** Stuckless (1969)

glassy quartz latite [OBSOLETE] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1969)

late stage domes and lavas [OBSOLETE] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1969)

Geronimo Head formation AND **Geronimo Head Formation** AND **lavas of Geronimo Head Formation** AND **tuffs of Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1969), Stuckless (1971), Stuckless and Sheridan (1971), Suneson (1976), Sheridan (1978)

rhyolite tuff, breccia, and lava AND **rhyolite ash-flows and lavas** AND **rhyolite lava [RENAMED] Tule Canyon Formation – Superstition Group** Sheridan and others (1971)

rhyolite ash flows and epiclastic breccias of the Geronimo Head Formation [OBSOLETE] probably **Tule Canyon Formation – Superstition Group** Stuckless and Sheridan (1971)

quartz latite domes [RENAMED] Tule Canyon Formation – Superstition Group Malone (1972)

Horse Mesa rhyolite lavas AND **rhyolite of Horse Mesa [OBSOLETE] Tule Canyon Formation – Superstition Group** Malone (1972), Suneson (1976), Sheridan (1978), Rettenmaier (1984)

younger rhyolite ashes and lahars [OBSOLETE] Tule Canyon Formation – Superstition Group Malone (1972)

glassy rhyolite dome [RENAMED] rhyolite – Tule Canyon Formation – Superstition Group Stuckless and O'Neil (1973)

glassy rhyolite dike [?] *possibly* **Tule Canyon Formation – Superstition Group** *No location given* Stuckless and O'Neil (1973)

Rhyolite [RENAMED] intrusive rhyolite – Tule Canyon Formation- Superstition Group Hillier (1978)

upper rhyolite dacite flows which cap mesas [RENAMED] lava – Tule Canyon Formation – Superstition Group Scarborough (1981a)

upper yellowish tuffs [RENAMED] tuff – Tule Canyon Formation – Superstition Group Scarborough (1981a)

NW-trending rhyolite dikes [RENAMED] intrusive rhyolite - Tule Canyon Formation – Superstition

Group Scarborough (1981a)
white tuff series [OBSOLETE] Tule Canyon Formation – Superstition Group Scarborough (1981a)
Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group Scarborough (1981a)
upper capping rhyodacite flows [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Apache Leap Tuff** Scarborough (1981b
pyroclastic ejecta blanket [RENAMED] tuff – Tule Canyon Formation – Superstition Group Scarborough (1981b
rhyolite of Horse Mesa [OBSOLETE] Tule Canyon Formation – Superstition Group Isagholian (1983)
Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group Isagholian (1983). Subdivided into the following units:
Black Cross Butte lava flow [RENAMED] unit of Black Cross Butte – Tule Canyon Formation – Superstition Group Isagholian (1983). Subdivided into two units:
Lava flow of Black Cross Butte [RETAINED] lava flow of Black Cross Butte – unit of Black Cross Butte – Tule Canyon Formation – Superstition Group Isagholian (1983)
Vitrophyre of Black Cross Butte [RETAINED] vitrophyre of Black Cross Butte – unit of Black Cross Butte – Tule Canyon Formation – Superstition Group Isagholian (1983)
Lava dome complexes [RENAMED] Tule Canyon Formation – Superstition Group Isagholian (1983). Subdivided into the following units:
Lava dome breccia [RENAMED] lava breccia – Tule Canyon Formation – Superstition Group Isagholian (1983)
Lava domes [RENAMED] lava – Tule Canyon Formation – Superstition Group Isagholian (1983). Subdivided into four units:
lava dome of Coronado Mesa [RENAMED] lava – Tule Canyon Formation – Superstition Group Isagholian (1983)
lava dome west of Black Cross Butte [RENAMED] lava – Tule Canyon Formation – Superstition Group Isagholian (1983)
lava dome complex south of Black Cross Butte [RENAMED] lava – Tule Canyon Formation – Superstition Group Isagholian (1983)
lava dome of Fish Creek [RENAMED] lava – Tule Canyon Formation – Superstition Group Isagholian (1983)
Surge [RENAMED] nonwelded tuff – Tule Canyon Formation – Superstition Group Isagholian (1983)
Willow Creek Rhyolites AND **Willow Creek Rhyolite tuff** AND **Willow Creek Rhyolite lavas [OBSOLETE] Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **monolithic avalanche breccia – Gila Group** Prowell (1984)
Coronado Mesa lava dome [RENAMED] lava – Tule Canyon Formation – Superstition Group Rettenmaier (1984)
Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Whitlow Canyon Formation – Superstition Group** Rettenmaier (1984). Subdivided into three units:
tuffs [OBSOLETE] tuff – Tule Canyon Formation – Superstition Group OR **tuff – Whitlow Canyon Formation – Superstition Group** Rettenmaier (1984)
lavas [OBSOLETE] lava – Tule Canyon Formation – Superstition Group OR **lava – Whitlow Canyon Formation – Superstition Group** Rettenmaier (1984)
vitrophyre [OBSOLETE] vitrophyre – Tule Canyon Formation – Superstition Group OR **vitrophyre – Whitlow Canyon Formation – Superstition Group** Rettenmaier (1984)
First Water Rhyolite AND **First Water Rhyolites** AND **First Water Rhyolite Tuff** AND **First Water Rhyolite Lava 1** AND **First Water Rhyolite Lava 2** AND **First Water Rhyolite Lavas** AND **First Water Rhyolite Tuffs [OBSOLETE] Tule Canyon Formation – Superstition Group** Kilbey (1986)
Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Apache Leap Tuff** OR **Coffee Flat Mountain Formation – Gila Group** Reynolds and others (1986). Includes the following unit:
16.50 Ma rhyolite dike [RENAMED] crystal-poor rhyolite – Tule Canyon Formation – Superstition Group Reynolds and others (1986)

Superstition volcanics [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Gila Group** Reynolds and others (1986). Includes the following units:

15.43 Ma rhyolite tuff [RENAMED] tuff – Tule Canyon Formation – Superstition Group Reynolds and others (1986)

17.46 Ma rhyolite [RENAMED] lava – Tule Canyon Formation – Superstition Group Reynolds and others (1986)

19.24 Ma rhyolite [RENAMED] lava – Tule Canyon Formation – Superstition Group Reynolds and others (1986)

Rhyolite of First Water Canyon [OBSOLETE] Tule Canyon Formation – Superstition Group Sheridan and Prowell (1986), Sheridan (1987)

First Water Rhyolite, First Water rhyolite vitrophyre #2, First Water rhyolite vitrophyre #1, First Water rhyolite pyroclastic sequences AND **First Water rhyolite pyroclastic deposits [OBSOLETE] Tule Canyon Formation – Superstition Group** Melchiorre and Clemens (1993)

rhyolite lava (rhyolite lavas of Tule Canyon) AND **rhyolite lava [RENAMED] rhyolite lava – Tule Canyon Formation – Superstition Group** Ferguson and Skotnicki (1995)

intrusive rhyolite [RENAMED] rhyolite – Tule Canyon Formation – Superstition Group Ferguson and Skotnicki (1995)

intrusive rhyolite [RETAINED] intrusive rhyolite – Tule Canyon Formation – Superstition Group Skotnicki and Ferguson (1995), Ferguson and Gilbert (1997), Gilbert and Ferguson (1997), Skotnicki and Leighty (1997)

rhyolite [RETAINED] rhyolite – Tule Canyon Formation – Superstition Group Skotnicki and Ferguson (1995), Skotnicki and Ferguson (1996), Skotnicki and Leighty (1997)

bedded tuff [GENERIC] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Skotnicki and Ferguson (1995)

lithic tuff [RETAINED] lithic tuff – Tule Canyon Formation – Superstition Group Skotnicki and Ferguson (1996)

volcaniclastic conglomerate, pebbly sandstone, and sandstone interbedded with abundant unwelded bedded lithic tuffs AND **volcaniclastic conglomerate and sandstone interbedded with unwelded tuff [OBSOLETE] volcaniclastic conglomerate and sandstone interbedded with nonwelded tuff – Tule Canyon Formation – Superstition Group** Ferguson and Gilbert (1997)

crystal-poor rhyolite lava AND **younger crystal-poor rhyolite lava [OBSOLETE] crystal-poor rhyolite lava – Tule Canyon Formation – Superstition Group** Ferguson and Gilbert (1997)

generic unwelded bedded or massive crystal-poor rhyolitic tuff AND **younger crystal-poor bedded unwelded rhyolitic tuff [OBSOLETE] Tule Canyon Formation** OR **Gila Group – Superstition Group** Ferguson and Gilbert (1997)

mixed crystal-poor rhyolite and Whitlow Canyon type rhyodacite lava [RENAMED] Tule Canyon Formation and Whitlow Canyon Formation (undifferentiated) – Superstition Group Ferguson and Gilbert (1997)

rhyolite lava AND **older rhyolite lava [RENAMED] rhyolite lava – Tule Canyon Formation – Superstition Group** Ferguson and Gilbert (1997)

older rhyolite lava and unwelded tuff undifferentiated [RENAMED] Tule Canyon Formation-Superstition Group Ferguson and Gilbert (1997)

brecciated rhyolite lava AND **brecciated older rhyolite lava [RENAMED] brecciated rhyolite lava- Tule Canyon Formation – Superstition Group** Ferguson and Gilbert (1997)

brecciated crystal-poor rhyolite lava AND **brecciated older crystal-poor rhyolite lava [RENAMED] brecciated crystal-poor rhyolite lava – Tule Canyon Formation – Superstition Group** Ferguson and Gilbert (1997)

brecciated crystal-rich rhyolite lava AND **brecciated older crystal-rich rhyolite lava [RENAMED] brecciated crystal-rich rhyolite lava – Tule Canyon Formation – Superstition Group** Ferguson and Gilbert (1997)

aphyric rhyolite lava AND **aphyric older rhyolite lava [RENAMED] aphyric rhyolite lava – Tule Canyon Formation – Superstition Group** Ferguson and Gilbert (1997)

crystal-poor rhyolite lava AND **crystal-poor older rhyolite lava [RENAMED] crystal-poor rhyolite lava –**

Tule Canyon Formation – Superstition Group Ferguson and Gilbert (1997)
crystal-rich rhyolite lava AND **crystal-rich older rhyolite lava [RENAMED] crystal-rich rhyolite lava – Tule Canyon Formation – Superstition Group** Ferguson and Gilbert (1997)
crystal-poor rhyolitic unwelded tuff AND **crystal-poor bedded unwelded rhyolitic tuff [RENAMED] crystal-poor rhyolitic nonwelded tuff – Tule Canyon Formation – Superstition Group** Ferguson and Gilbert (1997)
middle basalt [RENAMED] basalt – Tule Canyon Formation – Superstition Group Ferguson and Gilbert (1997), Gilbert and Ferguson (1997)
sandstone and conglomerate AND **volcaniclastic sandstone and conglomerate [RENAMED] sandstone and conglomerate – Tule Canyon Formation – Superstition Group** Gilbert and Ferguson (1997)
unwelded bedded lapilli tuff undifferentiated [RETAINED] unwelded bedded lapilli tuff undifferentiated – Tule Canyon Formation – Superstition Group Gilbert and Ferguson (1997)
unwelded bedded tuff AND **unwelded bedded tuff interbedded with nonvolcaniclastic conglomerate [RENAMED] nonwelded tuff and conglomerate – Tule Canyon Formation – Superstition Group** Gilbert and Ferguson (1997)
rhyolite lava undifferentiated [RETAINED] rhyolite lava undifferentiated – Tule Canyon Formation – Superstition Group Gilbert and Ferguson (1997)
aphyric rhyolite lava [RETAINED] aphyric rhyolite lava – Tule Canyon Formation – Superstition Group Gilbert and Ferguson (1997)
crystal-poor rhyolite lava [REDEFINED] crystal-poor rhyolite lava – Tule Canyon Formation – Superstition Group Gilbert and Ferguson (1997)
crystal-rich rhyolite lava [REDEFINED] crystal-rich rhyolite lava – Tule Canyon Formation – Superstition Group Gilbert and Ferguson (1997)
tuff of North Butte AND **welded tuff [RETAINED] tuff of North Butte- Tule Canyon Formation – Superstition Group** Richard and Spencer (1997)
bedded tuff (Tt) [RETAINED] bedded tuff – Tule Canyon Formation – Superstition Group Skotnicki and Leighty (1997)
Tule Canyon Formation [RETAINED] Tule Canyon Formation – Superstition Group McIntosh and Ferguson (1998)

Government Well Formation – Superstition Group [RETAINED] The Government Well Formation, first used by McIntosh and Ferguson (1998), includes all mafic to intermediate lava, lava breccia, tuff, tuff breccia and volcaniclastic rock that underlies the Tule Canyon Formation and overlies the Whitetail Formation. The formation can be divided into upper and lower divisions with the base of the upper division defined as the base of the oldest dacitic lava flow. The type section is located parallel to State Route 88 (the Apache Trail) and starts where Willow Creek enters the southern edge of the Mormon Flat Dam quadrangle. The type section includes 280 meters of the lower division consisting of amalgamated basaltic lava flows, and 1290 meters of the upper division consisting of interbedded dacitic lava, dacitic lava breccia, and non-welded dacitic tuff. At the type section, the upper 170 meters of upper division is further divided into the rhyodacite of Apache Gap, a distinctive, vitric, light-colored lava. Many other viable informal subdivisions have been recognized elsewhere. The age of the Government Well Formation is constrained by dates of underlying Whitetail Formation (20.5 Ma) and the overlying Tule Canyon Formation (19.0 Ma) (McIntosh and Ferguson, 1998). The latite of Government Well (Suneson, 1976) and many variations of this name refer only to the sequence we recognize as the upper division.

Undivided Government Well Formation and informal units:

Ash-flow tuffs (andesites) [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Government Well Formation – Superstition Group** Durand (1967)
basalt, andesite, dacite [RENAMED] Government Well Formation – Superstition Group Fodor (1969)
lower dacite lava [OBSOLETE] intrusive dacite – Coffee Flat Mountain Formation – Gila Group (east) OR **dacite of San Mateo Castro Ranch – Government Well Formation – Superstition Group** (west) Ferguson and Skotnicki (1995)

Government Well Formation [RETAINED] Government Well Formation – Superstition Group McIntosh and Ferguson (1998)

Divisions of the Government Well Formation:

upper Government Well Formation – Superstition Group [NEW] The upper division includes everything above and including the oldest intermediate composition lava in the Government Well Formation. The upper division consists mostly of crystal-rich latitic or dacitic lava, lava breccia, and non-welded tuff containing phenocrysts of plagioclase, biotite, ± hornblende, ± clinopyroxene, ± quartz. Locally, the upper Government Well Formation includes mafic lava flows. At the 1570 meter-thick type section, the upper division is represented by the uppermost 1290 meters, which includes 170 meters of the rhyodacite of Apache Gap at the top.

Undivided upper Government Well Formation and informal units:

dacite dome [RENAMED] rhyodacite of Apache Gap – upper Government Well Fm – Superstition Group Damon (1969)

glassy quartz latite [OBSOLETE] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1969)

late stage domes and lavas [OBSOLETE] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Stuckless (1969)

older dacite complex [RENAMED] upper Government Well Formation – Superstition Group Stuckless (1969)

dacite and rhyolite domes AND **late dacite domes and dikes** AND **late dacite dike [RENAMED] upper Government Well Formation – Superstition Group** Sheridan and others (1971)

andesite to dacite breccia and lava AND **early dacite domes** AND **early dacite dome [RENAMED] upper Government Well Formation – Superstition Group** Sheridan and others (1971)

younger silicic domes and lavas [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group Stuckless (1971)

older dacite complex [RENAMED] upper Government Well Formation – Superstition Group Stuckless (1971)

quartz latite dome, Apache Gap [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group Stuckless and Sheridan (1971)

quartz latite lava, Goldfield Mountains [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group sample 8073 of Stuckless and Sheridan (1971)

older dacite domes [RENAMED] upper Government Well Formation – Superstition Group Stuckless and Sheridan (1971)

Bronco Butte lahar [RENAMED] unit of Bronco Butte – upper Government Well Formation – Superstition Group Malone (1972), Sheridan and Prowell (1986), Sheridan (1987)

older rhyolite ashes and lahars [OBSOLETE] upper Government Well Formation – Superstition Group Malone (1972)

older rhyolite lava [OBSOLETE] upper Government Well Formation – Superstition Group Malone (1972)

Fish Creek trachyandesites and dacites [RENAMED] upper Government Well Formation – Superstition Group Malone (1972)

older dacite complex [RENAMED] upper Government Well Formation – Superstition Group sample AP-244 of Stuckless and O'Neil (1973)

rhyodacite of Apache Gap [RETAINED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group Suneson (1976)

latite of Government Well AND **Latite of Government Well** AND **latite lava of Government Wells** AND **latite of Government Wells** AND **Latites of Government Well [RENAMED] upper**

Government Well Formation – Superstition Group Suneson (1976), Hillier (1978), Prowell (1984), Sheridan and Prowell (1986), Sheridan (1987)

Geronimo Head Formation [OBSOLETE] upper Government Well Formation- Superstition Group Hillier (1978)

Latite of Government Well [RENAMED] upper Government Well Formation – Superstition Group Hillier (1978). Includes the following sub-units:

- **Obsidian [RETAINED] obsidian – upper Government Well Formation- Superstition Group** Hillier (1978)
- **Rhyodacite [RETAINED] rhyodacite – upper Government Well Formation- Superstition Group** Hillier (1978)
- **Dacite Breccia [RETAINED] dacite breccia – upper Government Well Formation – Superstition Group** Hillier (1978)
- **Latite [RETAINED] latite – upper Government Well Formation – Superstition Group** Hillier (1978)
- **Latite-andesite [RETAINED] latite-andesite – upper Government Well Formation – Superstition Group** Hillier (1978)

rhyodacite lavas [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group Sheridan (1978)

latite lavas, breccias, and domes [RENAMED] upper Government Well Formation – Superstition Group Sheridan (1978)

series of dacite flows, ignimbrites, and tuffs [OBSOLETE] upper Government Well Formation – Superstition Group Scarborough (1981a)

Apache Gap rhyodacite [RENAMED] rhyodacite of Apache Gap - upper Government Well Formation – Superstition Group Scarborough (1981a)

rhyodacite [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group Isagholian (1983), Skotnicki and Leighty (1997)

latite of Fish Creek AND **Latites of Fish Creek [RENAMED] upper Government Well Formation – Superstition Group** Isagholian (1983), Sheridan and Prowell (1986), Sheridan (1987)

latite lava flow [RENAMED] quartz phyric dacite – upper Government Well Formation – Superstition Group Isagholian (1983)

latite breccia [RENAMED] quartz phyric dacite – upper Government Well Formation – Superstition Group Isagholian (1983)

lava flow of Fish Creek [RENAMED] quartz phyric dacite – upper Government Well Formation – Superstition Group Isagholian (1983)

mixed volcanic rocks [OBSOLETE] upper Government Well Formation – Superstition Group OR **Coffee Flat Mountain Formation – Gila Group** Peterson and Jinks (1983)

dacite [OBSOLETE] upper Government Well Formation – Superstition Group OR **breccia – Apache Leap Tuff** Peterson and Jinks (1983)

Apache Gap rhyodacite lava, Apache Gap rhyodacite vitrophyre, **Apache Gap rhyodacite pyroclastic deposits [RENAMED] rhyodacite of Apache Gap, lava, vitrophyre, and pyroclastic deposits – upper Government Well Formation – Superstition Group** Prowell (1984)

rhyodacite of Apache Gap AND **Rhyodacite of Apache Gap [RETAINED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group** Rettenmaier (1984), Sheridan and Prowell (1986), Sheridan (1987)

trachyandesites and dacites of Fish Creek [RENAMED] upper Government Well Formation – Superstition Group Rettenmaier (1984)

Apache Gap rhyodacite AND **Apache Gap rhyodacites** AND **Apache Gap rhyodacite lava** AND **Apache Gap rhyodacite breccia** AND **Apache Gap rhyodacite lavas and breccias [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group** Kilbey (1986)

Apache Gap Basalt [RENAMED] basalt of Apache Gap – upper Government Well Formation – Superstition Group Kilbey (1986)

Government Well Latite AND **Government Well Latites [RENAMED] upper Government Well Formation – Superstition Group** Kilbey (1986). Subdivided into eight units:

Basalt subunit [RENAMED] basalt – upper Government Well Formation – Superstition Group Kilbey (1986)

rhyodacite subunit AND **Government Well rhyodacite lava [RENAMED] rhyodacite– upper Government Well Formation – Superstition Group** Kilbey (1986)

latite lava subunit AND **Government Well latite lava [RENAMED] latite lava – upper Government Well Formation – Superstition Group** Kilbey (1986)

latite breccia subunit AND **Government Well latite breccia [RENAMED] latite breccia – upper Government Well Formation – Superstition Group** Kilbey (1986)

latite tuff-breccia subunit AND **Government Well latite tuff-breccia [RENAMED] latite tuff-breccia – upper Government Well Formation – Superstition Group** Kilbey (1986)

Government Well rhyodacite breccia [RENAMED] rhyodacite breccia – upper Government Well Formation – Superstition Group Kilbey (1986)

rhyodacite welded tuff subunit AND **Government Well rhyodacite welded tuff [RENAMED] rhyodacite welded tuff – upper Government Well Formation – Superstition Group** Kilbey (1986)

andesitic-latite subunit AND **Government Well andesitic-latite lava** AND **Government Well andesitic-latite subunit [RENAMED] andesitic-latite lava – upper Government Well Formation – Superstition Group** Kilbey (1986)

Superstition volcanics [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Gila Group** Reynolds and others (1986). Includes the following units:

20.60 Ma dacite [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group Reynolds and others (1986)

29.90 Ma dacite [RENAMED] crystal-rich dacite – upper Government Well Formation – Superstition Group Reynolds and others (1986)

Older Rhyolite lava and ashes [OBSOLETE] upper Government Well Formation – Superstition Group Sheridan and Prowell (1986)

Apache Gap rhyodacite AND **rhyodacites of Apache Gap [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group** Melchiorre and Clemens (1993)

Government Well Latite [RENAMED] upper Government Well Formation – Superstition Group Melchiorre and Clemens (1993). Subdivided into seven units:

gray latite, unit 'b' [RETAINED] gray latite, unit 'b' – upper Government Well Formation – Superstition Group Melchiorre and Clemens (1993)

gray latite, unit 'a' [RETAINED] gray latite, unit 'a' – upper Government Well Formation – Superstition Group Melchiorre and Clemens (1993)

green latite [RETAINED] green latite – upper Government Well Formation – Superstition Group Melchiorre and Clemens (1993)

latite with xenoliths [RETAINED] latite with xenoliths – upper Government Well Formation – Superstition Group Melchiorre and Clemens (1993)

red latite [RETAINED] red latite – upper Government Well Formation – Superstition Group Melchiorre and Clemens (1993)

latite, pyroclastic [OBSOLETE] upper Government Well Formation – Superstition Group Melchiorre and Clemens (1993)

basal latite [RETAINED] basal latite – upper Government Well Formation – Superstition Group Melchiorre and Clemens (1993)

crystal rich dacite lava (dacite of Randolph Canyon) [OBSOLETE] upper Government Well Formation – Superstition Group OR **crystal rich dacite – Coffee Flat Mountain Formation – Gila Group** Ferguson and Skotnicki (1995)

upper andesite lava [RETAINED] upper andesite lava – upper Government Well Formation – Superstition Group Ferguson and Skotnicki (1995)

lower dacite (dacite of San Mateo Castro Ranch) [RENAMED] dacite of San Mateo Castro Ranch – upper Government Well Formation – Superstition Group Ferguson and Skotnicki (1995)

lower andesite lava [RETAINED] lower andesite lava – upper Government Well Formation – Superstition Group Ferguson and Skotnicki (1995)

lower rhyodacite lava [RENAMED] quartz-phyric dacite – upper Government Well Formation –

Superstition Group Ferguson and Skotnicki (1995) (same unit in southern and northern areas)
tuff of Quarter Circle U Ranch [RETAINED] tuff of Quarter Circle U Ranch – upper Government Well Formation – Superstition Group Ferguson and Skotnicki (1995)
Intrusive dacite [RETAINED] intrusive dacite – upper Government Well Formation – Superstition Group Skotnicki and Ferguson (1995), Skotnicki and Ferguson (1996), Gilbert and Ferguson (1997)
Dacite [RETAINED] dacite – upper Government Well Formation – Superstition Group Skotnicki and Ferguson (1995), Skotnicki and Leighty (1997)
Lower dacite [RENAMED] dacite of San Mateo Castro Ranch – upper Government Well Formation – Superstition Group Skotnicki and Ferguson (1995)
Bedded tuff [GENERIC] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Skotnicki and Ferguson (1995)
rhyodacite [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group OR **unit of Pass Mountain** Skotnicki and Ferguson (1996)
andesite [RETAINED] andesite – upper Government Well Formation – Superstition Group Skotnicki and Ferguson (1996)
andesite/basalt(?) [RENAMED] quartz-phyric basaltic andesite – upper Government Well Formation – Superstition Group Skotnicki and Ferguson (1996)
dacite [RENAMED] upper Government Well Formation – Superstition Group Skotnicki and Ferguson (1996)
very crystal-rich (15-20%) felsic lava [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group Ferguson and Gilbert (1997)
Apache Gap type rhyodacite lava AND **rhyodacite lava [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group** Ferguson and Gilbert (1997), Gilbert and Ferguson (1997)
porphyritic dacite lava AND **porphyritic dacite [RENAMED] quartz-phyric dacite – upper Government Well Formation – Superstition Group** Ferguson and Gilbert (1997)
dacite lava AND **crystal-rich dacite lava [RENAMED] crystal-rich dacite – upper Government Well Formation – Superstition Group** Ferguson and Gilbert (1997), Gilbert and Ferguson (1997)
dacitic crystal-rich tuff AND **dacitic crystal-rich unwelded tuff [RENAMED] dacitic crystal-rich tuff – upper Government Well Formation – Superstition Group** Ferguson and Gilbert (1997)
dacite lava breccia [RETAINED] dacite lava breccia – upper Government Well Formation – Superstition Group Ferguson and Gilbert (1997), Gilbert and Ferguson (1997)
fine-grained, hornblende-rich dacite [RETAINED] fine-grained, hornblende-rich dacite – upper Government Well Formation – Superstition Group Ferguson and Gilbert (1997)
moderately crystal-rich porphyritic dacite flows AND **quartz-phyric dacite lava [RENAMED] quartz-phyric dacite – upper Government Well Formation – Superstition Group** Gilbert and Ferguson (1997)
crystal-rich poorly to unwelded lapilli tuffs AND **dacitic crystal-rich unwelded tuff [RENAMED] dacitic crystal-rich tuff – upper Government Well Formation – Superstition Group** Gilbert and Ferguson (1997)
bedded tuff (Tdt) [RETAINED] bedded tuff – upper Government Well Formation – Superstition Group Skotnicki and Leighty (1997)

lower Government Well Formation – Superstition Group [NEW] The top of this unit is defined as the base of the oldest intermediate composition lava in the Government Well Formation. It is recognized throughout the Superstition Mountains. Its mafic lavas have phenocryst assemblages of plagioclase, pyroxene, ± olivine, ± biotite. The lower division includes lesser amounts of non-welded tuff, bedded basaltic scoria and scoriaceous sandstone. Locally, nonvolcaniclastic sandstone and conglomerate of the underlying Whitetail Formation intertongue with the lower Government Well Formation. At the type section, lower Government Well Formation is represented by the lowermost 280 meters of the formation (of 1570 meters).

Undivided lower Government Well Formation and informal units:

Basalt AND **basalt [RETAINED] basalt – lower Government Well Formation – Superstition Group** Durand (1967), Skotnicki and Ferguson (1995), Skotnicki and Ferguson (1996), Ferguson and Gilbert (1997)

Red Flow [RENAMED] basalt – lower Government Well Formation – Superstition Group Durand (1967)

older basalt AND **older basalts** AND **Older Basalt [RENAMED] basalt – lower Government Well Formation – Superstition Group** Stuckless (1969), Stuckless (1971), Suneson (1976), Hillier (1978)

alkali olivine basalt AND **early basalts** AND **early basalt [RENAMED] lower Government Well Formation – Superstition Group** Sheridan and others (1971)

Apache Lake basalts [RENAMED] basalt of Apache Lake – lower Government Well Formation – Superstition Group Malone (1972)

older basalt [RENAMED] basalt – lower Government Well Formation – Superstition Group sample AP-243 of Stuckless and O'Neil (1973)

Welded Tuff [OBSOLETE] lower Government Well Formation – Superstition Group Hillier (1978)

older basalts AND **Older basalt [RENAMED] lower Government Well Formation – Superstition Group** Sheridan (1978), Sheridan and Prowell (1986), Sheridan (1987)

andesite flows along north shore of Apache Lake [RENAMED] lower Government Well Formation – Superstition Group Scarborough (1981a)

andesite flows, flow breccias, and agglomerates [RETAINED] andesite flows, flow breccias, and agglomerates - lower Government Well Formation – Superstition Group Scarborough (1981a)

lower andesites and redbeds [RENAMED] lower Government Well Formation – Superstition Group OR **Whitetail Formation** Scarborough (1981b)

andesite [RETAINED] andesite – lower Government Well Formation – Superstition Group Peterson and Jinks (1983)

lower basalt [RENAMED] basalt – lower Government Well Formation – Superstition Group Peterson and Jinks (1983), Spencer and Richard (1995a), Skotnicki and Leighty (1997)

Blue Ridge Rhyolite Tuff [RENAMED] tuff of Blue Ridge – lower Government Well Formation – Superstition Group Kilbey (1986)

Cottonwood Spring Basalt [RENAMED] basalt of Cottonwood Spring – lower Government Well Formation – Superstition Group Kilbey (1986)

Saddle Rock Rhyolite Tuff [RENAMED] tuff of Saddle Rock – lower Government Well Formation – Superstition Group Kilbey (1986)

Weekes Wash Basalt [RENAMED] basalt of Weekes Wash – lower Government Well Formation – Superstition Group Kilbey (1986)

Superstition volcanics [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Gila Group** Reynolds and others (1986). Includes the following units:

- **18.15 Ma basalt [RETAINED] basalt – lower Government Well Formation – Superstition Group** Reynolds and others (1986)
- **18.31 Ma basalt [RETAINED] basalt – lower Government Well Formation – Superstition Group** Reynolds and others (1986)
- **21.40 Ma andesite [RENAMED] andesite – lower Government Well Formation – Superstition Group** Reynolds and others (1986)

yellow rhyolite [OBSOLETE] rhyolite of Bulldog Canyon – Whitetail Formation OR **tuff of Saddle Rock – lower Government Well Formation – Superstition Group** OR **tuff of Blue Ridge – lower Government Well Formation – Superstition Group** Melchiorre and Clemens (1993)

undifferentiated basalt flows [RENAMED] lower Government Well Formation – Superstition Group Melchiorre and Clemens (1993)

andesite or basaltic andesite lava [RENAMED] lower Government Well Formation – Superstition Group Ferguson and Skotnicki (1995) (same unit in southern and northern areas)

coarse-grained basalt / basaltic andesite [RETAINED] coarse-grained basalt / basaltic andesite – lower Government Well Formation – Superstition Group Ferguson and Skotnicki (1995)

basalt lava AND **older basalt lava [RETAINED] basalt lava – lower Government Well Formation – Superstition Group** Ferguson and Skotnicki (1995), Gilbert and Ferguson (1997)

andesitic volcanic rocks [RETAINED] andesitic volcanic rocks – lower Government Well Formation – Superstition Group Spencer and Richard (1995a)
Mafic to intermediate volcanic rocks, lower unit [OBSOLETE] lower Government Well Formation – Superstition Group OR **Gila Group** Spencer and Richard (1995b)
lithic tuff [RETAINED] lithic tuff – lower Government Well Formation – Superstition Group Skotnicki and Ferguson (1996)
basalt dikes and other hypabyssal intrusions AND **basalt dikes and other hypabyssal bodies [RENAMED] intrusive basalt – lower Government Well Formation – Superstition Group** Gilbert and Ferguson (1997)
basaltic sandstone and pyroclastic rocks [RETAINED] basaltic sandstone and pyroclastic rocks – lower Government Well Formation – Superstition Group Gilbert and Ferguson (1997)
basalt [GENERIC] basalt – lower Government Well Formation – Superstition Group OR **basalt – Gila Group** Skotnicki and Leighty (1997)

Units which are probably affiliated with the Superstition Group:

unit of Buzzards Roost [RENAMED] A crystal-rich rhyolite lava found to the southeast of the Superstition cauldron. The unit overlies the Whitlow Canyon Formation but its upper contact is not preserved and its age relationship with Apache Leap Tuff is uncertain.

upper rhyolite [OBSOLETE] unit of Buzzards Roost OR **Coffee Flat Mountain Formation – Gila Group** Peterson and Jinks (1983). Subdivided into two units:
zeolitized rhyolite [OBSOLETE] unit of Buzzards Roost OR **Coffee Flat Mountain Formation – Gila Group** Peterson and Jinks (1983)
rhyolite vents [OBSOLETE] unit of Buzzards Roost OR **Coffee Flat Mountain Formation – Gila Group** Peterson and Jinks (1983)
rhyodacite [OBSOLETE] Coffee Flat Mountain Formation – Gila Group OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost** Peterson and Jinks (1983). Subdivided into two units:
zeolitized rhyodacite [OBSOLETE] Coffee Flat Mountain Formation – Gila Group OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost** Peterson and Jinks (1983)
rhyodacite vents [OBSOLETE] Coffee Flat Mountain Formation – Gila Group OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost** Peterson and Jinks (1983)
upper dacite lava (dacite of Buzzards Roost) [RENAMED] unit of Buzzards Roost Ferguson and Skotnicki (1995). Subdivided into two units:
upper dacite lava, breccia [RENAMED] lava breccia – unit of Buzzards Roost Ferguson and Skotnicki (1995)
upper dacite lava, vitrophyre [RENAMED] vitrophyre – unit of Buzzards Roost Ferguson and Skotnicki (1995)
rhyodacite of Buzzards Roost [RENAMED] unit of Buzzards Roost McIntosh and Ferguson (1998)

unit of Pass Mountain [NEW] A crystal-rich dacitic lava and hypabyssal unit found only in the western Goldfield Mountains. The unit overlies and intrudes units as young as the Tule Canyon Formation, but no age relationship with the Apache Leap Tuff is preserved.

quartz latite lava [RENAMED] unit of Pass Mountain Damon (1969)
member B (qtz. latite) [RENAMED] unit of Pass Mountain Fodor (1969)
Superstition volcanics [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Gila Group** Reynolds and others (1986). Includes the following unit:
21.85 Ma quartz latite [RENAMED] unit of Pass Mountain Reynolds and others (1986)
massive lithic tuff [RETAINED] massive lithic tuff – unit of Pass Mountain Skotnicki and Ferguson (1996)
rhyodacite [OBSOLETE] rhyodacite of Apache Gap – upper Government Well Formation – Superstition

Group OR **unit of Pass Mountain** Skotnicki and Ferguson (1996)

[4. San Manuel Formation]

San Manuel Formation [RETAINED] Originally defined by Heindl (1963) in the Mammoth area about 75 km southeast of the Superstition volcanic field, this unit is included in this report because it borders the southern boundary of the Superstition volcanic field, and the absence of Apache Leap Tuff clasts is used as one of the criteria for its identification (Cornwall and Krieger, 1975a;1975b; Banks and Krieger, 1977; and Keith, 1983). The formation consists of nonvolcaniclastic sandstone and conglomerate, plus other finer grained sedimentary rocks interbedded with minor nonwelded felsic tuffs. Heindl (1963) places the San Manuel Formation within the Gila Group, but in a discussion (p. E15) indicates that this assignment may be open to question since it was deposited in a valley antedating the structural trough that forms the San Pedro Valley.

Since we define the Gila Group as being younger than the Apache Leap Tuff, we do not view the San Manuel as part of the Gila Group. It is clearly shown by Cornwall and Krieger (1975a;1975b), Banks and Krieger (1977), and Keith (1983) that the San Manuel Formation predates emplacement of the Apache Leap Tuff, and none of these workers indicate that it is a subdivision of the Gila Group. We consider the San Manuel Formation to be the southerly equivalent of the Whitetail Formation.

San Manuel Formation [RETAINED] San Manuel Formation Heindl (1963), Cornwall and Krieger (1975a; 1975b), Banks and Krieger (1977), Keith (1983)

[5. Whitetail Formation]

Whitetail Formation [RETAINED] Originally named by Ransome (1903;1904) for pre-volcanic sedimentary rocks in the Globe-Miami area. The formation is a rock-stratigraphic unit whose contacts are widely time-transgressive. Although dominated by conglomerate, the unit contains many different lithologies including sandstone, siltstone, mudstone, limestone, gypsum, coarse-grained avalanche breccia, and minor volcanics. At the southern edge of the Superstition volcanic field the Whitetail Formation and San Manuel Formation (Heindl, 1963) are probably equivalent.

Undivided Whitetail Formation and informal units:

Whitetail Formation AND **Whitetail formation [RETAINED] Whitetail Formation** Ransome (1903; 1904), Richard and Spencer (1998), McIntosh and Ferguson (1998)

Whitetail Conglomerate AND **Whitetail conglomerate [RENAMED] Whitetail Formation** Ransome (1919; 1923), N.P. Peterson (1954; 1961; 1963), N.P. Peterson and others (1953), D.W. Peterson (1960; 1969), Sell (1968), Cornwall and others (1971), Balla (1972), Cornwall and Krieger (1975b), Suneson (1976), Theodore and others (1978), Scarborough (1981a), Creasey and others (1983), Keith (1983), Peterson and Jinks (1983), Faulds (1986), Kilbey (1986), Sheridan and Prowell (1986), Sheridan (1987), Melchiorre and Clemens (1993), Dickinson (1995), Spencer and Richard (1995a), Richard and Spencer (1997)

Yellow Peak conglomerate [OBSOLETE] Whitetail Formation Sell (1968), Blucher, A.G., Jr. (1958 private report, according to Sell (1968))

Olberg beds [RENAMED] Whitetail Formation Sell (1968), Blucher and Kinnison (1960 personal communication, according to Sell (1968))

Blue Basalt [RENAMED] basalt – Whitetail Formation Sell (1968), Blucher, A.G., Jr. (1958 private report,

according to Sell (1968))

Rock Peak conglomerate [OBSOLETE] Whitetail Formation Sell (1968)

late-stage domes [OBSOLETE] rhyolite of Bulldog Canyon – Whitetail Formation Fodor (1969)

volcanic breccia AND **epiclastic breccia [RENAMED] epiclastic and volcanic breccia – Whitetail Formation** Fodor (1969)

arkosic conglomerate AND **arkosic conglomerate (White Tail** (sic) **equivalent) [RETAINED] arkosic conglomerate – Whitetail Formation** Stuckless (1969; 1971), Stuckless and Sheridan (1971), Malone (1972), Sheridan (1978)

volcanic tuff, poorly stratified [OBSOLETE] Whitetail Formation Wilson (1969)

gravel, sand, and boulders [OBSOLETE] Whitetail Formation Wilson (1969)

arkosic conglomerate redbeds [RENAMED] arkosic conglomerate – Whitetail Formation Sheridan and others (1971)

redbeds and local andesites [RETAINED] redbeds and local andesites – Whitetail Formation OR **redbeds and local andesites – Superstition Group** Scarborough (1981b)

lower andesites and redbeds [RENAMED] lower Government Well Formation – Superstition Group OR **Whitetail Formation** Scarborough (1981b)

monolithologic breccia [RETAINED] monolithologic breccia – Whitetail Formation Creasey and others (1983)

yellow rhyolite [OBSOLETE] rhyolite of Bulldog Canyon – Whitetail Formation OR **tuff of Saddle Rock – lower Government Well Formation – Superstition Group** OR **tuff of Blue Ridge – lower Government Well Formation – Superstition Group** Melchiorre and Clemens (1993)

conglomerate [RETAINED] conglomerate – **Whitetail Formation** Ferguson and Skotnicki (1995), Skotnicki and Ferguson (1995), Skotnicki and Ferguson (1996), Skotnicki and Leighty (1997)

Breccia [REDEFINED] breccia – Whitetail Formation Ferguson and Skotnicki (1995)

sandstone [RETAINED] sandstone – Whitetail Formation Skotnicki and Ferguson (1995), Skotnicki and Ferguson (1996)

conglomerate and sandstone, undivided [RETAINED] conglomerate and sandstone, undivided – Whitetail Formation Skotnicki and Ferguson (1995), Skotnicki and Ferguson (1996)

rock avalanche or talus breccia [RETAINED] rock avalanche or talus breccia – Whitetail Formation Spencer and Richard (1995a)

Clastic sedimentary rocks, lower unit [RENAMED] clastic sedimentary rocks – Whitetail Formation Spencer and Richard (1995b)

Rock avalanche breccia, lower unit [RENAMED] rock avalanche breccia – Whitetail Formation Spencer and Richard (1995b)

sandstone and conglomerate [RETAINED] sandstone and conglomerate – Whitetail Formation Ferguson and Skotnicki (1996)

basalt lava [OBSOLETE] basalt lava – Whitetail Formation (east) OR **basalt lava – Superstition Group** (west) Ferguson and Skotnicki (1996)

sedimentary breccia [RETAINED] sedimentary breccia – Whitetail Formation Ferguson and Skotnicki (1996)

rhyolite of Bulldog Canyon [RETAINED] rhyolite of Bulldog Canyon – Whitetail Formation Skotnicki and Ferguson (1996), McIntosh and Ferguson (1998). The following three nearby units are now considered to be subdivisions::

- **tuffaceous conglomerate [REDEFINED] tuffaceous conglomerate – rhyolite of Bulldog Canyon – Whitetail Formation** Skotnicki and Ferguson (1996), McIntosh and Ferguson (1998)
- **rhyolite, undifferentiated** AND **rhyolite [RETAINED] rhyolite – rhyolite of Bulldog Canyon – Whitetail Formation** Skotnicki and Ferguson (1996), McIntosh and Ferguson (1998)
- **massive tuff [RETAINED] massive tuff – rhyolite of Bulldog Canyon – Whitetail Formation** Skotnicki and Ferguson (1996), McIntosh and Ferguson (1998)

granite breccia [RETAINED] granite breccia – Whitetail Formation Skotnicki and Ferguson (1996)

arkosic conglomerate, pebbly sandstone, and sandstone [RETAINED] arkosic conglomerate, pebbly sandstone, and sandstone – Whitetail Formation Ferguson and Gilbert (1997), Gilbert and Ferguson (1997)

Whitetail Formation, undivided (Tw) [RETAINED] Whitetail Formation Richard and Spencer (1998).

Whitetail Formation *Undivided Whitetail Formation and informal units (continued)*

Subdivided into 4 units:

conglomerate, carbonate clast [RETAINED] conglomerate, carbonate clast – Whitetail Formation Richard and Spencer (1998)

conglomerate, Pinal Schist-clast [RETAINED] conglomerate, Pinal Schist-clast – Whitetail Formation Richard and Spencer (1998)

gypsum and mudstone [RETAINED] gypsum and mudstone – Whitetail Formation Richard and Spencer (1998)

fine-grained member [RENAMED] fine-grained unit – Whitetail Formation Richard and Spencer (1998)

PART III

LISTING OF CITATIONS

This is an alphabetical listing (by author) of citations dealing with stratigraphy in the Superstition Mountains area. After each citation, the unit names used by the author are listed (in bold type). Each unit name is followed by: the status of the old unit name (contained within bold brackets **[ ]**); the name and stratigraphic hierarchy that conforms to the stratigraphic framework described in this report (in bold type); and comments (in regular type).

Balla, J.C., 1972, The relationship of Laramide stocks to regional structure in central Arizona: Tucson, University of Arizona, Ph.D. dissertation, 132 p., 8 sheets.

San Tan Tuff [OBSOLETE] Apache Leap Tuff Balla (1972) equated this unit with the Siphon Draw Member of the Superstition Tuff, a term which is now considered obsolete and replaced by Apache Leap Tuff. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff and tuff of Comet Peak.

Whitetail Conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Banks, N.G., and Krieger, M.H., 1977, Geologic map of the Hayden quadrangle, Pinal and Gila Counties, Arizona: U.S. Geological Survey Geologic Quadrangle Map GQ-1391, 15 p., 1 sheet, scale 1:24,000.

Big Dome Formation (Tbg, Tbs, Tbl, Tbv, Tblt, AND **Tbql)[RETAINED] Big Dome Formation – Gila Group** Alluvial unit with rare tuff beds to the south of the volcanic field. Divided into members based on sedimentology and clast types. The conglomerates contain clasts of Apache Leap Tuff and the formation includes tuff beds that have been dated at 14 and 17 Ma. We formally include this formation within the Gila Group.

San Manuel Formation (Tsda AND **Tst) [RETAINED] San Manuel Formation** Originally defined by Heindl (1963). Cornwall and Krieger (1975a; 1975b), and Banks and Krieger (1977) mapped this formation along the southern edge of the volcanic field. The unit is included in this report because the absence of Apache Leap Tuff clasts is used as one of the criteria for its identification. The formation consists of nonvolcaniclastic sandstone and conglomerate, plus other finer grained sedimentary rocks interbedded with minor nonwelded felsic tuffs. The sequence is probably the southerly equivalent of the Whitetail Formation. In its type area the San Manuel Formation is placed within the Gila Group (Heindl, 1963), but since the unit predates emplacement of the Apache Leap Tuff, this assignment is not used in the Superstition volcanic field.

Cornwall, H.R., Banks, N.G., and Phillips, C.H., 1971, Geologic map of the Sonora quadrangle, Pinal and Gila Counties, Arizona: U.S. Geological Survey Geologic Quadrangle Map GQ-1021, 1 sheet, scale 1:24,000.

airfall tuff AND **rhyolitic airfall tuff (Tt) [RENAMED] rhyolite ash-fall tuff – Gila Group** A unit interbedded with post-Apache Leap Tuff sedimentary rocks in the southern part of the volcanic field.

conglomerate with angular igneous clasts (Tgi) [RENAMED] angular igneous clast conglomerate – Gila Group

conglomerate with mainly carbonate clasts (Tgc) [RENAMED] carbonate clast conglomerate – Gila Group

conglomerate with diverse types of clasts (Tg) [RENAMED] conglomerate – Gila Group

Apache Leap Tuff (Tal) [REDEFINED] Apache Leap Tuff This name was applied to the outflow sheet in the southeastern part of the volcanic field around Ray and northward toward the Superior area. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail Conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because

the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Cornwall, H.R., and Krieger, M.H., 1975a, Geologic map of the Kearny quadrangle, Pinal County, Arizona: U.S. Geological Survey Geologic Quadrangle Map GQ-1188, 9 p., 1 sheet, scale 1:24,000.

Big Dome Formation (Tbl, Tbc, Tblt, Tbs, Tbql, AND **Tbg) [RETAINED] Big Dome Formation – Gila Group** Alluvial unit with rare tuff beds to the south of the volcanic field. Divided into members based on sedimentology and clast types. The conglomerates contain clasts of Apache Leap Tuff and the formation includes tuff beds that have been dated at 14 Ma and 17 Ma. We formally include this formation within the Gila Group.

San Manuel Formation (Tsg, Tsda, Tsdp, Tst, Tsrt, Tsc, AND **Tsl) [RETAINED] San Manuel Formation** Originally defined by Heindl (1963). Cornwall and Krieger (1975a; 1975b) and Banks and Krieger (1977) mapped this formation along the southern edge of the volcanic field. The unit is included in this report because the absence of Apache Leap Tuff clasts is used as one of the criteria for its identification. The formation consists of nonvolcaniclastic sandstone and conglomerate, plus other finer grained sedimentary rocks interbedded with minor nonwelded felsic tuffs. The sequence is probably the southerly equivalent of the Whitetail Formation. In its type area the San Manuel Formation is placed within the Gila Group (Heindl, 1963), but since the unit predates emplacement of the Apache Leap Tuff, this assignment is not used in the Superstition volcanic field.

Cornwall, H.R., and Krieger, M.H., 1975b, Geologic map of the Grayback quadrangle, Pinal County, Arizona: U.S. Geological Survey Geologic Quadrangle Map GQ-1206, 2 p., 1 sheet, scale 1:24,000.

San Manuel Formation (Tsgu, Tsmd, Tst, Tsrt, Tsgl, AND **Tsmr) [RETAINED] San Manuel Formation** Originally defined by Heindl (1963). Cornwall and Krieger (1975a; 1975b) and Banks and Krieger (1977) mapped this formation along the southern edge of the volcanic field. The unit is included in this report because the absence of Apache Leap Tuff clasts is used as one of the criteria for its identification. The formation consists of nonvolcaniclastic sandstone and conglomerate, plus other finer grained sedimentary rocks interbedded with minor nonwelded felsic tuffs. The sequence is probably the southerly equivalent of the Whitetail Formation. In its type area the San Manuel Formation is placed within the Gila Group (Heindl, 1963), but since the unit predates emplacement of the Apache Leap Tuff, this assignment is not used in the Superstition volcanic field.

Whitetail Conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Creasey, S.C., Peterson, D.W., and Gambell, N.A., 1983, Geologic map of the Teapot Mountain quadrangle, Pinal County, Arizona: U.S. Geological Survey Geologic Quadrangle Map GQ-1559, 1 sheet, scale 1:24,000.

basalt (Qtb AND **Tbo) [RETAINED] basalt – Gila Group** Two basalt flows that occur above and below the Sleeping Buffalo Rhyolite and Road Runner Rhyolite of Creasey and others (1983).

younger gravel (Qtg) [RENAMED] conglomerate – Gila Group Post-Apache Leap Tuff sedimentary rocks in the southern part of the volcanic field. Since the unit is lithified, it is given a more appropriate rock name.

Road Runner Rhyolite (Trr) [REDEFINED] Road Runner Rhyolite Member– Picketpost Mountain Formation – Gila Group Creasey and others (1983) defined this unit as a formation level formal unit. It is a crystal-rich rhyolite lava that appears to be partly correlative with the Arnett Rhyolite Member (Tsba).

Sleeping Buffalo Rhyolite (Tsb) [REDEFINED] Sleeping Buffalo Rhyolite Member – Picketpost Mountain Formation – Gila Group Creasey and others (1983) defined this as a formation level formal unit. It is a crystal-rich rhyolite lava that is now considered to be a member of the Picketpost Mountain Formation.

Arnett Member – Sleeping Buffalo Rhyolite (Tsba) [REDEFINED] Arnett Rhyolite Member – Picketpost Mountain Formation – Gila Group Creasey and others (1983) defined this unit as a member within the Sleeping Buffalo Rhyolite. It is not clear from the map and unit descriptions of Creasey and others (1983) why this map unit was considered to be a member of the Sleeping Buffalo Rhyolite. Its phenocryst assemblage is more akin to the Road Runner Rhyolite and its contact relationship with the Road Runner Rhyolite strongly suggests that they are both part of the same flow sequence. Based on the observations discussed here, we redefine the Arnett Member as the Arnett Rhyolite Member of the Picketpost Mountain Formation and demote the Road Runner

Rhyolite and Sleeping Buffalo Rhyolite to members in the same formation. The tuff unit (Tsbt) separates the Arnett Rhyolite and Road Runner Rhyolite members from the Sleeping Buffalo Rhyolite member.

tuff member – Sleeping Buffalo Rhyolite (Tsbt) [REDEFINED] tuff – Picketpost Mountain Formation – Gila Group This tuff is now considered an informal unit within the Picketpost Mountain Formation. It overlies the Sleeping Buffalo Rhyolite Member **[REDEFINED]** of the Picketpost Mountain Formation **[NEW]**.

older tuff (Tto) [RENAMED] tuff of White Canyon – Picketpost Mountain Formation – Gila Group Renamed by Dickinson (1995).

older gravel (Tgo) [RENAMED] gravel of Walnut Canyon – Gila Group Renamed by Dickinson (1995).

sedimentary breccia (Txg) [RETAINED] sedimentary breccia – gravel of Walnut Canyon – Gila Group Renamed by Dickinson (1995).

Apache Leap Tuff (Tal) [REDEFINED] Apache Leap Tuff This name was applied to the outflow sheet in the southeastern part of the volcanic field south of Superior and west of Ray. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail Conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

monolithologic breccia (Twb) [RETAINED] monolithologic breccia – Whitetail Formation A viable subdivision of the Whitetail Formation in the southeastern part of the volcanic field.

Damon, P.E., 1969, Correlation and chronology of ore deposits and volcanic rocks, Annual Progress Report no. COO-689-120, Contract AT(11-1)-689 to Research Division, U.S. Atomic Energy Commission: Tucson, University of Arizona, Geochronology Laboratories, 141 p. [variously paginated].

younger basalt [RENAMED] basalt of Willow Springs – Gila Group Name used for basalt of Willow Springs in report on K/Ar whole rock age (18.26 ± 3.10 Ma) for sample PED-14-68. Stuckless and Sheridan (1971) stated that Damon's (1969) PED-14-68 (recalculated to 17.8 ± 3.1 Ma) is a sample of the basanite of Black Mesa (Superstition Mts.). They further stated that there is no age date available for basalt of Willow Springs of Suneson (1976), but LAT-LONG coordinates for PED-14-68 place it *precisely* on one of the five very small outcrops of basalt of Willow Springs as mapped by Suneson (1976), and this LAT-LONG exactly matches a sample location of Willow Springs basalt from Stuckless (1969).

welded tuff [RENAMED] unit of Hieroglyphic Canyon – Apache Leap Tuff Sample PED-18-68 mapped as Hieroglyphic member of Superstition Tuff by Skotnicki and Ferguson (1995).

dacite dome [RENAMED] rhyodacite of Apache Gap – upper Government Well Fm – Superstition Group Sample PED-16-68 also numbered as UAKA-68-16, dacite, of Shafiqullah and others (1980).

quartz latite lava [RENAMED] unit of Pass Mountain Location of sample PED-17-68 is probably in error since LAT-LONG coordinates place it in an area of Quaternary surficial deposits; cadastral location information is probably correct since it places the sample in an area mapped as Member B (qtz. latite) by Fodor (1969) and as rhyodacite (Trd) by Skotnicki and Ferguson (1996).

Damon, P.E., and Bikerman, M. 1964, Potassium-argon dating of post-Laramide plutonic and volcanic rocks within the Basin and Range province of southeastern Arizona and adjacent areas: Arizona Geological Society Digest, v. 7, p. 63-78.

Superior dacite [OBSOLETE] Apache Leap Tuff The use of the term Superior dacite was apparently in accordance with common usage at the time of this report. Later named Apache Leap Tuff (D.W. Peterson, 1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Dickinson, W.R., 1995, Tertiary stratigraphic and structural relationships in the Copper Butte area, Teapot Mountain quadrangle, Pinal County, Arizona: Arizona Geological Survey Contributed Report CR-95-H, 15 p.

Sleeping Buffalo Rhyolite (Tsb) [REDEFINED] Sleeping Buffalo Rhyolite Member – Picketpost Mountain Formation – Gila Group A crystal-rich rhyolite lava that is now considered to be a member of the Picketpost Mountain Formation.

tuff of White Canyon (Ttw) [RETAINED] tuff of White Canyon – Picketpost Mountain Formation – Gila

Group

gravel of Walnut Canyon (Tgw) [RETAINED] gravel of Walnut Canyon – Gila Group

Apache Leap Tuff (Tal) [REDEFINED] Apache Leap Tuff This name was applied to the outflow sheet in the southeastern part of the volcanic field south of Superior and west of Ray. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail Conglomerate (Twc) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Durand, H.S., III, 1967, Geology of the Sahuaro Lake area, Maricopa County, Arizona: Tucson, University of Arizona, M.S. thesis, 51 p., 1 sheet, scale 1:10,560.

Goldfield volcanics [OBSOLETE] Superstition Group Name used for Superstition Group volcanic rocks in the Goldfield Mountains apparently with no intention of establishing a formal name. No other author has used this term.

Ash-flow tuffs (andesites) [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Government Well Formation – Superstition Group** This unit is mostly Tule Canyon Formation but also includes some Government Well Formation. It includes several subdivisions of Brown flows (A-H) and Yellow flows (1-8) that span the contact between Government Well Formation and Tule Canyon Formation. The unit is obsolete because it crosses this contact and because the rocks are neither andesitic nor dominantly pyroclastic.

Basalt (ba) [RETAINED] basalt – lower Government Well Formation – Superstition Group Same as the lower basalt (Tbl) of Skotnicki and Leighty (1997) on the north side of Saguaro Lake.

Red Flow (rf) [RENAMED] basalt – lower Government Well Formation – Superstition Group Same as the lower basalt (Tbl) of Skotnicki and Leighty (1997) on the south side of Salt River just below Saguaro Lake.

Faulds, J.E., 1986, Tertiary geologic history of the Salt River Canyon region, Gila County, Arizona: Tucson, University of Arizona, M.S. thesis, 319 p., 3 sheets, scales 1:24,000 and 1:375,000.

Black Mesa basalts (Tb) [RENAMED] basalts of Black Mesa (Rockinstraw Mtn. Area) – Gila Group Olivine to tholeiitic basalt lava flows that overlie the unit of Chalk Creek in the Rockinstraw Mountain area.

Chalk Creek Formation (Tcu, Tcd, Tcl, AND **Tb) [RENAMED] unit of Chalk Creek – Gila Group** Conglomerate, volcaniclastic sandstone, dolomite and intercalated olivine basalt flows in the northeastern part of the volcanic field.

plugs of rhyodacite to dacite (Tri) [RETAINED] plugs of rhyodacite to dacite – Gila Group

breccia pipes within rhyodacite/dacite plugs (Tribr) [RETAINED] breccia pipes within rhyodacite/dacite plugs – Gila Group

lapilli breccia and agglomerate associated with felsic plugs (Tria) [RETAINED] lapilli breccia and agglomerate associated with felsic plugs – Gila Group

hornblende andesite plug (Tai) [RETAINED] hornblende andesite plug – Gila Group

plugs and dikes of basalt (Tbi) [RETAINED] plugs and dikes of basalt – Gila Group

lapilli breccia and agglomerate associated with basaltic intrusions (Tbia) [RETAINED] lapilli breccia and agglomerate associated with basaltic intrusions – Gila Group

Apache Leap Tuff (Tal) [REDEFINED] Apache Leap Tuff This name was applied to the outflow sheet in the area northwest of Superior to east of Roosevelt Lake. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak

Mud Springs basalt (Tm) [RENAMED] basalt of Mud Springs – Superstition Group A thin olivine basalt that underlies the Apache Leap Tuff in the Rockinstraw Mountain area at the northeast corner of the volcanic field. Age correlation with formations of the Superstition Group unknown.

Whitetail Conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Ferguson, C.A., and Gilbert, W.G., 1997, Geology of the Mormon Flat Dam quadrangle, Maricopa County, Arizona: Arizona Geological Survey Open-File Report 97-14, 28 p., 3 sheets, scale 1:24,000.

weakly indurated conglomerate, sandy conglomerate and pebbly sandstone (Tsy) [RETAINED] weakly indurated conglomerate, sandy conglomerate and pebbly sandstone – Gila Group Equivalent to the younger sedimentary basin-fill deposits (Tsy) of Skotnicki and Leighty (1997).

younger basalt (Tby) [RENAMED] basalt – Gila Group This unit lumps together three isolated exposures of basalt lava interbedded with volcaniclastic rocks of the Gila Group in the northwestern part of the volcanic field. Names for each of these isolated exposures are retained and considered valid (basalt of Canyon Lake (Suneson, 1976), basalt of Willow Springs (Suneson, 1976), and basalt of Black Mesa (Superstition Mts.) (Sheridan, 1978)). The term "basalt – Gila Group" is also useful for regional correlation.

crystal-rich unwelded tuff (Ttx) [RENAMED] crystal-rich nonwelded tuff – Gila Group A thin tuff preserved within post-cauldron volcaniclastic rocks northwest of the Superstition.

volcaniclastic conglomerate, pebbly sandstone, and sandstone interbedded with abundant unwelded bedded lithic tuffs (Text) AND **volcaniclastic conglomerate and sandstone interbedded with unwelded tuff** (Sheet 2) **(Tct) [OBSOLETE] volcaniclastic conglomerate and sandstone interbedded with nonwelded tuff – Tule Canyon Formation – Superstition Group** A sequence of bedded rocks originally interpreted to be post-Apache Leap Tuff in age, but now considered part of the Tule Canyon Formation.

volcaniclastic conglomerate, pebbly sandstone, sandstone, silty mudstone, and sedimentary breccia (Text) AND **volcaniclastic conglomerate, sandstone, silty mudstone, and sedimentary breccia** (Sheet 2) **(Tcv) [RENAMED] volcaniclastic conglomerate – Gila Group** Equivalent to the unit of Mesquite Flat in the vicinity of Tortilla Flat, and to the unit of Willow Springs in the Willow Springs area.

crystal-poor rhyolite lava (Text) AND **younger crystal-poor rhyolite lava (Sheet 2) (Trpy) [OBSOLETE] crystal-poor rhyolite lava – Tule Canyon Formation – Superstition Group** A series of gently dipping lava flows that overlies older lavas of the Tule Canyon Formation with angular unconformity along the Apache Trail near Apache Gap. Because of the unconformity it was originally thought that the lavas and tuffs of this map unit might be younger than the Apache Leap Tuff. Subsequent dating showed, however, that the lavas are part of the Tule Canyon Formation, and that tilting in the area was synchronous with deposition of the formation.

generic unwelded bedded or massive crystal-poor rhyolitic tuff (Text) AND **younger crystal-poor bedded unwelded rhyolitic tuff (Sheet 2) (Tty) [OBSOLETE] Gila Group** OR **Tule Canyon Formation – Superstition Group** This unit included four separate subdivisions listed 1-4, three of which are now known to be post-Apache Leap Tuff in age. The correct correlations for subdivisions 1-4 are as follows: 1) Coffee Flat Mountain Formation – Gila Group, 2) Tule Canyon Formation – Superstition Group (see discussion in next unit (Trpy)), 3) Gila Group, 4) Gila Group.

quartz latite lava (Text) AND **crystal-rich quartz latite lava** (Sheet 2) **(Tq) [RENAMED] crystal-rich quartz latite lava – Coffee Flat Mountain Formation – Gila Group** Lava dome complex that overlaps the north-central Superstition Cauldron margin. Equivalent in part with the Peters Canyon dome complex of Prowell (1984). Dated at 17.87 $\pm$ 0.06 Ma at Geronimo Head and 18.01 $\pm$ 0.10 Ma near Tortilla Ranch by McIntosh and Ferguson (1998).

brecciated quartz latite lava (Tqb) [RETAINED] brecciated quartz latite lava – Coffee Flat Mountain Formation – Gila Group Brecciated varieties of a post-cauldron lava dome complex that overlaps the north-central Superstition Cauldron margin.

quartz-phyric 5-10% phenocryst rhyolite lava breccia (Trd) [RENAMED] monolithic avalanche breccia– Gila Group A widespread monolithic breccia with tuff matrix that occurs above intracauldron Apache Leap Tuff in the northwestern part of the Superstition Cauldron. Based on the distinctive phenocryst mineralogy of the clasts, the unit is believed to be derived from Whitlow Canyon Formation rocks that were exposed along the cauldron margin. This interpretation is supported by an 18.7 Ma date from a lithic tuff directly overlying this unit at Black Mesa (Superstition Mts.) (McIntosh and Ferguson, 1998) which matches the age of the Whitlow Canyon Formation in the area. Same as the "rhyodacite breccia"(Sheet 1 Trd) of Skotnicki and Ferguson (1995).

volcanic and epiclastic breccia, conglomerate, and unwelded tuff (Tcx) [RETAINED] volcanic and epiclastic breccia, conglomerate, and unwelded tuff – Gila Group A complex unit that mantles a south-dipping unconformity south of Lewis and Pranty Creek. The unconformity is interpreted as the northern topographic margin of the Superstition Cauldron. The unit overlies lavas of the Government Well Formation, contains clasts of the Tule Canyon Formation and is intruded by the Coffee Flat Mountain Formation, but no age relationship with Apache Leap Tuff is preserved. The unit is tentatively classified as

part of the Gila Group, but it may be equivalent in age (partly) with the Apache Leap Tuff.

Superstition Tuff (Ts) [OBSOLETE] Apache Leap Tuff Same as the Apache Leap Tuff in the Superstition Mountains. Ferguson and Gilbert (1997) interpreted the Canyon Lake Member of the Superstition Tuff (e.g., Stuckless, 1971) to be the northern outflow sheet, and the Dogie Spring and Siphon Draw Members of the Superstition Tuff (e.g., Stuckless, 1971) to represent the intracauldron facies. Later, the Superstition Tuff was recognized to be the same as the Apache Leap Tuff (McIntosh and Ferguson, 1998).

Superstition Tuff mesobreccia (Text) AND **Superstition Tuff heterolithic mesobreccia** (Sheet 2) **(Tsx) [OBSOLETE] mesobreccia – Apache Leap Tuff** An intracauldron lithic breccia unit. The unit is heterolithic but this is not an essential characteristic for identification.

Whitlow Canyon type rhyodacite lava (Tw) [RENAMED] lava - Whitlow Canyon Formation – Superstition Group

monolithic breccia composed of Whitlow Canyon type rhyodacite lava (Text) AND **Whitlow Canyon type rhyodacite lava breccia** (Sheet 2) **(Twb) [RENAMED] lava breccia – Whitlow Canyon Formation – Superstition Group**

intrusive plugs of Whitlow Canyon type rhyodacite lava (Twi) [RENAMED] intrusive plugs – Whitlow Canyon Formation – Superstition Group

mixed crystal-poor rhyolite and Whitlow Canyon type rhyodacite lava (Tr-w) [RENAMED] Tule Canyon Formation and Whitlow Canyon Formation (undifferentiated) – Superstition Group A mixed unit consisting of lavas with characteristics of both formations, used as a unit in inaccessible areas.

rhyolite lava (Text) AND **older rhyolite lava** (Sheet 2) **(Tr) [RENAMED] rhyolite lava – Tule Canyon Formation – Superstition Group** Subdivision of the Tule Canyon Formation.

older rhyolite lava and unwelded tuff undifferentiated [RENAMED] Tule Canyon Formation – Superstition Group Used only on cross-sections, this unit represents the Tule Canyon Formation in its entirety.

intrusive rhyolite (Tri) [RETAINED] intrusive rhyolite – Tule Canyon Formation – Superstition Group Subdivision of the Tule Canyon Formation.

brecciated rhyolite lava (Text) AND **brecciated older rhyolite lava** (Sheet 2) **(Trb) [RENAMED] brecciated rhyolite lava – Tule Canyon Formation – Superstition Group** Includes crystal-poor and crystal-rich lava breccia.

brecciated crystal-poor rhyolite lava (Text) AND **brecciated older crystal-poor rhyolite lava** (Sheet 2) **(Trpb) [RENAMED] brecciated crystal-poor rhyolite lava – Tule Canyon Formation – Superstition Group** Lava flow breccias and/or block and ash-flows associated with crystal-poor lavas of the Tule Canyon Formation in the northern part of the volcanic field.

brecciated crystal-rich rhyolite lava (Text) AND **brecciated older crystal-rich rhyolite lava** (Sheet 2) **(Trxb) [RENAMED] brecciated crystal-rich rhyolite lava – Tule Canyon Formation – Superstition Group** Lava flow breccias and/or block and ash-flows associated with crystal-rich lavas of the Tule Canyon Formation in the northern part of the volcanic field.

aphyric rhyolite lava (Text) AND **aphyric older rhyolite lava** (Sheet 2) **(Tra) [RENAMED] aphyric rhyolite lava – Tule Canyon Formation – Superstition Group** Rhyolite lavas of the Tule Canyon Formation containing less than 0.5% phenocrysts. A subdivision recognized in the northern part of the volcanic field.

crystal-poor rhyolite lava (Text) AND **crystal-poor older rhyolite lava** (Sheet 2) **(Trp) [RENAMED] crystal-poor rhyolite lava – Tule Canyon Formation – Superstition Group** Rhyolite lavas of the Tule Canyon Formation containing between 0.5% and 3% phenocrysts. A subdivision recognized in the northern part of the volcanic field.

crystal-rich rhyolite lava (Text) AND **crystal-rich older rhyolite lava** (Sheet 2) **(Trx) [RENAMED] crystal-rich rhyolite lava – Tule Canyon Formation – Superstition Group** Rhyolite lavas of the Tule Canyon Formation containing more than 3% phenocrysts. A subdivision recognized in the northern part of the volcanic field.

very crystal-rich (15-20%) felsic lava (Trxx) [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group A lava near the confluence of LaBarge and Boulder Canyons that is probably equivalent to the rhyodacite of Apache Gap. The lava directly underlies Tule Canyon Formation and is truncated on the south by the northern margin of the Superstition Cauldron.

crystal-poor rhyolitic unwelded tuff (Text) AND **crystal-poor bedded unwelded rhyolitic tuff** (Sheet 2) **(Tt)**

[RENAMED] crystal-poor rhyolitic nonwelded tuff – Tule Canyon Formation – Superstition Group Nonwelded, bedded or massive, crystal-poor rhyolite tuffs interbedded between lava flows, or occurring near vents of lava flows in the Tule Canyon Formation.

middle basalt (Tbm) [RENAMED] basalt – Tule Canyon Formation – Superstition Group A thin olivine basalt that occurs within the rhyolite tuffs and lavas of the Tule Canyon Formation along the northern edge of the volcanic field.

Apache Gap type rhyodacite lava (Trda) [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group Same as rhyodacite of Apache Gap.

porphyritic dacite lava (Text) AND **porphyritic dacite** (Sheet 2) **(Tdp) [RENAMED] quartz-phyric dacite – upper Government Well Formation – Superstition Group** Same as the quartz-phyric dacite subdivision (Gilbert and Ferguson, 1997) of the upper Government Well Formation.

dacite lava (Text) AND **crystal-rich dacite lava** (Sheet 2) **(Td) [RENAMED] crystal-rich dacite – upper Government Well Formation – Superstition Group** A subdivision representing a major part of the upper Government Well Formation. It consists of crystal-rich dacitic lava that contains abundant plagioclase, biotite, ± hornblende and clinopyroxene phenocrysts. The lack of quartz phenocrysts distinguishes these lavas from the quartz-phyric dacite subdivision, and its coarse-grained, typically lavender crystalline matrix distinguishes it from the dacite of San Mateo Castro Ranch and the rhyodacite of Apache Gap subdivisions.

dacitic crystal-rich tuff (Text) AND **dacitic crystal-rich unwelded tuff** (Sheet 2) **(Ttd) [RENAMED] dacitic crystal-rich tuff – upper Government Well Formation – Superstition Group** Crystal-rich tuff associated with dacite lavas of the upper Government Well Formation in the northern part of the volcanic field.

dacite lava breccia (Tdb) [RETAINED] dacite lava breccia – upper Government Well Formation – Superstition Group Various breccias associated with dacitic lavas of the upper Government Well Formation in the northern part of the volcanic field.

fine-grained, hornblende-rich dacite (Tdh) [RETAINED] fine-grained, hornblende-rich dacite – upper Government Well Formation – Superstition Group A small body, possibly hypabyssal, considered a viable subdivision of the upper Government Well Formation north of Canyon Lake.

older basalt (Tb) [RENAMED] basalt – lower Government Well Formation – Superstition Group These mafic lavas constitute the lower Government Well Formation everywhere except one small exposure in First Water Creek that is part of upper Government Well Formation.

basalt dikes and other hypabyssal bodies (Tbi) [GENERIC] basalt dikes and other hypabyssal bodies Ferguson and Gilbert (1997) suggest that these feed into lavas of the lower Government Well Formation (their older basalt) but there is no evidence to prove this and basalt lavas belonging to other stratigraphic divisions (Tule Canyon Formation, Gila Group) are also present in the area.

basalt lava (Tbu) [GENERIC] basalt lava Age relative to other Tertiary units in the area is unknown.

arkosic conglomerate, pebbly sandstone, and sandstone (Tc) [RETAINED] arkosic conglomerate, pebbly sandstone, and sandstone – Whitetail Formation A viable subdivision of the Whitetail Formation in the northern part of the volcanic field.

Ferguson, C.A., and Skotnicki, S.J., 1995, Geologic map of the Florence Junction and the southern portion of the Weavers Needle 7.5' quadrangle, Pinal County, Arizona: Arizona Geological Survey Open-File Report 95-10, 25 p., 1 sheet, scale 1:24,000.

Ferguson and Skotnicki (1995) treated this map area as if it were two separate areas divided by an east-west trending valley underlain by Proterozoic crystalline basement. The valley coincides approximately with the southern margin of the Superstition Cauldron. The rocks were described separately on either side of the valley and some units were given the same map symbol if they were thought to be correlative. One important unit that occurs on both sides of the valley, but was given a different name is the Apache Leap Tuff which was called Superstition Tuff to the north and tuff of Comet Peak to the south. This was done because of slight differences in phenocryst mineralogy and to honor previous regional interpretations that suggested that the tuffs were different (e.g. Sheridan and others, 1969; Sheridan, 1978). Since then it has been shown that nearly all of these units can be correlated across the valley. The two areas are treated separately here.

Ferguson and Skotnicki (1995)
WHITLOW CANYON (southern) AREA

unit of Queen Valley (Tq) [RETAINED] unit of Queen Valley – Gila Group A fanning dip sequence of volcaniclastic conglomerate and sandstone in and around the town of Queen Valley. The sequence includes three basalt lava flows. The sequence is considered an important interval of the post-cauldron Gila Group because of its fanning dip sequence and interbedded lava flows. The name Gila Group is derived from this area.

basalt lava (Tqb) [RETAINED] basalt lava – unit of Queen Valley – Gila Group A sequence of three lava flows interbedded with sedimentary rocks in the Queen Valley area.

lamproite of Elephant Butte (Teb) [RETAINED] lamproite of Elephant Butte – Gila Group (?) A biotite-rich lamproitic lava plug along the Elephant Butte fault. Its age relative to Apache Leap Tuff is not known, but since it appears to intrude a major normal fault that cuts the Gila Group at Queen Valley it is assigned to the Gila Group.

tuff of Comet Peak (Tcp) [OBSOLETE] Apache Leap Tuff Apache Leap Tuff in the Florence Junction – Queen Valley area. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff and San Tan Tuff.

tuff of Comet Peak, poorly welded interval (Tcpu) [OBSOLETE] poorly welded interval – Apache Leap Tuff A poorly welded interval of the Apache Leap Tuff in the Florence Junction – Queen Valley area. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff and San Tan Tuff.

upper rhyodacite lava of Coffee Flat Mountain (Tfu) [RENAMED] upper rhyodacite lava – Coffee Flat Mountain Formation – Gila Group Crystal-rich rhyodacite lava that overlaps southeastern margin of the Superstition Cauldron and occurs as a single isolated dome south of the cauldron. The isolated dome overlies a lower flow-unit that is not present within the cauldron. The lava and dome have identical phenocryst assemblages and are dated at 18.02 ± 0.05 Ma and 18.08 ± 0.08 Ma respectively by McIntosh and Ferguson (1998). Both are considered valid subdivisions of the Coffee Flat Mountain Formation.

older flow unit of the upper rhyodacite lava of Coffee Flat Mountain (Text) AND **lower flow unit of the upper rhyodacite lava of Coffee Flat Mountain** (Sheet 1) **(Tful) [RENAMED] lower flow unit of the upper rhyodacite lava – Coffee Flat Mountain Formation – Gila Group** An older flow-unit of an isolated dome of lava that correlates with a widespread flow within the Superstition Cauldron. The flow within Superstition Cauldron overlies a lava that can be distinguished from both of the upper rhyodacite lavas of Coffee Flat Mountain. The dome occurs just south of the Superstition Cauldron. Dated at 18.30 ± 0.07 Ma by McIntosh and Ferguson (1998) and considered a valid subdivision of the Coffee Flat Mountain Formation.

upper dacite lava (dacite of Buzzards Roost) (Tdu) [RENAMED] unit of Buzzards Roost A plagioclase, sanidine, biotite-bearing lava which overlies Whitlow Canyon Formation in the Whitlow Canyon – Randolf Canyon area, but with no known age relationship with the Apache Leap Tuff. No geochemistry or detailed petrographic analysis have been done on this rock to determine whether it is dacite, rhyodacite, or rhyolite. The unit includes two subdivisions:

upper dacite lava, breccia (Tdub) [RENAMED] lava breccia – unit of Buzzards Roost

upper dacite lava, vitrophyre (Tduv) [RENAMED] vitrophyre – unit of Buzzards Roost

rhyodacite lava (rhyodacite of Whitlow Canyon) (Trd) [RENAMED] Whitlow Canyon Formation – Superstition Group This unit is elevated to formation status because of its lateral continuity and utility as a time-stratigraphic marker unit. The lava contains a distinctive assemblage of phenocrysts with the total phenocryst assemblage ranging in abundance between 1% and 15%. Listed in decreasing order of abundance these are; plagioclase, sanidine, large embayed quartz, and biotite. The type section is in the rugged country southeast of the Superstition Cauldron in the vicinity of the confluence of Tule Canyon and Whitlow Canyon.

rhyolite lava (rhyolite lavas of Tule Canyon) (Text) AND **rhyolite lava** (Sheet 1) **(Tr) [RENAMED] rhyolite lava – Tule Canyon Formation – Superstition Group** This unit constitutes the rhyolite lavas of the Tule Canyon Formation. The rest of the formation consists of unwelded tuff units that were defined as generic map units in this area. The type section is located on the west slope of the large mountain that forms the headwaters of Tule Canyon. The section is 535 meters thick and includes three lava units interbedded with three nonwelded tuff units with the lower tuff overlying dacite or andesite lava of the upper Government Well Formation.

unwelded bedded tuff (Tt) [GENERIC] nonwelded tuff Nonwelded tuffs associated with all lava units

including Government Well Formation, Tule Canyon Formation, unit of Buzzards Roost, and Coffee Flat Mountain Formation. It may be possible to divide this unit into nonwelded tuffs associated with each of the felsic lava units in the area. Retained because it was never intended as a stratigraphic unit.

crystal rich dacite lava (dacite of Randolph Canyon) (Tdx) [OBSOLETE] upper Government Well Formation – Superstition Group OR **crystal rich dacite – Coffee Flat Mountain Formation – Gila Group** Most of this map unit correlates with the crystal-rich dacite subdivision of upper Government Well Formation. However, a dacite dome to the north of Randolf Canyon that was originally correlated with this unit is now considered part of the Coffee Flat Mountain Formation.

bedded breccia (Tbb) [OBSOLETE] bedded breccia – Gila Group OR **bedded breccia – Apache Leap Tuff** This unit was originally thought to predate the Apache Leap Tuff because it is intruded by a dacitic lava (map unit Tdx of Ferguson and Skotnicki, 1995) on the north side of its currently known outcrop pattern. The Tdx unit was mistakenly correlated with pre-cauldron volcanic rocks of the Government Well Formation. The unit is now considered a cauldron margin breccia and the dacite dome to the north is correlated with the post-cauldron Coffee Flat Mountain Formation. No age relationship with intracauldron Apache Leap Tuff has been observed.

andesite or basaltic andesite lava (Ta) [RENAMED] lower Government Well Formation – Superstition Group Undifferentiated mafic lavas of the lower Government Well Formation which crop out just southwest of Coffee Flat Mountain, in the southeastern part of the volcanic field. Since there are no interbedded felsic lavas in this sequence it is appropriate to refer to these rocks as lower Government Well Formation.

upper andesite lava (Tau) [RETAINED] upper andesite lava – upper Government Well Formation – Superstition Group Upper subdivision of the andesite unit (Ta) of Ferguson and Skotnicki (1995).

lower dacite (dacite of San Mateo Castro Ranch) (Tdl) [RENAMED] dacite of San Mateo Castro Ranch – upper Government Well Formation – Superstition Group A distinctive, moderately crystal-rich (<15%), plagioclase, biotite-phyric dacite lava within the lower part of the upper Government Well Formation of the Whitlow Canyon area.

lower andesite lava (Tal) [RETAINED] lower andesite lava – upper Government Well Formation – Superstition Group Lower subdivision of the andesite unit (Ta) of Ferguson and Skotnicki (1995).

lower rhyodacite lava (Trdl) [RENAMED] quartz-phyric dacite – upper Government Well Formation – Superstition Group Same as the quartz-phyric dacite subdivision as defined by Gilbert and Ferguson (1997).

tuff of Quarter Circle U Ranch (Ttq) [RETAINED] tuff of Quarter Circle U Ranch – upper Government Well Formation – Superstition Group A crystal-rich, poorly welded to nonwelded dacitic tuff near the southern margin of the Superstition Cauldron that is associated with the dacitic lavas of the upper Government Well Formation. Originally thought to be a possible equivalent to the Apache Leap Tuff because at the time Apache Leap Tuff was widely believed to be older than Superstition Tuff. The lack of sanidine phenocrysts eliminates the possibility that it is Apache Leap Tuff.

coarse-grained basalt / basaltic andesite (Tbcg) [RETAINED] coarse-grained basalt / basaltic andesite – lower Government Well Formation – Superstition Group

basalt lava (Tb) [RETAINED] basalt lava – lower Government Well Formation – Superstition Group

conglomerate (Tc) [RETAINED] conglomerate – Whitetail Formation A viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field.

Breccia (Tx) [REDEFINED] breccia – Whitetail Formation This unit was mistakenly included in the Whitlow Canyon Area section. It is present only in one small area of the Superstition Mountains at the west end of Coffee Flat Mountain. It consists of heterolithic, crystalline basement-clast breccia that appears to underlie mafic lavas of the lower Government Well Formation. It was originally thought to be a possible cauldron margin breccia but the lack of volcanic matrix suggests that it is not volcanogenic.

Ferguson and Skotnicki (1995)
SUPERSTITION MOUNTAINS (northern area)

upper rhyolite lava (Tru) [RENAMED] rhyolite lava – Coffee Flat Mountain Formation Aphyric lava flow that overlies intracauldron Apache Leap Tuff in the south-central Superstition Cauldron, and considered a valid subdivision of the Coffee Flat Mountain Formation. The term “upper” is dropped because there are no other known rhyolites in the Coffee Flat Mountain Formation.

lithic tuff (Trut) [RETAINED] lithic tuff – Coffee Flat Mountain Formation Lithic tuff associated with an

aphyric lava flow (Tru) that overlies intracauldron Apache Leap Tuff in the south-central Superstition Cauldron, and considered a valid subdivision of the Coffee Flat Mountain Formation.

fine-grained intrusive rhyodacite (Tfi) [RETAINED] fine-grained intrusive rhyodacite – Coffee Flat Mountain Formation Hypabyssal bodies that intrude the lower rhyodacite of Coffee Flat Mountain (Ferguson and Skotnicki, 1995) along the southeastern margin of the Superstition Cauldron. Unit may represent feeder dike(s) for the upper rhyodacite lava – Coffee Flat Mountain Formation.

lower rhyodacite lava and intrusions of Coffee Flat Mountain (Tfl) [RENAMED] lower rhyodacite lava and intrusions – Coffee Flat Mountain Formation Crystal-rich rhyodacite lava and related hypabyssal rocks that intrude and overlap the southeastern margin of the Superstition Cauldron. Dated at 18.58 ± 0.06 Ma by McIntosh and Ferguson (1998), and considered a valid subdivision of the Coffee Flat Mountain Formation. This unit is overlain and intruded by the upper rhyodacite lava – Coffee Flat Mountain Formation.

Superstition Tuff (Ts) [OBSOLETE] Apache Leap Tuff

Superstition Tuff, upper Flatiron member (Tsfu) [OBSOLETE] upper Flatiron unit – Apache Leap Tuff Youngest of five informal intracauldron flow-units, defined as the flow-unit that forms the upper cliff of the Flatirons. This unit is discussed in text but is not in map legend.

Superstition Tuff, lower Flatiron member (Tsfl) [OBSOLETE] lower Flatiron unit – Apache Leap Tuff One of five informal intracauldron flow-units, defined as the flow-unit that forms the lower cliff of the Flatirons.

Superstition Tuff, Peralta Canyon member (Tsp) [OBSOLETE] unit of Peralta Canyon – Apache Leap Tuff One of five informal intracauldron flow-units, defined as the flow unit that forms the major cliff directly below the base of the Flatirons.

Superstition Tuff, Miners Needle member (Tsm) [OBSOLETE] unit of Miners Needle – Apache Leap Tuff One of five informally defined intracauldron flow-units. This is a relatively thin unit that crops out through Miners Needle. Ferguson and Skotnicki (1995) stated that the unit thins in the western part of the Superstition Mountains and is positioned between the Hieroglyphic member and the Peralta Canyon member.

Superstition Tuff, Hieroglyphic member (Tsh) [OBSOLETE] unit of Hieroglyphic Canyon – Apache Leap Tuff Oldest of five informally defined intracauldron flow-units.

Superstition Tuff mesobreccia (Tsx) [OBSOLETE] mesobreccia – Apache Leap Tuff An intracauldron lithic breccia unit.

Superstition Tuff megabreccia (Tsxg) [OBSOLETE] megabreccia – Apache Leap Tuff An intracauldron lithic breccia unit.

rhyolite lava breccia (Trx) [OBSOLETE] monolithic megabreccia – Apache Leap Tuff Since this breccia is interleaved with welded Apache Leap Tuff (Superstition Tuff of Ferguson and Skotnicki (1995)) it is interpreted as a syn-caldera avalanche breccia instead of the autobreccia of a pre-cauldron lava unit.

intrusive rhyolite (Tr) [RENAMED] rhyolite – Tule Canyon Formation – Superstition Group This unit occurs as a swarm of dikes cutting Proterozoic granite and as a probable flow just within the southern margin of the Superstition Cauldron at Peralta Canyon and east of Miners Needle.

lower dacite lava (Tdl) [OBSOLETE] intrusive dacite – Coffee Flat Mountain Formation – Gila Group (east) OR **dacite of San Mateo Castro Ranch – Government Well Formation – Superstition Group** (west) There are two exposures of this map unit in the Superstition Mountains. To the west at Carney Springs Campground, this lava is intruded by hypabyssal rhyolite of probable Tule Canyon Formation age and it is considered part of the Government Well Formation. To the east it occurs as a single dike that cuts Apache Leap Tuff (Superstition Tuff of Ferguson and Skotnicki (1995)) and it is interpreted as a dike that fed flows of the Coffee Flat Mountain Formation – Gila Group.

lower rhyodacite lava (Trdl) [RENAMED] quartz-phyric dacite – upper Government Well Formation – Superstition Group

andesite or basaltic andesite lava (Ta) [RENAMED] lower Government Well Formation – Superstition Group Undifferentiated mafic lavas of the lower Government Well Formation in the southeast part of the volcanic field. Since there are no felsic lavas within sequences of these lavas along the southern cauldron margin, it is appropriate to refer to these rocks as lower Government Well Formation.

Ferguson, C.A., and Skotnicki, S.J., 1996, Bedrock geology of the Santan Mountains, Pinal and Maricopa Counties, Arizona: Arizona Geological Survey Open-File Report 96-09, 22 p., 2 sheets, scale 1:24,000.

younger sedimentary deposits (Tsy) [RENAMED] conglomerate – Gila Group

basalt lava (Tbc) [RETAINED] basalt lava – Gila Group Basalt lava that apparently overlies Middle Proterozoic granite near Florence. The lava has been dated at about 8 or 6 Ma (Nason and others, 1982).

welded tuff (Ttw) [RENAMED] Apache Leap Tuff Apache Leap Tuff in the Santan Mountains. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

unwelded tuff (Tt) [GENERIC] nonwelded tuff This unit occurs above and below the Apache Leap Tuff (welded tuff of Ferguson and Skotnicki, 1996).

sandstone and conglomerate (Ts) [RETAINED] sandstone and conglomerate – Whitetail Formation A viable subdivision of the Whitetail Formation that forms a fanning dip sequence in the Santan Mountains. These rocks are equivalent to the Rock Peak and Yellow Peak conglomerates of Sell (1968).

basalt lava (Tb) [OBSOLETE] basalt lava – Superstition Group (west) OR **basalt lava – Whitetail Formation** (east) This unit occurs in two adjacent areas, and even though rocks in these areas may be time-equivalent, the rocks are assigned different stratigraphic names in accordance with the lithologic definitions of the Superstition Group and Whitetail Formation. The thick amalgamated lava sequence to the west that makes up the Malpais Hills is assigned to the Superstition Group because it underlies Apache Leap Tuff and because volcanic rock dominates this sequence. The thin basalt flows to the east, interbedded with sedimentary rocks at Rock Peak and Yellow Peak are classified as part of the Whitetail Formation because these rocks, although also overlain by Apache Leap Tuff, occur in a sequence dominated by nonvolcaniclastic rocks. The lava flows within Whitetail Formation correlate with the Blue Basalt of Sell (1968).

bedded basaltic scoria (Tbs) [RETAINED] bedded basaltic scoria – Superstition Group

sedimentary breccia (Tx) [RETAINED] sedimentary breccia – Whitetail Formation A viable subdivision of the Whitetail Formation that is interpreted to overlap a major low-angle fault in the central Santan Mountains. The unit overlies and interfingers with a fanning dip sequence of sandstone and conglomerate (Ts of Ferguson and Skotnicki, 1996).

Fodor, R.V., 1969, Petrography and petrology of the volcanic rocks in the Goldfield Mountains, Arizona: Tempe, Arizona State University, M.S. thesis, 66 p., 2 sheets, scale 1:24,000.

late-stage domes [OBSOLETE] rhyolite of Bulldog Canyon – Whitetail Formation Same as the rhyolite of Bulldog Canyon (Skotnicki and Ferguson (1996)). Fodor (1969) interpreted these rocks as the youngest volcanics in the Goldfield Mountains. Although it is true that the rhyolites intrude parts of the Whitetail Formation in the area, tuff from the dome(s) also interfinger with conglomerate of the Whitetail Formation, and the entire complex is overlain by basal volcanics of the Government Well Formation (basalt (Tb) or dacite (Tdc) units of Skotnicki and Ferguson, 1996).

ash-flow tuff and lava sequence [OBSOLETE] (mostly) **Tule Canyon Formation – Superstition Group** This term appears only in the text. On the map, only the subdivisions below are listed. With the exception of "member B (qtz. latite)", the subdivisions are valid because they represent different lava flows and interbedded nonwelded tuffs of the Tule Canyon Formation in the northern Goldfield Mountains. Fodor (1969) recognized 3 divisions of lava and tuff. But in reality, the sequence is more complex with many of the tuffs and lavas pinching out along strike and being replaced by other units that are not correlative.

- **member A [RENAMED] nonwelded tuff – Tule Canyon Formation – Superstition Group**
- **member B (rhyolite) [RENAMED] rhyolite lava – Tule Canyon Formation – Superstition Group**
- **member B (qtz. latite) [RENAMED] unit of Pass Mountain** Same as the unit of Pass Mountain at Pass Mountain and adjoining areas to the east. A crystal-rich dacite or rhyodacite lava and its associated tuff which caps Pass Mountain and other nearby peaks and ridges in the western Goldfield Mountains
- **member C [RENAMED] nonwelded tuff – Tule Canyon Formation – Superstition Group**
- **member D [RENAMED] rhyolite lava – Tule Canyon Formation – Superstition Group**
- **member E [RENAMED] nonwelded tuff – Tule Canyon Formation – Superstition Group**
- **member F [RENAMED] rhyolite lava – Tule Canyon Formation – Superstition Group**

basalt, andesite, dacite [RENAMED] Government Well Formation – Superstition Group Same as the

Government Well Formation.

volcanic breccia (text) AND **epiclastic breccia** (Plate I) **[RENAMED] epiclastic and volcanic breccia – Whitetail Formation** This unit includes nonvolcaniclastic conglomerate, breccia, volcaniclastic conglomerate and sandstone and minor pyroclastic tuff and breccia.

Apache Leap quartz latite [OBSOLETE] Apache Leap Tuff Fodor (1969) briefly referred to Apache Leap quartz latite in the text only, equating it with Superior dacite, only to establish a stratigraphic reference level in the Goldfield Mountains. No other author uses this term. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Gilbert, W.G., and Ferguson, C.A., 1997, Geology of the Horse Mesa Dam quadrangle, Maricopa and Gila Counties, Arizona: Arizona Geological Survey Open-File Report 97-15, 14 p., 3 sheets, scale 1:24,000.

weakly indurated conglomerate, sandy conglomerate and pebbly sandstone (Tsy) [RETAINED] weakly indurated conglomerate, sandy conglomerate and pebbly sandstone – Gila Group Equivalent to the younger sedimentary basin-fill deposits (Tsy) of Skotnicki and Leighty (1997). This unit correlates with the Tsy units of FS 96, Skotnicki and Ferguson (1996) and Ferguson and Gilbert (1997).

volcaniclastic conglomerate, pebbly sandstone, sandstone, and breccia (Tcv) [RENAMED] volcaniclastic conglomerate – Gila Group Equivalent to the unit of Mesquite Flat in the vicinity of Tortilla Flat.

younger unwelded rhyolite tuff associated with the quartz latite lava (Text) AND **unwelded rhyolite tuff associated with the quartz latite lava** (Sheet 2) **(Tty) [RENAMED] nonwelded rhyolite tuff associated with the quartz latite lava – Coffee Flat Mountain Formation – Gila Group** A subdivision of the Coffee Flat Mountain Formation along the northeastern margin of the Superstition Cauldron.

intrusions of crystal-rich quartz latite lava (Text) AND **intrusive bodies of the quartz latite lava** (Sheet 2) **(Tqi) [RENAMED] intrusive bodies of the quartz latite lava – Coffee Flat Mountain Formation – Gila Group** A subdivision of a post-cauldron lava dome complex that overlaps the north-central Superstition Cauldron margin. Equivalent in part with the Peters Canyon dome complex of Prowell (1984).

quartz latite lava (Text) AND **crystal-rich quartz latite lava** (Sheet 2) **(Tq) [RENAMED] crystal-rich quartz latite lava – Coffee Flat Mountain Formation – Gila Group** A subdivision of a post-cauldron lava dome complex that overlaps the north-central Superstition Cauldron margin. Equivalent in part with the Peters Canyon dome complex of Prowell (1984).

crystal-rich quartz latite lava breccia (Tqb) [RETAINED] crystal-rich quartz latite lava breccia – Coffee Flat Mountain Formation A subdivision of a post-cauldron lava dome complex that overlaps the north-central Superstition Cauldron margin. Equivalent in part with the Peters Canyon dome complex of Prowell (1984).

crystal-rich quartz latite lava vitrophyre (Tqv) [RETAINED] crystal-rich quartz latite lava vitrophyre – Coffee Flat Mountain Formation – Gila Group A subdivision of a post-cauldron lava dome complex that overlaps the north-central Superstition Cauldron margin. Equivalent in part with the Peters Canyon dome complex of Prowell (1984).

volcanic and epiclastic monolithic to heterolithic breccia, conglomerate, and bedded unwelded tuff (Tcx) [RETAINED] volcanic and epiclastic monolithic to heterolithic breccia, conglomerate, and bedded unwelded tuff – Apache Leap Tuff OR **Gila Group** A complex unit that mantles a south-dipping unconformity south of Lewis and Pranty Creek. The unconformity is interpreted as the northern topographic margin of the Superstition Cauldron. The unit overlies lavas of the Government Well Formation, contains clasts of the Tule Canyon Formation and is intruded by the Coffee Flat Mountain Formation, but no age relationship with Apache Leap Tuff is preserved.

Superstition Tuff (Ts) [OBSOLETE] Apache Leap Tuff Same as the Apache Leap Tuff in the Superstition Mountains.

upper Superstition Tuff (Tsu) [OBSOLETE] upper Apache Leap Tuff Upper of two units defined by a welding break in the outflow sheet at Goat Mountain, north of Apache Lake. No correlation was attempted between these welding units and the informal flow-unit divisions of the intracauldron tuff as defined by Skotnicki and Ferguson (1995) and Ferguson and Skotnicki (1995).

lower Superstition Tuff (Tsl) [OBSOLETE] lower Apache Leap Tuff Lower of two units defined by a welding break in the outflow sheet at Goat Mountain, north of Apache Lake. No correlation was attempted between these welding units and the informal flow-unit divisions of the intracauldron tuff as defined by

Skotnicki and Ferguson (1995) and Ferguson and Skotnicki (1995).

sandstone and conglomerate (Text) AND **volcaniclastic sandstone and conglomerate** (Sheet 2) **(Tcs) [RENAMED] sandstone and conglomerate – Tule Canyon Formation – Superstition Group** Volcaniclastic sandstone and conglomerate with 10% quartzite clasts found between the Ts and Tt map units along the north edge of the map area at Goat Mountain.

rhyolite lavas of Fish Creek Peak (Trf) [REDEFINED] rhyolite lavas of Fish Creek Peak – Coffee Flat Mountain Formation Part of a complex pile of lava, tuff, and hypabyssal rocks that overlap the northeastern margin of the Superstition Cauldron. Ages of 18.42 ± 0.06 Ma and 18.24 ± 0.08 Ma were obtained from other units within the massif (McIntosh and Ferguson, 1998). The unit is considered a valid subdivision of the Coffee Flat Mountain Formation. The unit is redefined because it was originally thought (Gilbert and Ferguson (1997)) that it may correlate with the Tule Canyon Formation.

unwelded rhyolite tuff associated with the rhyolite lavas of Fish Creek Peak (Ttf) [REDEFINED] nonwelded tuffs of Fish Creek Peak – Coffee Flat Mountain Formation Part of a complex pile of lava, tuff, and hypabyssal rocks that overlap the northeastern margin of the Superstition Cauldron. Ages of 18.42 ± 0.06 Ma and 18.24 ± 0.08 Ma were obtained from these rocks (McIntosh and Ferguson, 1998). The unit is considered a valid subdivision of the Coffee Flat Mountain Formation. The unit is redefined because it was originally thought (Gilbert and Ferguson (1997)) that it may correlate with the Tule Canyon Formation.

Whitlow Canyon type rhyodacite lava breccia (Text) AND **monolithic breccia composed of Whitlow Canyon type rhyodacite lava** (Sheet 2) **(Twb) [RENAMED] lava breccia – Whitlow Canyon Formation – Superstition Group** A single exposure of autobreccia that occurs at the top of thick section of Whitlow Canyon Formation along the northern Superstition Cauldron margin where it intersects Tortilla Creek in the southwest corner of the map area.

Whitlow Canyon type rhyodacite lava (Tw) [RENAMED] lava – Whitlow Canyon Formation – Superstition Group A subdivision of the Whitlow Canyon Formation.

middle basalt (Tbm) [RENAMED] basalt – Tule Canyon Formation – Superstition Group A thin olivine basalt that occurs interbedded with rhyolite tuff and lava of the Tule Canyon Formation along the north edge of the volcanic field. The term "middle" is dropped because there are no other basalts in the Tule Canyon Formation.

unwelded bedded lapilli tuff undifferentiated (Tt) [RETAINED] unwelded bedded lapilli tuff undifferentiated – Tule Canyon Formation – Superstition Group Nonwelded, bedded crystal-poor rhyolite tuffs interbedded between lava flows or occurring near vents of lavas of the Tule Canyon Formation.

unwelded bedded tuff (Text) AND **unwelded bedded tuff interbedded with nonvolcaniclastic conglomerate** (Sheet 2) (**Tts) [RENAMED] nonwelded tuff and conglomerate – Tule Canyon Formation – Superstition Group**

rhyolite lava undifferentiated (Tr) [RETAINED] rhyolite lava undifferentiated – Tule Canyon Formation – Superstition Group Subdivision of the Tule Canyon Formation.

intrusive rhyolite (Tri) [RETAINED] intrusive rhyolite – Tule Canyon Formation – Superstition Group Subdivision of the Tule Canyon Formation.

aphyric rhyolite lava (Tra) [RETAINED] aphyric rhyolite lava – Tule Canyon Formation – Superstition Group Rhyolite lavas of the Tule Canyon Formation containing less than 0.5% phenocrysts. A subdivision recognized in the northern part of the volcanic field.

crystal-poor rhyolite lava (Trp) [REDEFINED] crystal-poor rhyolite lava – Tule Canyon Formation – Superstition Group A subdivision of rhyolite lavas containing between 0.5% and 5% phenocrysts subdivision recognized in the northern part of the volcanic field. This unit is erroneously defined in the text and on Sheet 2 as consisting of between 7-1% and 0.5-3% phenocrysts respectively.

crystal-rich rhyolite lava (Trx) [REDEFINED] crystal-rich rhyolite lava – Tule Canyon Formation – Superstition Group A subdivision of rhyolite lavas containing between 5% and 10 % phenocrysts recognized in the northern part of the volcanic field. This unit is erroneously defined in the text and on Sheet 2 as consisting of between 20-7% and >3% phenocrysts respectively.

rhyodacite lava (Text) AND **Apache Gap type rhyodacite lava** (Sheet 2) **(Trda) [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group** Same as rhyodacite of Apache Gap.

moderately crystal-rich porphyritic dacite flows (Text) AND **quartz-phyric dacite lava** (Sheet 2) **(Tdp)**

[RENAMED] quartz-phyric dacite – upper Government Well Formation – Superstition Group Gilbert and Ferguson (1997) defined this subdivision in Fish Creek Canyon. It consists of moderately crystal-rich, dacite lavas characterized by conspicuous, 0.5 to 1.0 cm, embayed quartz phenocrysts. The lavas occur at various stratigraphic levels within the upper Government Well Formation correlating with the Trdl unit of Ferguson and Skotnicki (1995) and the Tdp unit of Ferguson and Gilbert (1997).

dacite lava (Text) AND **crystal-rich dacite lava** (Sheet 2) **(Td) [RENAMED] crystal-rich dacite – upper Government Well Formation – Superstition Group** A subdivision representing a major part of the upper Government Well Formation. It consists of dacitic lava and nonwelded tuff that contain abundant plagioclase, biotite, ± hornblende and clinopyroxene. The lack of quartz phenocrysts distinguishes these lavas from the quartz-phyric dacite subdivision, and its coarse-grained, typically lavender crystalline matrix distinguishes it from the dacite of San Mateo Castro Ranch and the rhyodacite of Apache Gap subdivisions.

crystal-rich poorly to unwelded lapilli tuffs (Text) AND **dacitic crystal-rich unwelded tuff** (Sheet 2) **(Tdt) [RENAMED] dacitic crystal-rich tuff – upper Government Well Formation – Superstition Group** Nonwelded, crystal-rich tuff associated with dacite lavas of the upper Government Well Formation in the northern part of the volcanic field.

dacite lava breccia (Tdb) [RETAINED] dacite lava breccia – upper Government Well Formation – Superstition Group Various breccias associated with dacitic lavas of the upper Government Well Formation in the northern part of the volcanic field.

intrusive dacite (Tdi) [RETAINED] intrusive dacite – upper Government Well Formation – Superstition Group The unit consists of plugs that probably fed the flows of upper Government Well Formation in the Bronco Butte area.

basalt lava (Text) AND **older basalt lava** (Sheet 2) **(Tb) [RENAMED] basalt lava – lower Government Well Formation – Superstition Group** Mafic lavas of the lower Government Well Formation.

basalt dikes and other hypabyssal intrusions (Text) AND **basalt dikes and other hypabyssal bodies** (Sheet 2) **(Tbi) [RENAMED] intrusive basalt – lower Government Well Formation – Superstition Group** Basalt dikes and other hypabyssal bodies related to lavas in the lower Government Well Formation in the northern part of the volcanic field

basaltic sandstone and pyroclastic rocks (Tbs) [RETAINED] basaltic sandstone and pyroclastic rocks – lower Government Well Formation – Superstition Group Bedded rocks associated with mafic lavas in the lower Government Well Formation south of Apache Lake.

arkosic conglomerate, pebbly sandstone, and sandstone (Tc) [RETAINED] arkosic conglomerate, pebbly sandstone, and sandstone – Whitetail Formation A viable subdivision of the Whitetail Formation in the northern part of the volcanic field.

Heindl, L.A., 1963, Cenozoic geology in the Mammoth area, Pinal County, Arizona: U.S. Geological Survey Bulletin 1141-E, p. E1-E41, 3 sheets, scale 1:63,360.

San Manuel Formation [RETAINED] San Manuel Formation Originally defined by Heindl (1963). Cornwall and Krieger (1975a; 1975b), and Banks and Krieger (1977) mapped this formation along the southern edge of the volcanic field. The unit is included in this report because the absence of Apache Leap Tuff clasts is used as one of the criteria for its identification. The formation consists of nonvolcaniclastic sandstone and conglomerate plus other finer grained sedimentary rocks interbedded with minor nonwelded felsic tuffs. In its type area the San Manuel Formation is placed within the Gila Group (Heindl, 1963), but since the unit predates emplacement of the Apache Leap Tuff this assignment is not used in the Superstition volcanic field. The sequence is probably the southerly equivalent of the Whitetail Formation.

Hillier, M.R., 1978, A geochemical study of the latite of Government Well, Superstition Mountains, Arizona: Tempe, Arizona State University, M.S. thesis, 69 p.

Geronimo Head Formation (T_G) [OBSOLETE] upper Government Well Formation – Superstition Group This unit corresponds to the dacitic crystal-rich tuff (Ttd) of Ferguson and Gilbert (1997) and it is considered part of the Government Well Formation.

Latite of Government Well [RENAMED] upper Government Well Formation – Superstition Group Hillier (1978) studied and mapped outcrops of this unit northeast of Government Well on east side of Apache Trail. Hillier (1978) *did not study* the outcrops in the Fish Creek area, and does not state that the Fish Creek trachyandesites and dacites outcrops of Malone (1972) are the same as latite of Government

Well, contrary to later statements by other authors. Hillier recognized 7 sub-units:

Rhyolite (T_R) [RENAMED] intrusive rhyolite – Tule Canyon Formation – Superstition Group A dike of rhyolite that is possibly the same age as Tule Canyon Formation.

Obsidian (T_O) [RETAINED] obsidian – upper Government Well Formation – Superstition Group A potentially viable subdivision of the upper Government Well Formation in this area.

Rhyodacite (T_{RD}) [RETAINED] rhyodacite – upper Government Well Formation – Superstition Group This map unit may represent individual lava flows in the upper Government Well Formation. The map of Hillier (1978) shows more detail than Ferguson and Gilbert (1997) who mapped this as undifferentiated crystal-rich dacite (Td).

Dacite Breccia (T_{BR}) [RETAINED] dacite breccia – upper Government Well Formation – Superstition Group This map unit may represent individual breccia sequences in the upper Government Well Formation. The map of Hillier (1978) shows more detail than Ferguson and Gilbert (1997) who mapped this as undifferentiated crystal-rich dacite (Td).

Latite (T_L) [RETAINED] latite – upper Government Well Formation – Superstition Group This map unit may represent individual lava flows in the upper Government Well Formation. The map of Hillier (1978) shows more detail than Ferguson and Gilbert (1997) who mapped this as undifferentiated crystal-rich dacite (Td).

Latite-andesite (T_L) [RETAINED] latite-andesite – upper Government Well Formation – Superstition Group This map unit may represent an individual lava flow in the upper Government Well Formation. The map of Hillier (1978) shows more detail than Ferguson and Gilbert (1997) who mapped this as undifferentiated crystal-rich dacite (Td).

Welded Tuff (T_T) [OBSOLETE] lower Government Well Formation – Superstition Group Ferguson and Gilbert (1997) mapped this as basalt lava.

Older Basalt (T_B) [RENAMED] basalt – lower Government Well Formation – Superstition Group

Isagholian, Varush, 1983, Geology of a portion of Horse Mesa and Fish Creek Canyon areas, central Arizona: Tempe, Arizona State University, M.S. thesis, 73 p., 1 sheet.

Mesquite Flat breccia (text) AND **breccia of Mesquite Flat** (map) **(Tmb) [RENAMED] unit of Mesquite Flat – Gila Group** Renamed because the unit is composed mostly of pebbly sandstone and conglomerate. Breccia is a very minor component of the unit.

vitrophyric zone of the Canyon Lake Tuff (text) **[OBSOLETE] vitrophyre - Apache Leap Tuff** Isagholian (1983) described a thin-section of this unit from near Canyon Lake.

rhyolite of Horse Mesa (text) **[OBSOLETE] Tule Canyon Formation – Superstition Group** This unit, which might have been a viable subdivision of the Tule Canyon Formation, has been abandoned to avoid confusion. Malone (1972), Suneson (1976), and Isagholian (1983) used this name or variations of it in reference to lavas of demonstrably different composition, based on mapping by Gilbert and Ferguson (1997), that cap mesas and buttes along the Salt River.

Apache Leap Formation (text) **[OBSOLETE] Apache Leap Tuff** Isagholian (1983) incorrectly attributed the term Apache Leap formation to D.W. Peterson (1968). This name was abandoned by Stuckless (1971) and Stuckless and Sheridan (1971) and replaced with Superstition Tuff. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group Original name for practically all silicic lavas of the northwestern Superstition volcanic field, including all of the Tule Canyon Formation, the Whitlow Canyon Formation near the town of Tortilla Flat, and much of the Coffee Flat Mountain Formation. The name was abandoned by Prowell (1984), who recognized that the lavas at Geronimo Head were younger than the lavas around Canyon Lake. Isagholian (1983) correlated this unit with the Geronimo Head Formation of Suneson (1976) and a unit termed "younger rhyolite ashes and lahars" by Malone (1972). He recognized several lava domes in the Fish Creek/Coronado Mesa/Black Cross Butte area as subdivisions of the Geronimo Head Formation. Unfortunately, Isagholian (1983) used multiple names for these subdivisions.

Black Cross Butte lava flow [RENAMED] unit of Black Cross Butte – Tule Canyon Formation – Superstition Group A viable subdivision of the Tule Canyon Formation, Isagholian (1983) equated this lava with the Horse Mesa rhyolite of Malone (1972) and the rhyolite of Horse Mesa of

Suneson (1976). Subdivided into the following units:

Lava flow of Black Cross Butte (Tbl) [RETAINED] lava flow of Black Cross Butte – unit of Black Cross Butte – Tule Canyon Formation – Superstition Group The upper and main subdivision of the unit of Black Cross Butte.

Vitrophyre of Black Cross Butte (Tbv) [RETAINED] vitrophyre of Black Cross Butte – unit of Black Cross Butte – Tule Canyon Formation – Superstition Group The lower of two subdivisions of the unit of Black Cross Butte.

Lava dome complexes [RENAMED] Tule Canyon Formation – Superstition Group Isagholian (1983) subdivided this unit into lava, domes, breccia, and nonwelded tuff.

Lava dome breccia (Tgb) [RENAMED] lava breccia – Tule Canyon Formation – Superstition Group This unit consists of lava breccia and dome breccia.

Lava domes (Tgl) [RENAMED] lava – Tule Canyon Formation – Superstition Group This unit consists of lava flows and domes. The following units are mentioned in the text:

Lava dome of Coronado Mesa (text) **[RENAMED] lava – Tule Canyon Formation – Superstition Group** Unit is not divided on the map.

Lava dome west of Black Cross Butte (text) **[RENAMED] lava – Tule Canyon Formation – Superstition Group** Unit is not divided on the map.

Lava dome complex south of Black Cross Butte (text) **[RENAMED] lava – Tule Canyon Formation – Superstition Group** Unit is not divided on the map.

Lava dome of Fish Creek (text) **[RENAMED] lava – Tule Canyon Formation – Superstition Group** Unit is not divided on the map.

Surge (Tgs) [RENAMED] nonwelded tuff – Tule Canyon Formation – Superstition Group A pyroclastic unit that contains surge deposits, but also a significant portion of ash-fall, and ash-flow tuff.

Rhyodacite (text) **[RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group** Isagholian (1983) sampled this rock at the confluence of Fish Creek and Salt River but did not map this area.

Latite of Fish Creek (text) **[RENAMED] upper Government Well Formation – Superstition Group** Same as the upper Government Well Formation. Isagholian (1983) used latite of Fish Creek with outcrops in general agreement with Malone (1972).

Latite lava flow (Tll) [RENAMED] quartz phyric dacite – upper Government Well Formation – Superstition Group This lava flow is part of this regional subdivision described by Gilbert and Ferguson (1997).

Latite breccia (Tlb) [RENAMED] quartz phyric dacite – upper Government Well Formation – Superstition Group This breccia is part of this regional subdivision described by Gilbert and Ferguson (1997).

Lava flow of Fish Creek (text) **[RENAMED] quartz phyric dacite – upper Government Well Formation – Superstition Group** This is a name used in the geochemistry section of the text.

Keith, Stanley B., 1983, Results of mapping project near Ray, Pinal County, Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report 83-14, 67 p., 13 sheets, scale 1:12,000.

Big Dome Formation [RETAINED] Big Dome Formation – Gila Group Keith subdivided this unit into 8 sedimentary and volcanic units. We formally include this formation within the Gila Group.

Picketpost Mountain Volcanics [REDEFINED] Picketpost Mountain Formation – Gila Group Keith (1983) subdivided the Picketpost Mountain Volcanics into 11 units, some or all of which may be viable units of this new formation.

older gravel (Tgo) [RENAMED] gravel of Walnut Canyon – Gila Group Renamed by Dickinson (1995).

Apache Leap tuff [REDEFINED] Apache Leap Tuff The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

San Manuel Formation [RETAINED] San Manuel Formation Keith (1983) shows this unit as a southerly equivalent of the Whitetail Formation. In its type area the San Manuel Formation is placed within the Gila Group (Heindl, 1963), but since the unit predates emplacement of the Apache Leap Tuff, this assignment is not used in the Superstition volcanic field.

Whitetail Conglomerate [RENAMED] Whitetail Formation Keith (1983) recognized three members of the Whitetail (upper, middle, and lower) and each of these were further subdivided. For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Kilbey, T.R., 1986, Geology and structure of the Goldfield mining district, central Arizona: Tempe, Arizona State University, M.S. thesis, 254 p., 2 sheets, scale 1:5,000.

First Water Rhyolite (text) AND **First Water Rhyolites** (text) AND **First Water Rhyolite Tuff** (Plate I) **(Tft)** AND **First Water Rhyolite Lava 1** (Plate I) **(Tfr1)** AND **First Water Rhyolite Lava 2** (Plate I) **(Tfr2)** AND **First Water Rhyolite Lavas** (Plate II) **(Tfr1** AND **Tfr2)** AND **First Water Rhyolite Tuffs** (Plate II) **(Tft) [OBSOLETE] Tule Canyon Formation – Superstition Group** Kilbey (1986) used these terms north of Bulldog Canyon and west of Cottonwood Spring in the Goldfield Mountains. The names represent various lavas and tuffs within the Tule Canyon Formation.

Apache Gap rhyodacite (text) AND **Apache Gap rhyodacites** (text) AND **Apache Gap rhyodacite lava** (Plate I) **(Tarl)** AND **Apache Gap rhyodacite breccia** (Plate I) **(Tarb)** AND **Apache Gap rhyodacite lavas and breccias** (Plate II) **(Tarl** AND **Tarb) [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group** The map of Kilbey (1986) shows the southern portion of the outcrop that extends westward from the type area of this unit at Apache Gap. Kilbey (1986) also stated, mistakenly, that Stuckless (1969) included this unit as the "lower portion of the Geronimo Head Formation", but Stuckless (1969) and Stuckless (1971) clearly showed the outcrop at Apache Gap as younger than the Geronimo Head Formation. Kilbey (1986) also stated that the Apache gap rhyodacites correspond to "Fodor's (1969) dacite unit", but Fodor (1969) did not have a "dacite unit" broken out on his map, although he did describe a "dacite" within a map unit referred to as "BASALT, ANDESITE, DACITE" which does correspond to the outcrop which Kilbey (1986) mapped near Cottonwood Spring (33°30'N 111°30'W).

Apache Gap Basalt (Tab) [RENAMED] basalt of Apache Gap – upper Government Well Formation – Superstition Group A thin basalt lava within the upper Government Well Formation. The name is changed because it was never formally defined.

Siphon Draw Tuff (text) AND **Siphon Draw Rhyodacite Tuff** (Plate I and Plate II) **(Tss) [OBSOLETE] Apache Leap Tuff** Kilbey (1986) used Siphon Draw Rhyodacite Tuff and Siphon Draw Tuff for a very small outcrop area in the extreme southeastern portion of his study area and did not mention Superstition Tuff. Same as the Siphon Draw Member of the Superstition Tuff, later shown to be same as Apache Leap Tuff.

Government Well Latite AND **Government Well Latites [RENAMED] upper Government Well Formation – Superstition Group** Kilbey (1986) used both Government Well Latite and Government Well Latites interchangeably in the area northwest of Goldfield on the west side of Apache Trail that included the presumed type-section, but did not overlap significantly with Hillier (1978). Kilbey (1986) *did not study* outcrops in the Fish Creek area, but did state that his Government Well latites are the same as the "trachyandesites" described by Malone (1972). Kilbey describes 8 sub-units which do not correspond to those of Hillier (1978). Although not completely reproducible as map units (see Skotnicki and Ferguson, 1995), some of the units of Kilbey (1986) are probably viable. Following are the sub-units of Kilbey (1986):

- **Basalt subunit** (text) **[RENAMED] basalt – upper Government Well Formation – Superstition Group** Thin discontinuous lava flows interbedded with the intermediate lavas of the upper Government Well Formation.
- **rhyodacite subunit** (text) AND **Government Well rhyodacite lava** (Plate I) **(Tgr) [RENAMED] rhyodacite – upper Government Well Formation – Superstition Group**
- **latite lava subunit** (text) AND **Government Well latite lava** (Plate I and Plate II) **(Tgl) [RENAMED] latite lava – upper Government Well Formation – Superstition Group**
- **latite breccia subunit** (text) AND **Government Well latite breccia** (Plate I and Plate II) **(Tglb) [RENAMED] latite breccia – upper Government Well Formation – Superstition Group**
- **latite tuff-breccia subunit** (text) AND **Government Well latite tuff-breccia** (Plate I and Plate II) **(Tgtb) [RENAMED] latite tuff-breccia – upper Government Well Formation – Superstition Group**
- **Government Well rhyodacite breccia** (Plate I) **(Tgrb) [RENAMED] rhyodacite breccia – upper**

Government Well Formation – Superstition Group

rhyodacite welded tuff subunit (text) AND **Government Well rhyodacite welded tuff** (Plate I) **(Tgw) [RENAMED] rhyodacite welded tuff – upper Government Well Formation – Superstition Group**

andesitic-latite subunit (text) AND **Government Well andesitic-latite lava** (Plate I) AND **Government Well andesitic-latite subunit** (Plate II) **(Tga) [RENAMED] andesitic-latite lava – upper Government Well Formation – Superstition Group**

Blue Ridge Rhyolite Tuff (Tbr) [RENAMED] tuff of Blue Ridge – lower Government Well Formation – Superstition Group The younger of two tuff units within the lower Government Well Formation in the eastern Goldfield Mountains. The unit is a viable subdivision but it should be referred to as tuff of Blue Ridge because it was never formally defined and because its phenocryst mineralogy (plagioclase and biotite) indicates that it is probably not a rhyolite.

Cottonwood Spring Basalt (Tcb) [RENAMED] basalt of Cottonwood Spring – lower Government Well Formation – Superstition Group The younger of two mafic lava units within the lower Government Well Formation in the eastern Goldfield Mountains.

Saddle Rock Rhyolite Tuff (Tsr AND **Tsrl) [RENAMED] tuff of Saddle Rock – lower Government Well Formation – Superstition Group** The older of two tuff units within lower Government Well Formation in the eastern Goldfield Mountains. Although much of this unit is viable, it should be referred to as tuff of Saddle Rock because it was never formally defined and because its phenocryst mineralogy (plagioclase and biotite) indicates that it is probably not a rhyolite. Along the western edge of the map of Kilbey (1986) however, the unit is better interpreted as sedimentary strata equivalent to the Whitetail Formation (Fodor, 1969; Skotnicki and Ferguson (1996)).

Weekes Wash Basalt (Twb) [RENAMED] basalt of Weekes Wash – lower Government Well Formation – Superstition Group The older of two mafic lava units within the lower Government Well Formation in the eastern Goldfield Mountains. Kilbey (1986) used Weekes Wash basalt for basalt outcrops in the Goldfield – Government Well area, but did not specify a type locality.

Whitetail Conglomerate (Twc) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Malone, G.B., 1972, The geology of the volcanic sequence in the Horse Mesa area, Arizona: Tempe, Arizona State University, M.S. thesis, 68 p., 1 sheet, scale 1:24,000.

quartz latite domes (Tq) [RENAMED] Tule Canyon Formation – Superstition Group

Horse Mesa rhyolite lavas (Trh) [OBSOLETE] Tule Canyon Formation – Superstition Group Malone (1972) used Horse Mesa rhyolite lavas for outcrops on western part of Horse Mesa south of Apache Lake, and on Black Cross Butte southwest of Apache Lake. On Horse Mesa the unit is aphyric (Gilbert and Ferguson, 1997), but at Black Cross Butte, it contains a few percent phenocrysts (Isagholian, 1983). The unit is obsolete because the proper informal name (rhyolite of Horse Mesa) was later used by Suneson (1976) for a different series of flows across Salt River Canyon as well as the outcrops of Malone (1972) and other outcrops to the west.

younger rhyolite ashes and lahars (Try) [OBSOLETE] Tule Canyon Formation – Superstition Group Equivalent to the bedded nonwelded tuffs of the Tule Canyon Formation. This unit name is considered obsolete because very few (if any) of these rocks are volcaniclastic or lahars.

Bronco Butte lahar (Tl) [RENAMED] unit of Bronco Butte – upper Government Well Formation – Superstition Group Same as the dacite lava breccia unit of Gilbert and Ferguson (1997) at Bronco Butte. This is a volcaniclastic sedimentary subdivision of the upper Government Well Formation in the Horse Mesa area. Because there is some debate (see Gilbert and Ferguson, 1997) over whether or not the unit was deposited as a lahar or some other type of debris flow, it is suggested that this unit should be referred to as "unit of Bronco Butte". Suneson (1976) apparently designated the area of the outcrop of this unit as latite of Government Well.

older rhyolite ashes and lahars (Tro) [OBSOLETE] upper Government Well Formation – Superstition Group This unit corresponds roughly to the dacite lava breccia unit of Gilbert and Ferguson (1997).

older rhyolite lava (Tr) [OBSOLETE] upper Government Well Formation – Superstition Group A rhyolitic unit supposedly interbedded with dacitic lavas of the upper Government Well Formation along the southern slopes of Horse Mesa. Gilbert and Ferguson (1997) could not find this unit during their mapping

of the area.

Fish Creek trachyandesites and dacites (Ttd) [RENAMED] upper Government Well Formation – Superstition Group Original name for the upper Government Well Formation in the north-central part of the volcanic field. Although Fish Creek was suggested as a type area prior to the use of latite of Government Well by Suneson (1976), the name Government Well is preferred because the unit is thicker and more diverse in the area of Government Well and very little of the unit is actually exposed along Fish Creek.

Apache Lake basalts (Tba) [RENAMED] basalt of Apache Lake – lower Government Well Formation – Superstition Group Mafic lava in the lower Government Well Formation along Apache Lake. Outcrops extend from southern shore of Apache Lake south to east of Bronco Butte and then south-southwest to Apache Trail. No type section/locality was named.

arkosic conglomerate (Tc) [RETAINED] arkosic conglomerate – Whitetail Formation A viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field.

McIntosh, W.C., and Ferguson, C.A., 1998, Sanidine, single crystal, laser-fusion $^{40}Ar/^{39}Ar$ geochronology database for the Superstition Volcanic Field, central Arizona: Arizona Geological Survey Open-File Report 98-27, 74 p.

Younger post-cauldron units [OBSOLETE] Gila Group OR **Picketpost Mountain Formation – Gila Group** Three volcanic rocks from the southern part of the volcanic field were dated and assigned to this informal unit. They are all considered to be part of the Gila Group. Two of these (samples J-4-11-96-2 and J-4-8-97-1) are nonwelded tuffs interbedded with Gila Group sedimentary rocks, and the tuffs were probably derived from nearby volcanic units of the Picketpost Mountain Formation. The third sample (J-1-17-96-1) is a hypabyssal felsic body (map unit Tri of Richard and Spencer, 1998) that is now considered part of the Picketpost Mountain Formation – Gila Group.

Coffee Flat Mountain Formation [RETAINED] Coffee Flat Mountain Formation – Gila Group The name of this formation appeared first in this publication. Eleven age dates are reported with an age range of between 18.6 and 17.9 Ma.

Apache Leap Tuff [REDEFINED] Apache Leap Tuff Based on high-precision, sanidine, single crystal, laser-fusion $^{40}Ar/^{39}Ar$ age-dating of 21 samples throughout the volcanic field, McIntosh and Ferguson (1998) concluded that there is no significant age difference between the Canyon Lake, Dogie Spring, and Siphon Draw Members of the Superstition Tuff (Stuckless and Sheridan, 1971) and the Apache Leap Tuff of Peterson (1969). The Apache Leap Tuff was formally defined by D.W. Peterson (1969) and is named for Apache Leap, a prominent west-facing cliff east of Superior. The type section is in Queen Creek Canyon and Oak Flat, also east of Superior. McIntosh and Ferguson (1998) and Ferguson and others (in preparation) redefine the Apache Leap Tuff to include all exposures of tuff previously referred to as Superstition Tuff and its subdivisions; Canyon Lake, Dogie Spring, and Siphon Draw members (Stuckless and Sheridan, 1971), San Tan Tuff (Balla,1972), tuff of Goat Mountain (Suneson, 1976), tuff of Comet Peak (Ferguson and Skotnicki, 1995), and welded tuff in the Santan Mountains (Ferguson and Skotnicki, 1996). Apart from precedence, the name Apache Leap Tuff was chosen to represent the entire ash-flow tuff sheet because the type section of D.W. Peterson (1969) is rigorously defined, complete, and uninterrupted by faults. The obsolete Superstition Tuff (Stuckless and Sheridan, 1971) has been abandoned because none of its type sections are complete, and the supposedly different phenocryst modes that help differentiate each of its members as defined by Stuckless and Sheridan (1971) are not reproducible (Ferguson and Gilbert, 1997).

rhyodacite of Buzzards Roost [RENAMED] unit of Buzzards Roost A plagioclase, sanidine, biotite-bearing lava in the Whitlow Canyon – Randolf Canyon area which overlies Whitlow Canyon Formation. The unit has no known age relationship with the Apache Leap Tuff, and two dates of approximately 18.6 Ma indicate that it could be either older or younger. In Figure 2 it is referred to as a unit, but in the text it is referred to as rhyodacite. Since no chemical analysis has been done on this rock, the moniker "unit of…" is preferred.

Whitlow Canyon Formation [RETAINED] Whitlow Canyon Formation – Superstition Group The name of this formation appeared first in this publication. Five age dates are reported with an age range of between 18.75 Ma and 18.53 Ma.

Tule Canyon Formation [RETAINED] Tule Canyon Formation – Superstition Group The name of this formation appeared first in this publication. Twenty dates are reported ranging between approximately 19.0 and 18.6 Ma.

Government Well Formation [RETAINED] Government Well Formation – Superstition Group The name

of this formation appeared first in this publication. No dates are reported but the age is constrained by dates of older formations at 20.5 Ma and younger formations at 19.0 Ma.

rhyolite of Bulldog Canyon (Trb) [RETAINED] rhyolite of Bulldog Canyon – Whitetail Formation Name for two lava domes and related rocks that intrude and are interbedded with Whitetail Formation conglomerates in the central Goldfield Mountains and dated at 20.5 Ma. Includes subdivisions of nearby tuff, lava, and volcaniclastic conglomerate:

massive tuff (Trbt) [RETAINED] massive tuff – rhyolite of Bulldog Canyon – Whitetail Formation

rhyolite (Tr) [RETAINED] rhyolite – rhyolite of Bulldog Canyon – Whitetail Formation

tuffaceous conglomerate (Tst) [RETAINED] tuffaceous conglomerate – rhyolite of Bulldog Canyon – Whitetail Formation

Whitetail Formation [RETAINED] Whitetail Formation

Melchiorre, E.B., and Clemens, D.M., 1993, Geology of the south-central Goldfield Mountains, Arizona: Arizona Geological Survey Contributed Map CM-93-A, 1 sheet, scale 1:10,000.

First Water Rhyolite AND **First Water rhyolite vitrophyre #2 (Tfv_2 and Tfw_2)** AND **First Water rhyolite vitrophyre #1 (Tfv_1 and Tfw_1)** AND **First Water rhyolite pyroclastic sequences** AND **First Water rhyolite pyroclastic deposits (Tfp) [OBSOLETE] Tule Canyon Formation – Superstition Group** Same as rhyolite of First Water Canyon (Sheridan and Prowell, 1986) and all of these units are now considered part of the Tule Canyon Formation. Melchiorre and Clemens (1993) used these terms in the area north of Bulldog Canyon and west of Cottonwood Spring in the Goldfield Mountains, including area referred to by Kilbey (1986) and further north to about 1.5 miles north of Cottonwood Spring.

Apache Gap rhyodacite AND **rhyodacites of Apache Gap (Tag) [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group** Same as rhyodacite of Apache Gap. Melchiorre and Clemens (1993) showed outcrops in the Cottonwood Spring area that agree with Kilbey (1986).

Government Well Latite [RENAMED] upper Government Well Formation – Superstition Group Melchiorre and Clemens (1993) used Government Well latite for area west, southwest, and south of Cottonwood Spring in the Goldfield Mountains which overlapped the Kilbey (1986) area, and described 7 sub-units which did not correspond to those of Hillier (1978), nor to those of Kilbey (1986). The seven units are listed below. Some or all of the units may represent viable subdivisions of the upper Government Well Formation.

gray latite, unit 'b' (Tglb) [RETAINED] gray latite, unit 'b' – upper Government Well Formation – Superstition Group

gray latite, unit 'a' (Tgla) [RETAINED] gray latite, unit 'a' – upper Government Well Formation – Superstition Group

green latite (Tgr) [RETAINED] green latite – upper Government Well Formation – Superstition Group

latite with xenoliths (Tlx) [RETAINED] latite with xenoliths – upper Government Well Formation – Superstition Group

red latite (Trl) [RETAINED] red latite – upper Government Well Formation – Superstition Group

latite, pyroclastic (Tlp) [OBSOLETE] upper Government Well Formation – Superstition Group

basal latite (Tbl) [RETAINED] basal latite – upper Government Well Formation – Superstition Group

yellow rhyolite (Tyr) [OBSOLETE] rhyolite of Bulldog Canyon – Whitetail Formation (west) OR **tuff of Saddle Rock** OR **tuff of Blue Ridge – lower Government Well Formation – Superstition Group** (east) To the west this unit represents nonwelded tuff, volcaniclastic conglomerate and rhyolite lava of the rhyolite of Bulldog Canyon, an important unit within the Whitetail Formation that clearly underlies the Government Well Formation. To the east, the unit represents at least two separate sequences of nonwelded tuff and volcaniclastic sedimentary rock interbedded with mafic lava flows of the lower Government Well Formation. The tuffs in the Government Well Formation were given names by Kilbey (1986), but were mapped as undifferentiated nonwelded tuff by Skotnicki and Ferguson (1996).

undifferentiated basalt flows (Tub) [RENAMED] lower Government Well Formation – Superstition

Group Part of the lower Government Well Formation in the Goldfield Mountains.

Whitetail Conglomerate (Twt) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Nelson, E. W., 1966, The geology of Picketpost Mountain, Pinal County, Arizona: unpublished M.S. thesis, Tucson, University of Arizona, 123 pp., 2 plates 1:6,000 scale.

Gila Conglomerate (TQg) [REDEFINED] conglomerate – Gila Group The Gila Group includes all volcanic and sedimentary rocks younger than the Apache Leap Tuff.

Olivine basalt (TQb) [RETAINED] olivine basalt – Gila Group A viable subdivision of the Gila Group in this area.

Tower Tuff (Ttt) [RENAMED] tuff of The Tower– Picketpost Mountain Formation – Gila Group A diatreme-like intrusive tuff breccia related to emplacement of the Heliograph Member of the Picketpost Mountain Formation. Note that the name "The Tower" is not a formal place name.

Heliograph Formation (Th) [RENAMED] Heliograph Member – Picketpost Mountain Formation – Gila Group A crystal-rich quartz latite or dacite lava that forms the main mass of Picketpost Mountain. The member includes a vent breccia (**br**). Note that the name "Heliograph" is not a formal place name.

Tuff III (TtIII) [RETAINED] tuff III – Picketpost Mountain Formation – Gila Group A viable subdivision of the Picketpost Mountain Formation in this area. One of three tuff units that occur between the Arnett Rhyolite and Heliograph members of the Picketpost Mountain Formation.

Tuff II (TtII) [RETAINED] tuff II – Picketpost Mountain Formation – Gila Group A viable subdivision of the Picketpost Mountain Formation in this area. One of three tuff units that occur between the Arnett Rhyolite and Heliograph members of the Picketpost Mountain Formation.

Tuffaceous sandstone (Tts) [RETAINED] tuffaceous sandstone – Picketpost Mountain Formation – Gila Group A viable subdivision of the Picketpost Mountain Formation in this area.

Tuff I (TtI) [RETAINED] tuff I – Picketpost Mountain Formation – Gila Group A viable subdivision of the Picketpost Mountain Formation in this area. One of three tuff units that occur between the Arnett Rhyolite and Heliograph members of the Picketpost Mountain Formation.

Arnett Rhyolite (Tar) [RENAMED] Arnett Rhyolite Member – Picketpost Mountain Formation –Gila Group Apparently the same as the Arnett member of the Sleeping Buffalo Rhyolite (Creasey and others, 1983). All of these units are now considered members of the Picketpost Mountain Formation. Nelson (1966) subdivided this unit into 5 zones (A, B, C, D, E) based on flow textures, devitrification, and crystallization features.

Arnett Tuff (Tat) [RENAMED] tuff – Picketpost Mountain Formation – Gila Group Apparently the same as the tuff member of the Sleeping Buffalo Rhyolite (Creasey and others, 1983). All of these units are now considered members of the Picketpost Mountain Formation.

Basalt (Tb) [RETAINED] basalt – Gila Group Several basalt flows are interbedded with Gila Group sedimentary rocks and/or felsic volcanics of the Picketpost Mountain Formation in this area.

Lower dacite tuff (Tdt) [RETAINED] lower dacite tuff – Superstition Group (?) OR **lower dacite tuff – Picketpost Mountain Formation – Gila Group (?)** This crystal-rich (40% phenocryst) tuff overlies crystalline basement and is locally steeply dipping suggesting that it may represent a remnant of a pyroclastic deposit derived from one of the Superstition Group lavas to the north. Its mineralogy is unlike any of the rocks from the nearby Picketpost Mountain Formation felsic eruptive centers, but since there is no Apache Leap Tuff preserved in the area it is difficult to assess its stratigraphic affinity.

Peterson, D.W., 1960, Geology of the Haunted Canyon quadrangle, Arizona: U.S. Geological Survey Geologic Quadrangle Map GQ-128, 1 sheet, scale 1:24,000.

Gila conglomerate (QTg) [REDEFINED] conglomerate – Gila Group The Gila Group includes all volcanic and sedimentary rocks younger than the Apache Leap Tuff.

basalt (Qtb) [RETAINED] basalt – Gila Group A basalt lava interbedded with the Gila conglomerate of this report.

later volcanic rocks *principally dacite* (Td) [OBSOLETE] Apache Leap Tuff Later renamed Apache Leap Tuff (D.W. Peterson, 1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

earlier volcanics (Tev) [RENAMED] Superstition Group Name for undivided volcanics which underlie

Apache Leap Tuff in the vicinity of the Haunted Canyon Cauldron, and therefore considered equivalent to the Superstition Group.

Whitetail conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Peterson, D.W., 1966, The geology of Picketpost Mountain, northeast Pinal County, Arizona: Arizona Geological Society Digest, v. 8, p. 159-176.

quartz latite (ql) [RENAMED] Heliograph Member – Picketpost Mountain Formation – Gila Group Same as the Heliograph Formation (Th) of Nelson (1966) and considered a valid subdivision of the Picketpost Mountain Formation.

tuff (tu) [RETAINED] tuff – Picketpost Mountain Formation – Gila Group A valid subdivision of the volcanics of Picketpost Mountain.

breccia (br) [RENAMED] tuff of The Tower – Picketpost Mountain Formation – Gila Group Same as the intrusive, diatreme-like unit mapped by Nelson as the Tower Tuff (**Ttt**).

rhyolite (rh) [RENAMED] Arnett Rhyolite Member – Picketpost Mountain Formation – Gila Group A valid subdivision of the volcanics of Picketpost Mountain.

basalt (ba) [RETAINED] basalt – Gila Group Same as the basalt (Tb) of Nelson (1966).

Peterson, D.W., 1968, Zoned ash-flow sheet in the region around Superior, Arizona, in Titley, S.R., ed., Southern Arizona Guidebook III: Arizona Geological Society, p. 215-222.

"dacite" [OBSOLETE] Apache Leap Tuff Renamed by Peterson (1969). This work describes in detail the internal zonations and other petrographic features of the Apache Leap Tuff near its type section. These zonations were defined based on degrees of welding and vapor–phase crystallization and they probably do not correspond to the members defined by Skotnicki and Ferguson (1995) in the Superstition Mountains. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Peterson, D.W., 1969, Geologic map of the Superior quadrangle, Pinal County, Arizona: U.S. Geological Survey Geologic Quadrangle Map GQ-818, 1 sheet, scale 1:24,000.

basalt (QTb) [RETAINED] basalt – Gila Group

gravel and conglomerate (QTg) [RETAINED] gravel and conglomerate – Gila Group

volcanic rocks, *lava* (QTvl) [RENAMED] Arnett Rhyolite Member – Picketpost Mountain Formation – Gila Group

volcanic rocks, *tuff* (QTv*t)* [RENAMED] tuff– Picketpost Mountain Formation – Gila Group

Apache Leap Tuff (Tal) [REDEFINED] Apache Leap Tuff This unit was formally defined in this report and is named for Apache Leap, a prominent west-facing cliff east of Superior. The type section is in Queen Creek Canyon and Oak Flat, also east of Superior. The name was used by later workers for the outflow sheet in the southeastern and northeastern part of the volcanic field (e.g. Cornwall and others, 1971; Suneson, 1976; Theodore and others, 1978; Creasey and others, 1983; Keith, 1983; Faulds, 1984; Dickinson, 1995; Richard and others, 1998). As redefined by McIntosh and Ferguson (1998) and Ferguson and others (in preparation), the Apache Leap Tuff includes all exposures of tuff previously referred to as Superstition Tuff and its subdivisions; Canyon Lake, Dogie Spring, and Siphon Draw members (Stuckless and Sheridan, 1971), San Tan Tuff (Balla,1972), tuff of Goat Mountain (Suneson, 1976), tuff of Comet Peak (Ferguson and Skotnicki, 1995), and welded tuff in the Santan Mountains (Ferguson and Skotnicki, 1996). Apart from precedence, the name Apache Leap Tuff was chosen to represent the entire ash-flow tuff sheet because the type section of D.W. Peterson (1969) is rigorously defined, complete, and uninterrupted by faults. The obsolete Superstition Tuff (Stuckless and Sheridan, 1971) has been abandoned because none of its type sections are complete, and the phenocryst modes of each of its members as defined by Stuckless and Sheridan (1971) are not reproducible (Ferguson and Gilbert, 1997).

rhyolite (Tr) [RENAMED] Superstition Group Name for undivided volcanics which underlie Apache Leap Tuff between Apache Leap and Haunted Canyon, and therefore considered equivalent to the Superstition Group.

Whitetail Conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Peterson, D.W., and Jinks, J.E., 1983, Mineral resource potential of the Superstition Wilderness and contiguous roadless areas, Maricopa, Pinal, and Gila Counties, Arizona, with a section on Geochemical interpretations by W.A. Miller and J.M. Motooka and with a section on Geophysical investigations by J.C. Wynn: U.S. Geological Survey Open-File Report 83-0885, 81 p., 3 sheets, scale 1:48,000.

fanglomerate (Qf) [RENAMED] conglomerate – Gila Group A younger Tertiary unit that is probably equivalent to the younger sedimentary rocks (Tsy) of Skotnicki and Ferguson (1996), Ferguson and Gilbert (1997), Gilbert and Ferguson (1997), and Skotnicki and Leighty (1997).

upper tuff (Ttu) [OBSOLETE] unit of Mesquite Flat – Gila Group Obsolete because this unit consists almost entirely of volcaniclastic sedimentary rocks.

upper basalt (Tbu) [RENAMED] basalt of Black Mesa (Superstition Mts.) – Gila Group Same as basalt of Black Mesa (Superstition Mts.).

upper ash-flow tuff (Tafu) [OBSOLETE] Apache Leap Tuff OR **tuff – Coffee Flat Mountain Formation – Gila Group** Same as Apache Leap Tuff at Canyon Lake, but also shown as a sliver near Tortilla Ranch where the unit is a nonwelded tuff in the Coffee Flat Mountain Formation.

middle ash-flow tuff (Tafm) [RENAMED] ash-flow tuff – Coffee Flat Mountain Formation – Gila Group A viable subdivision of the Coffee Flat Mountain Formation within the Superstition Cauldron.

rhyodacite (Trd) [OBSOLETE] Coffee Flat Mountain Formation – Gila Group OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost** Mostly equivalent to the Coffee Flat Mountain Formation within the Superstition Cauldron, but south of Randolf Canyon it is equivalent to both Whitlow Canyon Formation and unit of Buzzards Roost. Contains the following subdivisions:

zeolitized rhyodacite (Trdz) [OBSOLETE] Coffee Flat Mountain Formation – Gila Group OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost**

rhyodacite vents (Trdv) [OBSOLETE] Coffee Flat Mountain Formation – Gila Group OR **Whitlow Canyon Formation – Superstition Group** OR **unit of Buzzards Roost**

middle tuff (Ttm) [RENAMED] tuff – Coffee Flat Mountain Formation – Gila Group A viable subdivision of the Coffee Flat Mountain Formation within the Superstition Cauldron.

upper rhyolite (Tr) [OBSOLETE] unit of Buzzards Roost OR **Coffee Flat Mountain Formation – Gila Group** This unit is mostly equivalent to Coffee Flat Mountain Formation within Superstition Cauldron, but south of Fraser Canyon it is the same as unit of Buzzards Roost. Contains the following subdivisions:

zeolitized rhyolite (Trz) [OBSOLETE] unit of Buzzards Roost OR **Coffee Flat Mountain Formation – Gila Group** Equivalent to Coffee Flat Mountain Formation along Fish Creek Canyon, but to the south of Fraser Canyon this unit is equivalent to the unit of Buzzards Roost

rhyolite vents (Trv) [OBSOLETE] unit of Buzzards Roost OR **Coffee Flat Mountain Formation – Gila Group** Equivalent to Coffee Flat Mountain Formation along Fish Creek Canyon, but to the south of Fraser Canyon this unit is equivalent to the unit of Buzzards Roost.

mixed volcanic rocks (Tmv) [OBSOLETE] upper Government Well Formation – Superstition Group OR **Coffee Flat Mountain Formation – Gila Group** Most of this unit is equivalent to the Government Well Formation, but near the confluence of Randolf and Whitlow canyons, some of the unit is equivalent to the Coffee Flat Mountain Formation, and at the confluence of Red Tanks Canyon and Randolf Canyon most of this unit is cauldron margin breccia correlative in age with the Apache Leap Tuff.

lower ash-flow tuff (Tafl in legend and text but shown as **Taf** on map**) [RENAMED] Apache Leap Tuff** Same as the Apache Leap Tuff. The map shows this unit filling both the Superstition Cauldron, and the Haunted Canyon Cauldron. Peterson and Jinks (1983) declined to use either Apache Leap Tuff or Superstition Tuff as stratigraphic terms in this area and stated disagreement with Stuckless and Sheridan (1971) and Stuckless (1971) over nomenclature.

dacite (Td) [OBSOLETE] upper Government Well Formation – Superstition Group OR **breccia – Apache Leap Tuff** With minor exception, this is the same as the upper Government Well Formation in the western part of the Superstition Mountains. Lenses of **Td** shown within the **Taf** (**Tafl** in legend and text) unit at the west edge of the map area are now interpreted as cauldron margin breccias correlative in age with the Apache Leap Tuff (Skotnicki and Ferguson, 1995).

andesite (Ta) [RETAINED] andesite – lower Government Well Formation – Superstition Group Mafic lavas of the lower Government Well Formation in the southeast part of the volcanic field

lower tuff (Ttl) [OBSOLETE] Superstition Group This unit is probably equivalent to the Tule Canyon

Formation in most areas but may also include nonwelded tuffs of the Government Well Formation, Whitlow Canyon Formation, and unit of Buzzards Roost.

lower basalt (Tbl) [RENAMED] basalt – lower Government Well Formation – Superstition Group Mafic lava in the lower Government Well Formation.

lower rhyolite (Trl) [OBSOLETE] Superstition Group This unit is probably equivalent to Tule Canyon Formation in most areas but it may also include Government Well Formation, Whitlow Canyon Formation, and unit of Buzzards Roost.

Whitetail Conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Peterson, N.P., 1954, Geology of the Globe quadrangle, Arizona: U.S. Geological Survey Geologic Quadrangle Map GQ-41, 1 sheet, scale 1:24,000.

Gila conglomerate (QTg) [REDEFINED] conglomerate – Gila Group The Gila Group includes all volcanic and sedimentary rocks younger than the Apache Leap Tuff.

dacite (Td) [OBSOLETE] Apache Leap Tuff Later named Apache Leap Tuff (D.W. Peterson, 1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Peterson, N.P., 1961, Preliminary geologic map of the Pinal Ranch quadrangle, Arizona: U.S. Geological Survey Mineral Investigations Field Studies Map MF-81, 1 sheet, scale 1:24,000.

Gila conglomerate (QTg) [REDEFINED] conglomerate – Gila Group The Gila Group includes all volcanic and sedimentary rocks younger than the Apache Leap Tuff.

interbedded tuffaceous sandstone (QTgt) [RENAMED] tuffaceous sandstone and tuff – Gila Group Some of this unit consists of nonwelded tuff, which was mapped as Tt by Richard and Spencer (1998) and dated at 16.91 ± 0.05 Ma by McIntosh and Ferguson (1998).

basalt (QTb) [RETAINED] basalt – Gila Group This unit includes a basalt lava interbedded with the Gila conglomerate of N.P. Peterson (1961).

dacite (Td) [OBSOLETE] Apache Leap Tuff Later named Apache Leap Tuff (D.W. Peterson, 1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Peterson, N.P., 1963, Geology of the Pinal Ranch quadrangle, Arizona: U.S. Geological Survey Bulletin 1141-H, 18 p., 1 sheet, scale 1:24,000.

Gila conglomerate (QTg) [REDEFINED] conglomerate – Gila Group The Gila Group includes all volcanic and sedimentary rocks younger than the Apache Leap Tuff.

interbedded tuffaceous sandstone (QTgt) [RENAMED] tuffaceous sandstone and tuff – Gila Group Some of this unit consists of nonwelded tuff, which was mapped as Tt by Richard and Spencer (1998) and dated at 16.91 ± 0.05 Ma by McIntosh and Ferguson (1998).

basalt (QTb) [RETAINED] basalt – Gila Group This unit includes a basalt lava interbedded with the Gila conglomerate of N.P. Peterson (1961).

dacite (Td) [OBSOLETE] Apache Leap Tuff Later named Apache Leap Tuff (D.W. Peterson, 1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Peterson, N.P., Gilbert, C.M., Quick, G.L., Dorr, J.V.N., II, Bejnar, W., and MacKallor, J.A., 1953, Geologic map of a portion of the Inspiration quadrangle, Arizona: U.S. Geological Survey Open-File Report, 2 sheets, scale 1:12,000.

Gila conglomerate (QTg) [REDEFINED] conglomerate – Gila Group The Gila Group includes all volcanic

and sedimentary rocks younger than the Apache Leap Tuff.

basalt (QTb) [RETAINED] basalt – Gila Group This unit includes a basalt lava interbedded with the Gila conglomerate of N.P. Peterson and others (1953)

dacite (Td) [OBSOLETE] Apache Leap Tuff Later named Apache Leap Tuff (D.W. Peterson, 1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Prowell, S.E., 1984, Stratigraphic and structural relations of the north-central Superstition volcanic field: Tempe, Arizona State University, M.S. thesis, 122 p., 1 sheet.

Black Mesa basalt (Tob in legend but shown as **Tbb** on map**) [RENAMED] basalt of Black Mesa (Superstition Mts.) – Gila Group** Prowell (1984) used Black Mesa basalt for outcrop on top of Hackberry Mesa. Same as basalt of Black Mesa (Superstition Mts.).

Black Mesa lahar (Tbl in legend but shown as **Tb** on map**) [RENAMED] conglomerate – Gila Group** Prowell (1984) used Black Mesa lahar for a unit on the west, north, and east slopes of Hackberry Mesa, the same outcrops for which Sheridan (1978) used the name breccia of First Water. The unit is partly equivalent to the coarse-grained volcaniclastic sedimentary rocks ,mapped as Tcv by Ferguson and Gilbert (1997) which underlie Hackberry Mesa. Name abandoned because very little if any of these deposits can be shown to be deposited as lahars.

Mesquite Flat Breccia [RENAMED] unit of Mesquite Flat – Gila Group Prowell (1984) used Mesquite Flat breccia for outcrops in Mesquite Flat basin, and divided unit into upper member and lower member. She showed outcrops north of Canyon Lake and south of Mormon Flat Dam, and did not study area west of Apache Gap. Renamed because the unit is composed mostly of pebbly sandstone and conglomerate. Breccia is a very minor component of the unit.

upper member of the Mesquite Flat Breccia (Tabu) [RENAMED] upper unit of Mesquite Flat – Gila Group Name changed because the unit was never formally defined and because it is composed mostly of pebbly sandstone and conglomerate. The upper member should be referred to as upper unit.

lower member of the Mesquite Flat Breccia (Tabl) [RENAMED] lower unit of Mesquite Flat – Gila Group Name changed because the unit was never formally defined and because it is composed mostly of pebbly sandstone and conglomerate. The lower member should be referred to as lower unit.

Canyon Lake basalt (Tclb) [RENAMED] basalt of Canyon Lake – Gila Group The informal name “basalt of Canyon Lake” seems more appropriate for this unit (Suneson (1976).

Canyon Lake welded tuff (Tclt) [OBSOLETE] Apache Leap Tuff Same as Canyon Lake Member of the Superstition Tuff, later shown to be same as Apache Leap Tuff. Prowell (1984) used Canyon Lake welded tuff and Canyon Lake vitrophyre and did not mention relationship to Superstition Tuff. She assigned the bulk of outcrops around Canyon Lake to Willow Creek rhyolite tuff, Willow Creek rhyolite lavas, and Peters Canyon dome complex, while using Canyon Lake welded tuff and Canyon Lake vitrophyre for a much smaller outcrop area restricted to: a) very small area north of Hwy. 88 on west side of Canyon Lake; b) area around mouth of La Barge Creek on south side of Canyon Lake; and c) a small area along Tortilla Creek on east side of Canyon Lake.

Canyon Lake vitrophyre (Tclv) [OBSOLETE] vitrophyre – Apache Leap Tuff

Peters Canyon dome complex [RENAMED] unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group A large post-cauldron lava dome complex along the northern margin of the Superstition Cauldron which includes Geronimo Head, the type area for Geronimo Head Formation of Stuckless and Sheridan (1971). Recognizing that the lavas at Geronimo Head were younger than the rest of the formation, Prowell (1984) redefined the lavas at Geronimo Head as the Peters Canyon dome complex and divided it into 15 subunits of 5 different lava sequences, all of which are probably valid subdivisions of the Coffee Flat Mountain Formation. The subunits are listed below:

upper dome vitrophyre, Peters Canyon dome complex (Tpuv) [RENAMED] upper dome vitrophyre – unit of Peters Canyon – Coffee Flat Mountain Formation

upper dome pyroclastic deposits, Peters Canyon dome complex (Tpup) [RENAMED] upper

dome pyroclastic deposits – unit of Peters Canyon – Coffee Flat Mountain Formation

Tortilla dome lava, Peters Canyon dome complex (Tptl) [RENAMED] Tortilla dome lava – unit of Peters Canyon – Coffee Flat Mountain Formation

Tortilla dome vitrophyre, Peters Canyon dome complex (Tptv) [RENAMED] Tortilla dome vitrophyre – unit of Peters Canyon – Coffee Flat Mountain Formation

Tortilla dome pumice breccia, Peters Canyon dome complex (Tptp) [RENAMED] Tortilla dome pumice breccia – unit of Peters Canyon – Coffee Flat Mountain Formation

Tortilla dome surge deposits, Peters Canyon dome complex (Tpts) [RENAMED] Tortilla dome surge deposits – unit of Peters Canyon – Coffee Flat Mountain Formation

Geronimo Head dome lava, Peters Canyon dome complex (Tpgl) [RENAMED] Geronimo Head dome lava – unit of Peters Canyon – Coffee Flat Mountain Formation

Geronimo Head dome vitrophyre, Peters Canyon dome complex (Tpgv) [RENAMED] Geronimo Head dome vitrophyre – unit of Peters Canyon – Coffee Flat Mountain Formation

Geronimo Head dome pyroclastic deposits, Peters Canyon dome complex (Tpgp) [RENAMED] Geronimo Head dome pyroclastic deposits – unit of Peters Canyon – Coffee Flat Mountain Formation

Malapais dome lava, Peters Canyon dome complex (Tpml) [RENAMED] Malapais dome lava – unit of Peters Canyon – Coffee Flat Mountain Formation

Malapais dome vitrophyre, Peters Canyon dome complex (Tpmv) [RENAMED] Malapais dome vitrophyre – unit of Peters Canyon – Coffee Flat Mountain Formation

Malapais dome pyroclastic deposits, Peters Canyon dome complex (Tpmp) [RENAMED] Malapais dome pyroclastic deposits – unit of Peters Canyon – Coffee Flat Mountain Formation

lower dome lava, Peters Canyon dome complex (Tpll in legend but shown as **Tppl** on map**) [RENAMED] lower dome lava – unit of Peters Canyon – Coffee Flat Mountain Formation**

lower dome vitrophyre, Peters Canyon dome complex (Tplv in legend but shown as **Tppv** on map**) [RENAMED] lower dome vitrophyre – unit of Peters Canyon – Coffee Flat Mountain Formation**

lower dome pyroclastic deposits, Peters Canyon dome complex (Tplp in legend but shown as **Tppl** on map**) [RENAMED] lower dome pyroclastic deposits – unit of Peters Canyon – Coffee Flat Mountain Formation**

Willow Creek Rhyolites (text) AND **Willow Creek Rhyolite tuff (Twrt)** AND **Willow Creek Rhyolite lavas (Twrl) [OBSOLETE] Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **monolithic avalanche breccia – Gila Group** This unit is the same as Tule Canyon Formation and Whitlow Canyon Formation to the west of Tortilla Flat. To the east of Tortilla Flat it is equivalent to the Whitlow Canyon Formation. The southernmost lava of this unit as mapped by Prowell (1984) near Battleship Mountain has been reinterpreted as a post-cauldron monolithic avalanche breccia unit (Trd of Ferguson and Gilbert, 1997). Originally, these rocks were referred to as Geronimo Head Formation, but after it was recognized that they were older than the lavas at Geronimo Head Prowell (1984) renamed the unit Willow Creek Rhyolites and assigned a type section west of Apache Trail along Willow Creek. Later, the unit was renamed rhyolite of First Water by Sheridan and Prowell (1986).

Apache Gap rhyodacite lava (Tardl) AND **Apache Gap rhyodacite vitrophyre (Tardv)** AND **Apache Gap rhyodacite pyroclastic deposits (Tardp) [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group** Same as rhyodacite of Apache Gap. Prowell (1984) showed outcrop 1 mile east of Apache Gap and subdivided it into three units.

latite lava of Government Wells AND **latite of Government Wells (Tgl) [RENAMED] upper Government Well Formation – Superstition Group** This unit includes the intermediate lavas, lava breccias, tuffs, tuff breccias and volcaniclastic rocks that underlie Tule Canyon Formation and overlie Whitetail Formation.

Siphon Draw welded tuff (Tst) [OBSOLETE] Apache Leap Tuff Prowell (1984) used Siphon Draw welded tuff for outcrops south of Geronimo Head and east of Black Mesa (Superstition Mts.) and stated "the relation... to the Dogie Spring (18 m.y.) and Apache Leap (19 m.y.) (Peterson, 1969) welded tuffs to the east is uncertain". Same as the Siphon Draw Member of the Superstition Tuff and later shown to be same as Apache Leap Tuff.

Ransome, F.L., 1903, Geology of the Globe Copper District, Arizona: U.S. Geological Survey Professional Paper 12, 168 p., 2 sheets, scales 1:62,500, and 1:12,000.

Gila conglomerate [REDEFINED] conglomerate – Gila Group The Gila Group includes all volcanic and sedimentary rocks younger than the Apache Leap Tuff.

Basalt [RETAINED] basalt – Gila Group

Dacite [OBSOLETE] Apache Leap Tuff Later named Apache Leap Tuff (D.W. Peterson, 1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail formation [RETAINED] Whitetail Formation Original name for pre-volcanic sedimentary rocks throughout much of central Arizona.

Ransome, F.L., 1904, Description of the Globe quadrangle, Arizona: U.S. Geological Survey Atlas, Folio 111, 17 pp., 6 maps, scales 1:62,500, and 1:12,000.

Gila conglomerate (Qg) [REDEFINED] conglomerate – Gila Group The Gila Group includes all volcanic and sedimentary rocks younger than the Apache Leap Tuff.

Basalt (Qb) [RETAINED] basalt – Gila Group

Dacite (Td) [OBSOLETE] Apache Leap Tuff Later named Apache Leap Tuff (D.W. Peterson, 1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail formation (Tw) [RETAINED] Whitetail Formation Original name for pre-volcanic sedimentary rocks throughout much of central Arizona.

Ransome, F.L., 1919, The copper deposits of Ray and Miami, Arizona: U.S. Geological Survey Professional Paper 115, 192 pp.

Gila conglomerate (Qgc) [REDEFINED] conglomerate – Gila Group The Gila Group includes all volcanic and sedimentary rocks younger than the Apache Leap Tuff.

Dacite (Td) [OBSOLETE] Apache Leap Tuff Later named Apache Leap Tuff (D.W. Peterson, 1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail conglomerate (Tw) [RENAMED] Whitetail Formation Although originally designated as a formation (Ransome, 1903;1904), Ransome (1919) refers to this unit as a conglomerate in this publication. Although dominated by conglomerate the unit contains many different lithologies including sandstone, siltstone, mudstone, limestone, gypsum, coarse-grained avalanche breccia, and minor volcanics. Therefore, the name Whitetail Formation is preferred. At the southern edge of the volcanic field the Whitetail Formation and San Manuel Formation are probably equivalent.

Ransome, F.L., 1923, Description of the Ray quadrangle, Ray, Arizona: U.S. Geological Survey Atlas, Folio 217, 24 pp., 4 maps, 1:62,500 scale.

Gila conglomerate (Qg AND **Qgt) [REDEFINED] conglomerate – Gila Group** The Gila Group includes all volcanic and sedimentary rocks younger than the Apache Leap Tuff.

Dacite (Td) [OBSOLETE] Apache Leap Tuff Later named Apache Leap Tuff (D.W. Peterson, 1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail conglomerate (Tw) [RENAMED] Whitetail Formation Although originally designated as a formation (Ransome 1903;1904), Ransome (1923) refers to this unit as a conglomerate in this publication. Although dominated by conglomerate the unit contains many different lithologies including sandstone, siltstone, mudstone, limestone, gypsum, coarse-grained avalanche breccia, and minor volcanics. Therefore, the name Whitetail Formation is preferred. At the southern edge of the volcanic field the Whitetail Formation and San Manuel Formation are probably equivalent.

Rettenmaier, K.A., 1984, Provenance and genesis of the Mesquite Flat breccia, Superstition Volcanic Field, Arizona: Tempe, Arizona State University, M.S. thesis, 174 p., 2 sheets.

tuffaceous sandstone (Tts) [RETAINED] tuffaceous sandstone – unit of Mesquite Flat – Gila Group Rettenmaier (1984) apparently did not include this as a subdivision of the upper unit of Mesquite Flat.

Mesquite Flat breccia [RENAMED] unit of Mesquite Flat – Gila Group Rettenmaier (1984) used Mesquite Flat breccia, dividing the unit into upper and lower members for the deposits in the Mesquite Flat basin, and specified source areas of Coronado Mesa and Black Cross Butte (southwest of Apache Lake) and some unidentified source southeast of Mesquite Flat basin. Renamed because the unit is composed mostly of pebbly sandstone and conglomerate. Breccia is a very minor component of the unit. Rettenmaier (1984) divided the unit into upper and lower parts with the upper part containing three members:

upper Mesquite Flat breccia [RENAMED] upper unit of Mesquite Flat – Gila Group Name changed because the unit was never formally defined and because it is composed mostly of pebbly sandstone and conglomerate. Therefore, the upper part should be referred to as upper unit.

member A, upper Mesquite Flat breccia ($Tmbu_A$) [RENAMED] unit A – upper unit of Mesquite Flat – Gila Group A viable subdivision, but since it was never formally defined, it should be referred to as unit A.

member B, upper Mesquite Flat breccia ($Tmbu_B$) [RENAMED] unit B – upper unit of Mesquite Flat – Gila Group A viable subdivision, but since it was never formally defined, it should be referred to as unit B.

member C, upper Mesquite Flat breccia ($Tmbu_h$) [RENAMED] unit C – upper unit of Mesquite Flat – Gila Group A viable subdivision, but since it was never formally defined, it should be referred to as unit C.

lower Mesquite Flat breccia (Tmbl) [RENAMED] lower unit of Mesquite Flat – Gila Group Name changed because the unit was never formally defined and because it is composed mostly of pebbly sandstone and conglomerate. Therefore, the lower part should be referred to as lower unit.

ash-flow tuff A [RETAINED] ash-flow tuff A – unit of Mesquite Flat – Gila Group Tuffaceous bedded rocks at the base of the unit of Mesquite Flat. The same rocks were interpreted as volcaniclastic by Gilbert and Ferguson (1997).

ash-flow tuff B (Tab) [RETAINED] ash-flow tuff B – unit of Mesquite Flat – Gila Group Tuffaceous bedded rocks at the base of the unit of Mesquite Flat. The same rocks were interpreted as volcaniclastic by Gilbert and Ferguson (1997).

ash-flow tuff C (Tac) [RETAINED] ash-flow tuff C – unit of Mesquite Flat – Gila Group Tuffaceous bedded rocks at the base of the unit of Mesquite Flat. The same rocks were interpreted as volcaniclastic by Gilbert and Ferguson (1997).

basalt of Canyon Lake (Tclb) [RETAINED] basalt of Canyon Lake – Gila Group One of three basalt sequences interbedded with post-Apache Leap Tuff conglomerates in the northwestern part of the volcanic field, the others being basalt of Black Mesa (Superstition Mts.) and basalt of Willow Springs. Rettenmaier (1984) used basalt of Canyon Lake in the Mesquite Flat area, and stated that it conformably overlies Canyon Lake welded tuff.

rhyolite of Horse Mesa (Thr) [OBSOLETE] Tule Canyon Formation – Superstition Group This unit correlates with a younger lava flow of the Tule Canyon Formation at Black Cross Butte. The lava is demonstrably separate and distinct from Malone's (1972) Horse Mesa rhyolite lavas based on petrography and mapping by Ferguson and Gilbert (1997), and Gilbert and Ferguson (1997). We recommend abandoning this name altogether to avoid confusion.

Coronado Mesa lava dome (Tcml) [RENAMED] lava – Tule Canyon Formation – Superstition Group

Peters Canyon dome complex [RENAMED] unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group A large post-cauldron lava dome complex along the northern margin of the Superstition Cauldron which includes Geronimo Head, the type area for Geronimo Head Formation of Stuckless and Sheridan (1971). Recognizing that the lavas were younger than the rest of the formation, Prowell (1984) redefined the lavas at Geronimo Head as the Peters Canyon dome complex and divided it into 15 subunits of 5 different lava sequences, all of which are valid subdivisions of the Coffee Flat Mountain Formation. Rettenmaier (1984) divided the unit into lavas or tuffs on his map and did not distinguish the various lava sequences. The unit of Rettenmaier (1984) contains the following subdivisions:

lavas (Tpt) [RENAMED] lava – unit of Peters Canyon – Coffee Flat Mountain Formation

tuffs (Tpl) [RENAMED] tuff – unit of Peters Canyon – Coffee Flat Mountain Formation

Canyon Lake Member of the Superstition Tuff (Tsc) [OBSOLETE] Apache Leap Tuff Rettenmaier used Canyon Lake Member of the Superstition Tuff as a map unit, but also refers to this unit as the Canyon Lake welded tuff frequently in his text. This unit was originally thought to be a younger division of the

Superstition Tuff, but later it was shown, based on detailed mapping (Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998), to be the northern outflow sheet of the Apache Leap Tuff.

basalt of Willow Springs (Twsb) [RETAINED] basalt of Willow Springs – Gila Group One of three basalt sequences interbedded with post-Apache Leap Tuff conglomerates in the northwestern part of the volcanic field, the others being basalt of Canyon Lake and basalt of Black Mesa (Superstition Mts.).

Willow Springs breccia [RENAMED] unit of Willow Springs – Gila Group Volcaniclastic sandstone and conglomerate preserved in a north-striking half-graben northeast of the Superstition Cauldron. The deposits overlie Apache Leap Tuff, are overlain by the basalt of Willow Springs, and are equivalent in age to the unit of Mesquite Flat. Name changed because breccia is a very rare or nonexistent component, and because the unit was never formally defined. Rettenmaier (1984) subdivided the unit as follows:

upper Willow Springs breccia (Twbu) [RENAMED] upper unit of Willow Springs – Gila Group Conceptually this is probably a valid subdivision, but there are many ways to subdivide this complex unit.

lower Willow Springs breccia (Twbl) [RENAMED] lower unit of Willow Springs – Gila Group Conceptually this is probably a valid subdivision, but there are many ways to subdivide this complex unit.

Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Whitlow Canyon Formation – Superstition Group** Original name for practically all silicic lavas of the northwestern Superstition volcanic field, including all of the Tule Canyon Formation, the Whitlow Canyon Formation near the town of Tortilla Flat, and much of the Coffee Flat Mountain Formation. Rettenmaier (1984) followed the recommendation of Prowell (1984), that the lavas at Geronimo Head were younger than the lavas around Canyon Lake, and mapped the rocks at Geronimo Head as part of the Peters Canyon dome complex. However, Rettenmaier (1984) continued to use the name Geronimo Head Formation for lavas around Canyon Lake despite the recommendation by Prowell (1984) that these lavas be renamed the Willow Creek Rhyolites. The Geronimo Head Formation of Rettenmaier (1984) includes the following subdivisions:

tuffs (Tght) [OBSOLETE] tuff – Tule Canyon Formation – Superstition Group OR **tuff – Whitlow Canyon Formation – Superstition Group**

lavas (Tghl) [OBSOLETE] lava – Tule Canyon Formation – Superstition Group OR **lava – Whitlow Canyon Formation – Superstition Group**

vitrophyre (Tghv) [OBSOLETE] vitrophyre – Tule Canyon Formation – Superstition Group OR **vitrophyre – Whitlow Canyon Formation – Superstition Group**

rhyodacite of Apache Gap (Tard) [RETAINED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group Originally defined by Suneson (1976), this is a relatively felsic-appearing suite of lava flows that occur at the top of the upper Government Well Formation in the northern part of the volcanic field. The lavas are characterized by light color (typically greenish gray) and a vitric or devitrified matrix. Like many of the other lavas of the upper Government Well Formation, these contain 30-50% phenocrysts of plagioclase, biotite, and hornblende. Because this phenocryst assemblage is similar to most of the other lavas in the upper Government Well Formation it is difficult to differentiate the unit consistently using objective criteria and we advise that its use remain informal. Suneson (1976) did not specify a type section, but presumably he intended the type section to be at Apache Gap (33º31’13”N 111º27’21”W) on State Route 88 (the Apache Trail) and it is now stated to be the type section, in agreement with the type section of the Government Well Formation. At the type section, 170 meters of rhyodacite of Apache Gap represents the top of the Government Well Formation.

trachyandesites and dacites of Fish Creek (Tft) [RENAMED] upper Government Well Formation – Superstition Group Although Fish Creek was suggested as a type area for this unit (Malone, 1972) prior to the use of latite of Government Well by Suneson (1976), the name Government Well Formation is preferred because the unit is thicker and more diverse in the area of Government Well and very little of the unit is actually exposed along Fish Creek.

Reynolds, S.J., Florence, F.P., Welty, J.W., Roddy, M.S., Currier, D.A., Anderson, A.V., and Keith, S.B., 1986, Compilation of radiometric age determinations in Arizona: Arizona Bureau of Geology and Mineral Technology Bulletin 197, 258 p., 2 sheets, scale 1:1,000,000.

Apache Leap Tuff [REDEFINED] Apache Leap Tuff The two dates reported for this unit are from the type

section east of Superior. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Coffee Flat Mountain Formation – Gila Group** The heading "Geronimo Head Formation" in Reynolds and others (1986) includes 5 entries, listed below by age as reported in Reynolds and others (1986). Note that we consider some of these ages to be erroneous.

16.50 Ma rhyolite dike [RENAMED] crystal-poor rhyolite – Tule Canyon Formation – Superstition Group

16.60 Ma quartz latite [RENAMED] Coffee Flat Mountain Formation – Gila Group Fission track zircon analysis of sample AP 200 (Stuckless and Sheridan, 1971).

16.60 Ma quartz latite [RENAMED] Coffee Flat Mountain Formation – Gila Group Fission track sphene analysis of sample AP 200 (Stuckless and Sheridan, 1971).

16.68 Ma rhyolite tuff [RENAMED] tuff – Coffee Flat Mountain Formation – Gila Group

18.85 Ma quartz latite tuff [RENAMED] Apache Leap Tuff This sample was erroneously assigned to the Geronimo Head Formation by Reynolds and others (1986). Stuckless and Sheridan (1971) referred to this unit as the Dogie Spring Member of the Superstition Tuff, which is now considered to be intracauldron Apache Leap Tuff.

Hackberry Mesa basalt [OBSOLETE] basalt of Black Mesa (Superstition Mts.) – Gila Group Reynolds and others (1986) used Hackberry Mesa basalt for age date from Scarborough (1981b). Same as basalt of Black Mesa (Superstition Mts.).

Picketpost Mountain dacite [RENAMED] Heliograph Member – Picketpost Mountain Formation – Gila Group The two dates reported from this unit are from the crest of Picketpost Mountain.

Superstition Tuff [OBSOLETE] Apache Leap Tuff The heading "Superstition Tuff" in Reynolds and others (1986) includes 7 entries, listed below by age as reported in Reynolds and others (1986). Note that we consider some of these ages to be erroneous.

15.40 Ma ash-flow tuff [RENAMED] Apache Leap Tuff This is a fission track zircon analysis of sample AP234 that was called Canyon Lake Member of the Superstition Tuff by Stuckless and Sheridan (1971).

15.90 Ma ash-flow tuff [RENAMED] Apache Leap Tuff This is a fission track sphene analysis of sample AP234 that was called Canyon Lake Member of the Superstition Tuff by Stuckless and Sheridan (1971).

24.10 Ma tuff [RENAMED] Apache Leap Tuff This is a fission track sphene analysis of sample AP232 that was called Siphon Draw Member of the Superstition Tuff by Stuckless and Sheridan (1971).

25.00 Ma tuff [RENAMED] Apache Leap Tuff This is a fission track zircon analysis of sample AP232 that was called Siphon Draw Member of the Superstition Tuff by Stuckless and Sheridan (1971).

25.30 Ma tuff [RENAMED] Apache Leap Tuff This is a fission track zircon analysis of sample AP236 that was called Siphon Draw Member of the Superstition Tuff by Stuckless and Sheridan (1971).

25.60 Ma tuff [RENAMED] Apache Leap Tuff This is a fission track apatite analysis of sample AP232 that was called Siphon Draw Member of the Superstition Tuff by Stuckless and Sheridan (1971).

26.20 Ma tuff [RENAMED] Apache Leap Tuff This is a fission track sphene analysis of sample AP236 that was called Siphon Draw Member of the Superstition Tuff by Stuckless and Sheridan (1971).

Superstition volcanics [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Gila Group** This was a loosely defined name used to describe volcanic rocks of the Superstition volcanic field. It was never intended as a stratigraphic name and it is abandoned in order to avoid confusion with the name Superstition Group. Thirteen age dates are listed under the heading "Superstition volcanics". The samples are listed below by age as reported in Reynolds and others (1986). Note that we consider some of these ages to be erroneous.

15.43 Ma rhyolite tuff [RENAMED] tuff – Tule Canyon Formation – Superstition Group

15.53 Ma basaltic andesite [RENAMED] basalt – Gila Group An isolated exposure surrounded by

younger basin-fill deposits mapped as Tb by Skotnicki and Leighty (1997).

17.46 Ma rhyolite [RENAMED] lava – Tule Canyon Formation – Superstition Group

18.15 Ma basalt [RETAINED] basalt – lower Government Well Formation – Superstition Group Basalt lava that underlies breccia and pyroclastic rocks tentatively interpreted as Superstition Group. Mapped as Tbl by Skotnicki and Leighty (1997).

18.26 Ma basalt [RENAMED] basalt of Willow Springs – Gila Group

18.31 Ma basalt [RETAINED] basalt – lower Government Well Formation – Superstition Group Basalt lava along the north shore of Saguaro Lake that underlies nonwelded tuff of the Tule Canyon Formation. Mapped as Tbl by Skotnicki and Leighty (1997).

19.24 Ma rhyolite [RENAMED] lava – Tule Canyon Formation – Superstition Group

20.60 Ma dacite [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group

21.40 Ma andesite [RETAINED] andesite – lower Government Well Formation – Superstition Group

21.85 Ma quartz latite [RENAMED] unit of Pass Mountain This sample is mislocated based on the coordinates given in Reynolds and others (1986).

22.60 Ma basalt [RENAMED] basalt of Canyon Lake – Gila Group

23.13 Ma welded tuff [RENAMED] Apache Leap Tuff Mapped as Superstition Tuff by many authors, this sample is from the intracauldron facies of the Apache Leap Tuff.

29.90 Ma dacite [RENAMED] crystal-rich dacite – upper Government Well Formation – Superstition Group This unit was originally interpreted as the western outflow sheet of the Apache Leap Tuff by Stuckless and Sheridan (1971).

Richard, S.M., and Spencer, J.E., 1997, Geologic map of the North Butte area, central Arizona: Arizona Geological Survey Open-File Report 97-04, 18 p., 1 sheet, scale 1:24,000.

basalt lava AND **basalt (Tby) [RENAMED] basalt lava – Gila Group**

sandstone and conglomerate (Tsy) [RETAINED] sandstone and conglomerate – Gila Group

conglomerate (Tc) [RETAINED] conglomerate – Gila Group Subdivided into two units:

- **rhyolite clast conglomerate** AND **conglomerate, rhyolite-lithic facies (Tcur) [RENAMED] rhyolite clast conglomerate – conglomerate – Gila Group**
- **conglomerate, volcanic lithic facies (Tcv) [RENAMED] volcanic lithic facies – conglomerate – Gila Group**

basalt of Donnelly Wash (Tbd) [RETAINED] basalt of Donnelly Wash – Gila Group

tuff, undivided (Tt) [RETAINED] tuff, undivided – Picketpost Mountain Formation – Gila Group A map unit that locally includes up to 8 subdivisions (ordered according to map legend):

- **felsite-lithic tuff, undivided** (map) AND **felsite-lithic tuff** (text) **(Ttf) [RENAMED] felsite-lithic tuff, undivided – Picketpost Mountain Formation – Gila Group**
- **tuff and tuffaceous sediments, undivided (Tts) [RETAINED] tuff and tuffaceous sediments, undivided – Picketpost Mountain Formation – Gila Group**
- **tuffaceous sediments, upper** (map) AND **upper tuff and tuffaceous sediment** (text) **(Tts_2) [RENAMED] tuffaceous sediments, upper – Picketpost Mountain Formation – Gila Group**
- **felsite-lithic tuff, upper** (map) AND **upper felsite-lithic tuff** (text) **(Ttf_2) [RENAMED] felsite-lithic tuff, upper – Picketpost Mountain Formation – Gila Group**
- **Pinal Schist-clast tuff (Ttp) [RETAINED] Pinal Schist-clast tuff – Picketpost Mountain Formation – Gila Group**
- **biotite crystal tuff** (map) AND **biotite-rich crystal tuff** (text) **(Ttl) [RENAMED] biotite crystal tuff – Picketpost Mountain Formation – Gila Group**
- **tuffaceous sediments, lower** (map) AND **lower tuff and tuffaceous sediments** (text) **(Tts_1) [RENAMED] tuffaceous sediments, lower – Picketpost Mountain Formation – Gila Group**
- **felsite-lithic tuff, lower** (map) AND **lower felsite lithic tuff** (text) **(Ttf_1) [RENAMED] felsite-lithic tuff, lower – Picketpost Mountain Formation – Gila Group**

vitrophyre of South Butte (Tvsb) [RETAINED] vitrophyre of South Butte – Picketpost Mountain Formation – Gila Group

volcanogenic breccia of South Butte (Tvx) [RETAINED] volcanogenic breccia of South Butte – Picketpost

Mountain Formation – Gila Group

North Butte rhyolite complex (Trn) [RETAINED] North Butte rhyolite complex – Picketpost Mountain Formation – Gila Group

rock avalanche breccia (Tx) [RETAINED] rock avalanche breccia – Gila Group A unit interleaved with the Picketpost Mountain Formation.

dacite of North Butte (Td) [RETAINED] dacite of North Butte – Picketpost Mountain Formation – Gila Group

tuff of North Butte (map) AND **welded tuff** (Text) **(Ttb) [RETAINED] tuff of North Butte – Tule Canyon Formation – Superstition Group** A rhyolite tuff at North Butte along the Gila River whose age of approximately 19.0 Ma indicates probable derivation from lava domes of the Tule Canyon Formation in the main part of the volcanic field.

Whitetail Conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Richard, S.M., and Spencer, J.E., 1998, Compilation geologic map of the Ray-Superior area, central Arizona: Arizona Geological Survey Open-File Report 98-13, 47 p., 3 sheets, scale 1:24,000.

conglomerate (Tc) [RETAINED] conglomerate – Gila Group Includes 3 subdivisions:

granite clast facies AND **conglomerate, granite clast (Tcl) [RENAMED] granite clast conglomerate – conglomerate – Gila Group**

Paleozoic carbonate clast facies AND **conglomerate, Paleozoic carbonate clast (Tcc) [RENAMED] Paleozoic clast conglomerate – conglomerate – Gila Group**

tuff (Tt) [RETAINED] tuff – conglomerate – Gila Group This is a tuff that is not listed separately in the unit descriptions or on the map explanation, but is shown on the map. The tuff was dated at 16.91 ± 0.05 Ma (McIntosh and Ferguson, 1998).

tuff and volcanic-lithic sandstone (Tbs) [RETAINED] tuff and volcanic-lithic sandstone – Gila Group

basalt, upper unit (Tb) [RETAINED] basalt, upper unit – Gila Group

Picketpost Mountain Volcanics AND **volcanic rocks of Picketpost Mountain [REDEFINED] Picketpost Mountain Formation – Gila Group** Picketpost Mountain was suggested as the place name to accompany an informal name for a large composite silicic lava dome, flow, and intrusive complex west of Superior. The name is based on the names used by Keith (1983) and Richard and Spencer (1998) for the complex. This unit contains 4 subdivisions:

felsic intrusive rocks (Tri) [RETAINED] felsic intrusive rocks – Picketpost Mountain Formation – Gila Group A valid subdivision of the Picketpost Mountain Formation. This unit includes the Sleeping Buffalo and Road Runner rhyolites of Creasey and others (1983)

felsic volcanic rocks (Tr) [RETAINED] felsic volcanic rocks – Picketpost Mountain Formation – Gila Group A valid subdivision of the Picketpost Mountain Formation. This unit includes the Sleeping Buffalo and Road Runner rhyolites of Creasey and others (1983)

Pinal Schist-clast tuff (Tmt) [RETAINED] Pinal Schist-clast tuff – Picketpost Mountain Formation – Gila Group A valid subdivision of the Picketpost Mountain Formation.

tuff of White Canyon (Ttw) [RETAINED] tuff of White Canyon – Picketpost Mountain Formation – Gila Group A valid subdivision of the Picketpost Mountain Formation.

basaltic rocks (Tbo) [RETAINED] basaltic rocks – Gila Group

gravel of Walnut Canyon (Tgw) [RETAINED] gravel of Walnut Canyon – Gila Group Contains 2 subdivisions:

sedimentary breccia (Tgx(t)) [RETAINED] sedimentary breccia – gravel of Walnut Canyon – Gila Group This breccia contains clasts of Apache Leap Tuff.

sedimentary breccia, granite clast (Tgx(g)) [RETAINED] sedimentary breccia, granite clast – gravel of Walnut Canyon – Gila Group This breccia contains clasts of Proterozoic and Tertiary granitoids.

Apache Leap Tuff (Tal) [REDEFINED] Apache Leap Tuff The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail Formation, undivided (Tw) [RETAINED] Whitetail Formation Original name for pre-volcanic sedimentary rocks throughout much of central Arizona. Although dominated by conglomerate the unit

contains many different lithologies including sandstone, siltstone, mudstone, limestone, gypsum, coarse-grained avalanche breccia, and minor volcanics. This unit contains 4 subdivisions:

conglomerate, carbonate clast (Twc) [RETAINED] conglomerate, carbonate clast – Whitetail Formation

conglomerate, Pinal Schist-clast (Twp) [RETAINED] conglomerate, Pinal Schist-clast – Whitetail Formation

gypsum and mudstone (Twe) [RETAINED] gypsum and mudstone – Whitetail Formation

fine-grained member (Tws) [RENAMED] fine-grained unit – Whitetail Formation This unit is renamed because it is not formally defined.

Scarborough, R.B., 1981a, Reconnaissance geology, Salt River – from Roosevelt Dam to Granite Reef Dam, central Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report 81-30, 86 p., 9 sheets, scale 1:24,000.

fanglomerate of Mesquite Flat (text) **[RENAMED] unit of Mesquite Flat – Gila Group** Renamed because the unit is composed mostly of pebbly sandstone and conglomerate; breccia is a very minor component of the unit. Fanglomerate is a term that implies a specific depositional environment that may not apply to the entire sequence.

upper rhyolite dacite flows which cap mesas (text) **[RENAMED] lava – Tule Canyon Formation – Superstition Group**

upper yellowish tuffs (text) [RENAMED] tuff – Tule Canyon Formation – Superstition Group

NW-trending rhyolite dikes (text) [RENAMED] intrusive rhyolite - Tule Canyon Formation – Superstition Group

white tuff series (text) **[OBSOLETE] Tule Canyon Formation – Superstition Group** Some of this unit is probably equivalent to older and younger rocks.

andesite flows along north shore of Apache Lake (text) **[RENAMED] lower Government Well Formation – Superstition Group**

series of dacite flows, ignimbrites, and tuffs (text) **[OBSOLETE] upper Government Well Formation – Superstition Group** Some of this unit is probably equivalent to younger rocks in the Tortilla Flat area.

andesite flows, flow breccias, and agglomerates (text) **[RETAINED] andesite flows, flow breccias, and agglomerates - lower Government Well Formation – Superstition Group**

Whitetail Conglomerate [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Geronimo Head Formation (Horse Mesa Dam map) [OBSOLETE] Tule Canyon Formation – Superstition Group

Apache Gap rhyodacite (Horse Mesa Dam map) [RENAMED] rhyodacite of Apache Gap - upper Government Well Formation – Superstition Group This unit is divided into several subdivisions which may be valid subdivisions of the upper Government Well Formation.

Scarborough, R. B., 1981b, Reconnaissance geology, Goldfield and northern Superstition Mountains: Tucson, Arizona Bureau of Geology and Mineral Technology Fieldnotes, v. 11, no. 4, p. 6-10.

basin fill [RENAMED] Gila Group Post-volcanic conglomeratic deposits that overlap the volcanic field in the north or northeast.

fanglomerate of Mesquite Flat [RENAMED] unit of Mesquite Flat – Gila Group Renamed because the unit is composed mostly of pebbly sandstone and conglomerate; breccia is a very minor component of the unit. Fanglomerate is a term that implies a specific depositional environment which may not apply to the entire sequence.

basalt of Hackberry Mesa [OBSOLETE] basalt of Black Mesa (Superstition Mts.) – Gila Group Same as basalt of Black Mesa (Superstition Mts.). Scarborough (1981b) used basalt of Hackberry Mesa for a flat-lying unit on top of Hackberry Mesa, but his map did not extend onto Black Mesa. He gave age on this unit from sample UAKA-80-129.

upper capping rhyodacite flows [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Apache Leap Tuff** Equivalent to Tule Canyon Formation on Horse Mesa and at El Recortado, but also equivalent to Apache Leap Tuff on Goat Mountain.

redbeds and local andesites [RETAINED] redbeds and local andesites – Whitetail Formation OR **redbeds**

and local andesites – Superstition Group This unit includes rocks in the McDowell Mountain area whose affinity with the Superstition volcanic field is uncertain.

interbedded pyroclastics and flows [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Coffee Flat Mountain Formation – Gila Group** Equivalent to all silicic volcanics of the Superstition volcanic field southwest of Canyon Lake including all of the Superstition Group, Apache Leap Tuff, and Coffee Flat Mountain Formation.

pyroclastic ejecta blanket [RENAMED] tuff – Tule Canyon Formation – Superstition Group A pyroclastic subdivision of the Tule Canyon Formation around Horse Mesa.

older dacite tuffs and vitrophyres [OBSOLETE] Superstition Group OR **Apache Leap Tuff** OR **Coffee Flat Mountain Formation – Gila Group** This unit includes parts of the Tule Canyon Formation, Whitlow Canyon Formation, Apache Leap Tuff, and Coffee Flat Mountain Formation.

lower andesites and redbeds [RENAMED] lower Government Well Formation – Superstition Group OR **Whitetail Formation** The volcanic rocks are part of the lower Government Well Formation along Apache Lake, but the redbeds are probably tongues of the Whitetail Formation.

Scarborough, R.B., 1989, Cenozoic erosion and sedimentation in Arizona, in Jenney, J.P., and Reynolds, S.J., eds., Geologic evolution of Arizona: Arizona Geological Society Digest 17, p. 515-537.

"breccia" of Mesquite Flat in the Superstition Mountains [RENAMED] unit of Mesquite Flat – Gila Group Renamed because the unit is composed mostly of pebbly sandstone and conglomerate. Breccia is a very minor component of the unit.

Sedgeley, D.R., 1976, A paleomagnetic study of some welded tuffs in central Arizona: Tempe, Arizona State University, M.S. thesis, 110 p.

Apache Leap Tuff [REDEFINED] Apache Leap Tuff Studied in the Queen Creek area east of Superior.

Canyon Lake Member (Superstition Tuff) **[OBSOLETE] Apache Leap Tuff** This unit was originally thought to be a younger division of the Superstition Tuff but later it was shown, based on detailed mapping (Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998), to be the northern outflow sheet of the Apache Leap Tuff.

Siphon Draw Member (Superstition Tuff) **[OBSOLETE] Apache Leap Tuff** Intracauldron facies of the Apache Leap Tuff in the western Superstition Mountains.

Sell, J.D., 1968, Correlation of some post-Laramide Tertiary units, Globe (Gila County) to Gila Bend (Maricopa County), Arizona, in Titley, S.R., ed., Southern Arizona Guidebook III: Arizona Geological Society, p. 69-74.

dacite (Td) [OBSOLETE] Apache Leap Tuff Later named Apache Leap Tuff (D.W. Peterson, 1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail Conglomerate [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Yellow Peak conglomerate [OBSOLETE] Whitetail Formation Lower part of fanning dip sequence in the Santan Mountains that was equated with Whitetail Formation by Sell (1968).

Olberg beds [RENAMED] Whitetail Formation Brownish sedimentary rocks in the Santan Mountains, now considered part of the Whitetail Formation.

Blue Basalt [RENAMED] basalt – Whitetail Formation Basalt lava interbedded with conglomeratic fanning dip sequence below Apache Leap Tuff in the Santan Mountains. Never intended as a formal name, and now considered part of the Whitetail Formation.

Rock Peak conglomerate [OBSOLETE] Whitetail Formation The younger part of the fanning dip sequence preserved below the Apache Leap Tuff in the Santan Mountains. Described as volcaniclastic in origin by Sell (1968) and Blucher, A.G., Jr. (Private Report 1958, according to Sell (1968)), but reinterpreted as nonvolcaniclastic by Ferguson and Skotnicki (1996) and therefore considered part of the Whitetail Formation.

Shafiqullah, M., Damon, P.E., Lynch, D.J., Reynolds, S.J., Rehrig, W.A., and Raymond, R.H., 1980, K-Ar geochronology and geologic history of southwestern Arizona and adjacent areas, in Jenney, J.P., and Stone, Claudia, eds., Studies in western Arizona: Arizona Geological Society Digest, v. 12, p. 201-260.

Shafiqullah, M., and others, 1980 (continued)

This report includes age dates for several rocks in the Superstition volcanic field, all of which are duplicated in Reynolds and others (1986). Please consult Reynolds and others (1986) and our review of it for information.

Sheridan, M.F., 1978, The Superstition cauldron complex, in Burt, D.M., and Péwé, T.L., eds., Guidebook to the geology of central Arizona; 74th Cordilleran Section Meeting, Geological Society of America, Arizona State University, Tempe, Arizona: Arizona Bureau of Geology and Mineral Technology Special Paper No. 2, p. 85-96.

basalt of Willow Springs (B3) [RETAINED] basalt of Willow Springs – Gila Group One of three basalt sequences interbedded with post-Apache Leap Tuff conglomerates in the northwestern part of the volcanic field, the others being basalt of Canyon Lake and basalt of Black Mesa (Superstition Mts.). Sheridan (1978) used basalt of Willow Springs and did not include unit in Geronimo Head Formation. His map area included two of the five small outcrops west and northwest of Apache Gap.

breccia of Mesquite Flat (BRm) [RENAMED] unit of Mesquite Flat – Gila Group Renamed because the unit is composed mostly of pebbly sandstone and conglomerate. Breccia is a very minor component of the unit. Sheridan (1978) used breccia of Mesquite Flat and did not include it as part of Geronimo Head Formation. His outcrops agreed with those of Suneson (1976), and he included the outcrops in Willow Springs Basin and extended main outcrop east and southeast to Fish Creek crossing of Apache Trail. Sheridan (1978) used breccia of Mesquite Flat, as opposed to Willow Springs breccia of Rettenmaier (1984), for the same outcrops in the Willow Springs basin that Suneson (1976) named epiclastic breccia of Mesquite Flat.

rhyolite of Horse Mesa (RH) [OBSOLETE] Tule Canyon Formation – Superstition Group This term is abandoned because it has been applied to several different flows of demonstrably different composition in and around the Horse Mesa area in the northeastern part of the volcanic field.

basalt of Canyon Lake (B2) [RETAINED] basalt of Canyon Lake – Gila Group One of three basalt sequences interbedded with post-Apache Leap Tuff conglomerates in the northwestern part of the volcanic field, the others being basalt of Black Mesa (Superstition Mts.) and basalt of Willow Springs. Sheridan (1978) used basalt of Canyon Lake, showed same outcrops as Stuckless (1969) except he was a little unclear about the status of outcrops on north shore of Canyon Lake, and did not include this unit with Geronimo Head Formation.

Canyon Lake member, Superstition Tuff (Sc) [OBSOLETE] Apache Leap Tuff Sheridan (1978), showed outcrops of Canyon Lake Member of Superstition Tuff around Canyon Lake, and correlated this unit with tuff of Goat Mountain. This unit was originally thought to be a younger division of the Superstition Tuff but later it was shown, based on detailed mapping (Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998), to be the northern outflow sheet of the Apache Leap Tuff.

tuffs of Geronimo Head Formation (Gt) [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Original name for practically all silicic lavas of the northwestern Superstition volcanic field, including all of the Tule Canyon Formation, the Whitlow Canyon Formation near the town of Tortilla Flat, and much of the Coffee Flat Mountain Formation. The name was abandoned by Prowell (1984), who recognized that the lavas at Geronimo Head were younger than the lavas around Canyon Lake. Sheridan (1978) showed "tuffs" and "lavas" of Geronimo Head Formation and outcrops west of Apache Trail south of Canyon Lake that agree with Suneson (1976) and extended outcrops east of Apache Trail and south of Canyon Lake to east of Tortilla Flat.

lavas of Geronimo Head Formation (Gl) [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Original name for practically all silicic lavas of the northwestern Superstition volcanic field, including all of the Tule Canyon Formation, the Whitlow Canyon Formation near the town of Tortilla Flat, and much of the Coffee Flat Mountain Formation. The name was abandoned by Prowell (1984), who recognized that the lavas at Geronimo Head were younger than the lavas around Canyon Lake. Sheridan (1978) showed "tuffs" and "lavas" of Geronimo Head Formation and outcrops west of Apache Trail south of Canyon Lake that agree with Suneson (1976) and extended outcrops east of Apache Trail and south of Canyon Lake to east of Tortilla Flat.

basalt of Black Mesa (Bl) [RETAINED] basalt of Black Mesa (Superstition Mts.) – Gila Group Name for at least two prominent basalt lava flows that cap Black Mesa in the northwestern part of the Superstition

Cauldron. The unit is one of three basalt sequences interbedded with post-Apache Leap Tuff conglomerates in the northwestern part of the volcanic field, the others being basalt of Canyon Lake and basalt of Willow Springs. Sheridan (1978) showed outcrops from Black Mesa continuing onto Hackberry Mesa.

breccia of First Water (Bro) [OBSOLETE] volcaniclastic sandstone – Gila Group OR **megabreccia – Apache Leap Tuff** Sheridan (1978) referred to the outcrops on the west, north, and east slopes of Hackberry Mesa as breccia of First Water. These are coarse-grained volcaniclastic sedimentary rocks that underlie Hackberry Mesa and for the most part are equivalent to the volcaniclastic sandstone unit of Skotnicki and Ferguson (1995). Name abandoned to avoid confusion with other units using the same place name such as rhyolite of First Water, and because, in most areas, the rock is not a breccia or pyroclastic as originally interpreted by Sheridan (1978). A small area of this unit correlates with megabreccia within Apache Leap Tuff along the northeast margin of the Superstition Cauldron (directly southwest of Hackberry Mesa) as mapped by Skotnicki and Ferguson (1995).

rhyodacite lavas (RD) [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group

Siphon Draw member, Superstition Tuff (Ss) [OBSOLETE] Apache Leap Tuff Sheridan (1978) used Siphon Draw Member of Superstition Tuff, but area of maps is mainly to northeast of outcrop area.

latite lavas, breccias, and domes (LT) [RENAMED] upper Government Well Formation – Superstition Group

older basalts (Bo) [RENAMED] lower Government Well Formation – Superstition Group

arkosic conglomerate (AK) [RETAINED] arkosic conglomerate – Whitetail Formation

Sheridan, M.F., 1987, Caldera structures along the Apache Trail in the Superstition Mountains, Arizona, in Davis, G.H., and VandenDolder, E.M., eds., Geologic diversity of Arizona and its margins: Excursions to choice areas; Field-trip guidebook, 100th Annual Meeting, The Geological Society of America, Phoenix, Arizona, October 26-29, 1987: Arizona Bureau of Geology and Mineral Technology Special Paper 5, p. 238-243.

Mesquite Flat breccia (Tmb) [RENAMED] unit of Mesquite Flat – Gila Group Sheridan (1987) used Mesquite Flat breccia for rocks in both the Mesquite Flat basin and Willow Springs basin. Renamed because the unit is composed mostly of pebbly sandstone and conglomerate. Breccia is a very minor component of the unit.

Younger basalt lava (Tyb) [RENAMED] basalt, undivided – Gila Group Sheridan (1987) used this term to refer to all of the basalts younger than his Superstition Tuff, and he stated that this unit both underlies and overlies the unit of Mesquite Flat. The unit clearly includes the three main basalt units, basalt of Canyon Lake, basalt of Black Mesa (Superstition Mts.), and basalt of Willow Springs.

Canyon Lake Tuff (Tcl) [OBSOLETE] Apache Leap Tuff Sheridan (1987) used Canyon Lake tuff for both the welded tuff and the vitrophyres of Prowell (1984) and listed Superstition Tuff as a separate unit. In this publication there was no mention of a relationship between Canyon Lake Tuff and Superstition Tuff.

Rhyolite of First Water Canyon (Tfw) [OBSOLETE] Tule Canyon Formation – Superstition Group Sheridan (1987) used rhyolite of First Water Canyon for the outcrops south of Canyon Lake around First Water Creek and extending to the west of Apache Trail (formerly assigned to Geronimo Head Formation).

Rhyodacite of Apache Gap (Tard) [RETAINED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group Sheridan (1987) used both latites of Fish Creek and rhyodacite of Apache Gap as valid terms and showed small maps of areas around Fish Creek with outcrops of both latites of Fish Creek and rhyodacite of Apache Gap.

Bronco Butte Lahar [RENAMED] unit of Bronco Butte – upper Government Well Formation – Superstition Group Same as the dacite lava breccia unit of Gilbert and Ferguson (1997) at Bronco Butte, this is a valid volcaniclastic sedimentary subdivision of the upper Government Well Formation in the Horse Mesa area. Because there is some debate (see Gilbert and Ferguson, 1997) over whether or not the unit was deposited as a lahar or some other type of debris flow, it is suggested that this unit should be referred to as "unit of Bronco Butte". Suneson (1976) apparently designated the area of the outcrop of this unit as latite of Government Well. Sheridan (1987) used Bronco Butte lahar for outcrops on Horse Mesa and Bronco Butte (excluding outcrops on south shore of Apache Lake ?) and said it may be equivalent to other lahar units that underlie the rhyodacite of Apache Gap in other parts of Superstition Mountains area.

Superstition Tuff [OBSOLETE] Apache Leap Tuff Same as the Apache Leap Tuff in the Superstition Mountains. Sheridan (1987) described the Superstition Tuff as a caldera-filling unit and compared it to

Apache Leap Tuff except for age.

Latites of Fish Creek (Tgl) [RENAMED] upper Government Well Formation – Superstition Group Sheridan (1987) used latites of Fish Creek (he says for "western... parts of the Apache Trail" but means eastern parts of the Apache Trail) and wrote that they are in a stratigraphically equivalent position to latites of Government Well (he says for "eastern... parts of the Apache Trail" but means western parts of the Apache Trail).

Latites of Government Well (Tgl) [RENAMED] upper Government Well Formation – Superstition Group The unit is renamed as the upper division of the Government Well Formation, but its definition (Suneson, 1976) has remained unchanged. The unit includes all intermediate lava, lava breccia, tuff, tuff breccia and volcaniclastic rock that underlies the Tule Canyon Formation and overlies the Whitetail Formation. Using this definition, a significant thickness of mafic lava is excluded at the base of the formation and these are assigned to the lower division of the Government Well Formation. The formation can be divided into upper and lower divisions throughout most of the Superstition Mountains, but it may not be possible to continue these subdivisions farther east or south. Sheridan (1987) used latites of Government Well (he says for "eastern... parts of the Apache Trail" but means western parts of the Apache Trail) and said they are in a stratigraphically equivalent position to latites of Fish Creek (he says for "western... parts of the Apache Trail" but means eastern parts of the Apache Trail).

Older basalt (Tob) [RENAMED] lower Government Well Formation – Superstition Group

Whitetail Conglomerate (Twc) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Sheridan, M.F., and Prowell, S.E., 1986, Stratigraphy, structure, and gold mineralization related to calderas in the Superstition Mountains, in Beatty, B., and Wilkinson, P.A.K., eds., Frontiers in geology and ore deposits of Arizona and the Southwest: Arizona Geological Society Digest, v. 16, p. 306-311.

Mesquite Flat breccia (Tmb) [RENAMED] unit of Mesquite Flat – Gila Group Sheridan and Prowell (1986) used the term Mesquite Flat breccia without a map or a discussion of its outcrop area. Renamed because the unit is composed mostly of pebbly sandstone and conglomerate. Breccia is a very minor component of the unit.

Younger basalt lava (Tyb) [RENAMED] basalt, undivided – Gila Group Sheridan (1987) used this term to refer to all of the basalts younger than his Superstition Tuff, and he stated that this unit both underlies and overlies the unit of Mesquite Flat. The unit clearly includes the three main basalt units, basalt of Canyon Lake, basalt of Black Mesa (Superstition Mts.), and basalt of Willow Springs.

Canyon Lake Tuff (Tct) [OBSOLETE] Apache Leap Tuff Sheridan and Prowell (1986) used Canyon Lake tuff for both the welded tuff and the vitrophyres of Prowell (1984) and listed Superstition Tuff as a separate unit. There is no mention of a relationship between Canyon Lake Tuff and Superstition Tuff although it is clearly implied that this unit is younger. Superstition Tuff was described as a caldera-filling unit.

Rhyolite of First Water Canyon (Tfr) [OBSOLETE] Tule Canyon Formation – Superstition Group Same as the Tule Canyon Formation in the northwestern part of the volcanic field. Abandoned because the name is similar to a previously described unit (breccia of First Water) and because there are no continuous sections of the unit preserved along First Water Creek or Willow Creek. Sheridan and Prowell (1986) used the term rhyolite of First Water Canyon for the unit Prowell (1984) referred to as Willow Creek rhyolites.

Geronimo Head Formation [OBSOLETE] unit of Peters Canyon – Coffee Flat Mountain Formation – Gila Group Although the position of this unit in the rock units section of Sheridan and Prowell (1986) implies that the unit is older than the Tule Canyon Formation (their rhyolite of First Water Canyon) it is clear that they considered this a young unit, correlative with other rhyolite lava domes in the Coffee Flat Mountain Formation farther to the southeast.

Rhyodacite of Apache Gap (Tard) [RETAINED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group

Bronco Butte Lahar (Tbl) [RENAMED] unit of Bronco Butte – upper Government Well Formation – Superstition Group Same as the dacite lava breccia unit of Gilbert and Ferguson (1997) at Bronco Butte. A volcaniclastic sedimentary subdivision of the upper Government Well Formation in the Horse Mesa area. Because there is some debate (see Gilbert and Ferguson, 1997) over whether or not the unit was deposited as a lahar or some other type of debris flow, it is suggested that this unit should be referred to as "unit of Bronco Butte". Suneson (1976) apparently designated the area of the outcrop of this unit as latite of

Government Well. Sheridan and Prowell (1986) used Bronco Butte lahar for outcrops on Horse Mesa and Bronco Butte (excluding outcrops on south shore of Apache Lake ?) and said it may be equivalent to other lahar units that underlie the rhyodacite of Apache Gap in other parts of Superstition Mountains area.

Older Rhyolite lava and ashes (Torl AND **Tora) [OBSOLETE] upper Government Well Formation – Superstition Group** This unit is based on Malone's (1972) mapping in the Horse Mesa area which shows a rhyolite within a thick pile of dacitic lava breccia. Gilbert and Ferguson (1997) were unable to find unit in this area.

Superstition Tuff (Tst) [OBSOLETE] Apache Leap Tuff Same as the Apache Leap Tuff in the Superstition Mountains. Sheridan and Prowell (1986) described the Superstition Tuff as a caldera-filling unit and compared it to Apache Leap Tuff except for age.

Latites of Fish Creek (Tfl) [RENAMED] upper Government Well Formation – Superstition Group Same as the upper Government Well Formation. Sheridan and Prowell (1986) used latites of Fish Creek (they say for "western... parts of the Apache Trail" but mean eastern parts of the Apache Trail) and said they are in a stratigraphically equivalent position to latites of Government Well (they say for "eastern... parts of the Apache Trail" but mean western parts of the Apache Trail).

Latites of Government Well [RENAMED] upper Government Well Formation – Superstition Group The original unit, latite of Government Well as defined by Suneson (1976), included only the intermediate lavas of this formation. The formation can be divided into upper and lower divisions throughout most of the Superstition Mountains, but it may not be possible to continue these subdivisions farther east or south. Many viable informal subdivisions have been recognized. Sheridan and Prowell (1986) used latites of Government Well (they say for "eastern... parts of the Apache Trail" but mean western parts of the Apache Trail) and said they are in a stratigraphically equivalent position to latites of Fish Creek (they say for "western... parts of the Apache Trail" but mean eastern parts of the Apache Trail).

Older basalt (tob) [RENAMED] lower Government Well Formation – Superstition Group

Whitetail Conglomerate (Two) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Sheridan, M.F., and Stuckless, J.S., 1969, Volcanics related to the Black Mesa caldera, central Arizona [abs.]: Geological Society of America Abstracts with Programs for 1969, part 3, p. 60-61.

Apache Leap Formation [OBSOLETE] Apache Leap Tuff Sheridan and Stuckless (1969) used Apache Leap formation in the Black Mesa area (Superstition Mts.). This name was abandoned by Stuckless (1971) and Stuckless and Sheridan (1971) and replaced with Superstition Tuff. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Sheridan, M.F., Stuckless, J.S., and Fodor, R.V., 1971, A Tertiary silicic cauldron complex at the northern margin of the Basin and Range Province, central Arizona, U.S.A.: Bulletin of Volcanology, v. 34, p. 649-662.

Superior dacite [OBSOLETE] Apache Leap Tuff Sheridan and others (1971) incorrectly attributed the term Superior dacite to D.W. Peterson (1961) and Ransome (1903), but the term was not used in those reports. Named Apache Leap Tuff by D.W. Peterson (1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Apache Leap Formation [OBSOLETE] Apache Leap Tuff Sheridan and others (1971) incorrectly attributed the term Apache Leap formation to D.W. Peterson (1968) and D.W. Peterson (1969), but the term was not used in either of those reports. This name was abandoned by Stuckless (1971) and Stuckless and Sheridan (1971) and replaced with Superstition Tuff. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

basalt and basanite lavas AND **basanite lavas** AND **basanite lava [RENAMED] basalt – Gila Group**

dacite and rhyolite domes AND **late dacite domes and dikes** AND **late dacite dike [RENAMED] upper Government Well Formation – Superstition Group**

rhyolite tuff, breccia, and lava AND **rhyolite ash-flows and lavas** AND **rhyolite lava [RENAMED] Tule Canyon Formation – Superstition Group**

quartz latite welded tuff [OBSOLETE] Apache Leap Tuff The Apache Leap Tuff is now extended to a

much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

andesite to dacite breccia and lava AND **early dacite domes** AND **early dacite dome [RENAMED] upper Government Well Formation – Superstition Group**

alkali olivine basalt AND **early basalts** AND **early basalt [RENAMED] lower Government Well Formation – Superstition Group**

arkosic conglomerate redbeds [RENAMED] arkosic conglomerate – Whitetail Formation

Skotnicki, S.J., and Ferguson, C.A., 1995, Geologic map of the Goldfield quadrangle and the northern part of the Superstition Mts. SW quadrangle, Maricopa and Pinal Counties, Arizona: Arizona Geological Survey Open-File Report 95-09, 24 p., 2 sheets, scale 1:24,000.

Nepheline basalt (Tbu) [RENAMED] basalt of Black Mesa (Superstition Mts.) – Gila Group

Volcaniclastic sandstone (Tsv) [RETAINED] volcaniclastic sandstone – Gila Group

Lithic tuff (Ttu) [RETAINED] lithic tuff – Gila Group A nonwelded lithic tuff and volcaniclastic sandstone unit mapped in the northwestern interior and along the northwestern margin of the Superstition Cauldron. A date of approximately 18.7 Ma (McIntosh and Ferguson (1998)) from this unit is interpreted as a detrital sanidine age of sanidine crystals derived from the Whitlow Canyon Formation. Note that the tuff overlies the 18.58 ±0.03 Ma Apache Leap Tuff (McIntosh and Ferguson, 1998).

Rhyodacite (Trd) [RENAMED] monolithic avalanche breccia – Gila Group A widespread monolithic breccia with tuff matrix that occurs above intracauldron Apache Leap Tuff in the northwestern part of the Superstition Cauldron. Based on the distinctive phenocryst mineralogy of the clasts, the unit is believed to be derived from Whitlow Canyon Formation outcrops that were exposed along the cauldron margin. This interpretation is supported by an 18.7 Ma date from a lithic tuff directly overlying the breccia at Black Mesa (Superstition Mts.) (McIntosh and Ferguson, 1998), a date that matches the age of the Whitlow Canyon Formation in the area.

Superstition Tuff (or Siphon Draw Tuff) (Ts) [OBSOLETE] Apache Leap Tuff Same as the Apache Leap Tuff in the Superstition Mountains.

Upper Flatiron member of the Superstition Welded Tuff [OBSOLETE] upper Flatiron unit – Apache Leap Tuff An informal intracauldron flow-unit, defined as the flow-unit that forms the upper cliff of the Flatirons.

Lower Flatiron member of the Superstition Welded Tuff [OBSOLETE] lower Flatiron unit – Apache Leap Tuff An inform intracauldron flow-unit, defined as the flow-unit that forms the lower cliff of the Flatirons.

Miners Needle break of the Superstition Welded Tuff (Tsm) [OBSOLETE] unit of Miners Needle – Apache Leap Tuff Informally defined second oldest intracauldron flow-unit. This is a relatively thin unit that crops out through Miners Needle, a prominent landmark of the eastern Superstition Mountains, 1.5 miles northeast of Peralta Spring. Skotnicki and Ferguson (1995) stated that the unit thins in the western part of the Superstition Mountains and is positioned between the Hieroglyphic member and the Peralta member.

Peralta member of the Superstition Welded Tuff (Tsp) [OBSOLETE] unit of Peralta Canyon – Apache Leap Tuff Informal intracauldron flow-unit, defined as the flow unit that forms the major cliff directly below the base of the Flatirons.

Hieroglyphic member of the Superstition Welded Tuff (Tsh) [OBSOLETE] unit of Hieroglyphic Canyon – Apache Leap Tuff Informally defined oldest intracauldron flow-unit.

Comet Peak Welded Tuff (Tcp) [OBSOLETE] Apache Leap Tuff Now considered to be Apache Leap Tuff in the Florence Junction – Queen Valley area. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff and San Tan Tuff.

Comet Peak Tuff, poorly welded interval (Tcpu) [OBSOLETE] poorly welded interval – Apache Leap Tuff A thin interval of poorly welded tuff. Now considered to be Apache Leap Tuff in the Florence Junction – Queen Valley area. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff and San Tan Tuff.

Intrusive rhyolite (Tri) [RETAINED] intrusive rhyolite – Tule Canyon Formation – Superstition Group Isolated dikes of crystal-poor rhyolite correlated with the Tule Canyon Formation.

Intrusive dacite (Tdi) [RETAINED] intrusive dacite – upper Government Well Formation – Superstition

Group A viable subdivision of the upper Government Well Formation in the northwestern part of the volcanic field consisting of dikes, plugs, and other hypabyssal bodies.

Rhyolite (Tr) [RETAINED] rhyolite – Tule Canyon Formation – Superstition Group Based on composition, these isolated outcrops southwest of the Superstition Cauldron are correlated with the Tule Canyon Formation.

Mesobreccia (Tsx) [RETAINED] mesobreccia – Apache Leap Tuff An intracauldron lithic breccia unit.

Megabreccia (Tsxg) [RETAINED] megabreccia – Apache Leap Tuff An intracauldron lithic breccia unit.

Dacite (Tdc) [RETAINED] dacite – upper Government Well Formation – Superstition Group Dacite lava in the upper Government Well Formation.

Sandstone (Tss) [RETAINED] sandstone – Whitetail Formation Nonvolcaniclastic sandstone interbedded with older volcanics of the Government Well Formation. This unit is considered a viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field, even though it is interleaved with a younger formation.

Lower dacite (Tdl) [RENAMED] dacite of San Mateo Castro Ranch – upper Government Well Formation – Superstition Group A distinctive, moderately crystal-rich (<15%), plagioclase, biotite-phyric dacite lava within the lower part of the upper Government Well Formation of the Whitlow Canyon area.

Bedded tuff (Tt) [GENERIC] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** A generic unit of nonwelded tuffs interbedded with dacite lavas southwest of the Superstition Cauldron. The same map unit is used for tuffs associated with Tule Canyon Formation lavas farther west and the Coffee Flat Mountain Formation lavas within the Superstition Cauldron. Unit retained because its original description specified that it was associated with different lava units. It may be possible to divide this unit into nonwelded tuffs associated with each of the felsic lava units in the area.

Basalt (Tb) [RETAINED] basalt – lower Government Well Formation – Superstition Group Lavas that are part of the lower Government Well Formation in the Whitlow Canyon area and Goldfield Mountains.

Conglomerate (Tc) [RETAINED] conglomerate – Whitetail Formation A viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field.

Sandstone (Ts) [RETAINED] sandstone – Whitetail Formation A viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field.

Conglomerate and sandstone, undivided (Tsc) [RETAINED] conglomerate and sandstone, undivided – Whitetail Formation A viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field.

Skotnicki, S.J., and Ferguson, C.A., 1996, Bedrock geologic map of the Apache Junction and Buckhorn quadrangles, Maricopa and Pinal Counties, Arizona: Arizona Geological Survey Open-File Report 96-08, 17 p., 1 sheet, scale 1:24,000.

younger sedimentary deposits AND **younger sedimentary basin-fill deposits (Tsy) [RETAINED] younger sedimentary deposits – Gila Group**

rhyolite ($Tr_{1,2,3}$) [RETAINED] rhyolite – Tule Canyon Formation – Superstition Group A series of crystal-poor rhyolite lava flows at the base of the Tule Canyon Formation in the south-central Goldfield Mountains. The flows were separated because angular unconformities occur between some of the flows indicating that tilting was synvolcanic.

massive lithic tuff (Trdt) [RETAINED] massive lithic tuff – unit of Pass Mountain Crystal-rich massive tuff and tuff breccia associated with the unit of Pass Mountain.

lithic tuff (Trt) [RETAINED] lithic tuff – Tule Canyon Formation – Superstition Group Nonwelded, bedded or massive, crystal-poor rhyolite tuffs interbedded between lava flows, or occurring near vents of the Tule Canyon Formation.

rhyodacite (Trd) [OBSOLETE] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group OR **unit of Pass Mountain** Same as rhyodacite of Apache Gap in the eastern Goldfield Mountains where it underlies the Tule Canyon Formation, but to the west, where this unit overlies nonwelded tuff of the Tule Canyon Formation, it is equivalent to a younger unit; the unit of Pass Mountain, which consists of a crystal-rich dacite or rhyodacite lava and associated nonwelded tuff unit (Trdt) that contains plagioclase, biotite and hornblende phenocrysts.

intrusive dacite (Tdi) [RETAINED] intrusive dacite – upper Government Well Formation – Superstition Group A viable subdivision of the upper Government Well Formation in the northwestern part of the volcanic field consisting of dikes, plugs, and other hypabyssal bodies.

andesite (Ta) [RETAINED] andesite – upper Government Well Formation – Superstition Group Mafic lava interbedded with dacitic lava in the upper Government Well Formation. The unit also occurs as intrusive bodies within the lower Government Well Formation.

andesite/basalt(?) (Tab) [RENAMED] quartz-phyric basaltic andesite – upper Government Well Formation – Superstition Group A distinctive quartz-phyric mafic lava that occurs at the top of the upper Government Well Formation.

dacite (Tdc) [RENAMED] upper Government Well Formation – Superstition Group Same as the upper Government Well Formation.

lithic tuff (Tt) [RETAINED] lithic tuff – lower Government Well Formation – Superstition Group A sequence of three lithic, nonwelded tuffs interbedded with basalt lavas of the lower Government Well Formation in the southeastern Goldfield Mountains. The tuffs correlate with the Saddle Rock and Blue Ridge rhyolite tuff units of Kilbey (1986).

sandstone (Tss) [RETAINED] sandstone – Whitetail Formation Nonvolcaniclastic sandstone interbedded with volcanics of the lower Government Well Formation. This unit is considered a viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field, even though it is interleaved with a younger formation.

basalt (Tb) [RETAINED] basalt – lower Government Well Formation – Superstition Group

rhyolite of Bulldog Canyon (Trb) [RETAINED] rhyolite of Bulldog Canyon – Whitetail Formation Name for a lava dome(s) and related rocks that intrude and are interbedded with conglomerates of the Whitetail Formation in the central Goldfield Mountains and dated at 20.5 Ma (McIntosh and Ferguson, 1998). The following three nearby units are now considered to be subdivisions:

- **tuffaceous conglomerate (Tst) [REDEFINED] tuffaceous conglomerate – rhyolite of Bulldog Canyon – Whitetail Formation** This unit was not originally considered part of the rhyolite of Bulldog Canyon.
- **rhyolite, undifferentiated (Tr) [RETAINED] rhyolite – rhyolite of Bulldog Canyon – Whitetail Formation**
- **massive tuff (Trbt) [RETAINED] massive tuff – rhyolite of Bulldog Canyon – Whitetail Formation**

granite breccia (Tstb) [RETAINED] granite breccia – Whitetail Formation A viable subdivision of the Whitetail Formation in the Goldfield Mountains.

conglomerate (Tc) [RETAINED] conglomerate – Whitetail Formation A viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field.

sandstone (Ts) [RETAINED] sandstone – Whitetail Formation A viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field.

conglomerate and sandstone, undivided (Tsc) [RETAINED] conglomerate and sandstone, undivided – Whitetail Formation A viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field.

Skotnicki, S.J., and Leighty, R.S., 1997, Geologic map of the Stewart Mountain Quadrangle, Maricopa County, Arizona: Arizona Geological Survey Open-File Report 97-12, 19 p., 1 sheet, scale 1:24,000.

younger sedimentary basin-fill deposits (Tsy) [RETAINED] younger sedimentary basin-fill deposits – Gila Group

monolithic breccia (Tsb) [RENAMED] breccia – Gila Group A problematic unit consisting of cobble to boulder-sized clasts of granite and rhyolite. The unit is tentatively assigned to the Gila Group because it includes clasts of Superstition Group volcanic rocks. It is renamed because it is not monolithic.

basalt (Tb) [GENERIC] basalt – lower Government Well Formation – Superstition Group OR **basalt – Gila Group** This unit includes three exposures of basalt lava that may differ in age significantly. Two exposures either directly overlie crystalline basement or thin sequences of Whitetail Formation conglomerate and these are assigned to the lower Government Well Formation of the Superstition Group. The northernmost exposure, dated at 15.53 Ma overlies the younger sedimentary basin-fill unit (Tsy) and is assigned to the Gila Group.

rhyolite (Tr) [RETAINED] rhyolite – Tule Canyon Formation – Superstition Group Subdivision of the Tule Canyon Formation.

intrusive rhyolite (Tri) [RETAINED] intrusive rhyolite – Tule Canyon Formation – Superstition Group Subdivision of the Tule Canyon Formation.

bedded tuff (Tt) [RETAINED] bedded tuff – Tule Canyon Formation – Superstition Group Subdivision of the Tule Canyon Formation.

rhyodacite (Trda) [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group

dacite (Td) [RETAINED] dacite – upper Government Well Formation – Superstition Group

bedded tuff (Tdt) [RETAINED] bedded tuff – upper Government Well Formation – Superstition Group Nonwelded, crystal-rich tuff associated with dacite lavas of the upper Government Well Formation in the northern Goldfield Mountains.

massive tuff (Tt_2) [RETAINED] massive tuff – Superstition Group Nonwelded, massive tuffs exposed only near Blue Point. The tuff might be correlative to either Tule Canyon or Government Well formations.

bedded tuff (Tt_1) [RETAINED] bedded tuff – Superstition Group Nonwelded tuff exposed only near Blue Point. The tuff might be correlative to either Tule Canyon or Government Well formations.

lower basalt (Tbl) [RENAMED] basalt – lower Government Well Formation – Superstition Group Mafic lava in the lower Government Well Formation.

conglomerate (Tc) [RETAINED] conglomerate – Whitetail Formation A viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field.

Spencer, J.E., and Richard, S.M., 1995a, Geologic map of the Picketpost Mountain [Picketpost Mtn.] and the southern part of the Iron Mountain 7 1/2' quadrangles, Pinal County, Arizona: Arizona Geological Survey Open-File Report 95-15, 12 p., 1 sheet, scale 1:24,000.

conglomerate (Tcg) [RETAINED] conglomerate – Gila Group

sandstone (Tss) [RETAINED] sandstone – Gila Group

basalt (Tb) [RETAINED] basalt – Gila Group

volcanogenic breccia (Tvx) [RETAINED] volcanogenic breccia – Picketpost Mountain Formation – Gila Group This unit correlates in part with Nelson's (1966) Tower Tuff.

quartz latite (Tql) [RENAMED] Heliograph Member – Picketpost Mountain Formation – Gila Group This is the same as a unit previously named by Nelson (1966).

perlitic aphyric rhyolite (Tp) [RETAINED] perlitic aphyric rhyolite – Picketpost Mountain Formation – Gila Group Overlies the conglomerate unit (Tcg).

Apache Leap Tuff (Tal) [REDEFINED] Apache Leap Tuff The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

spherulitic rhyolite (Tr) [RETAINED] spherulitic rhyolite – Superstition Group This map unit caps the volcanic sequence in the Millsite Canyon/Hewett Canyon area, but its relationship to Apache Leap Tuff is uncertain. It may correlate with the unit of Buzzards Roost and it is tentatively considered part of the Superstition Group.

tuff (Tt) [GENERIC] tuff Nonwelded tuffs associated mostly with Superstition Group volcanics north of highway 60. South of highway 60 the unit is post Apache Leap Tuff in age. The unit name is retained because the unit was never intended as a stratigraphic unit. It may be possible to divide this unit into nonwelded tuffs associated with each of the felsic lava units in the area.

felsic volcanic rocks, undivided (Tf) [GENERIC] felsic volcanic rocks, undivided North of highway 60 this unit is probably equivalent to the Superstition Group, including rocks of the unit of Buzzards Roost, Whitlow Canyon Formation, Tule Canyon Formation, and possibly Government Well Formation. South of highway 60 the unit consists of post Apache Leap Tuff volcanics. The unit name is retained because it was never intended to have stratigraphic relevance.

crystal poor felsic volcanic rocks (Tfp) [RETAINED] crystal poor felsic volcanic rocks – Superstition Group Probably includes both Whitlow Canyon Formation and Tule Canyon Formation-aged volcanic rocks, and therefore considered as part of the Superstition Group.

andesitic volcanic rocks (Tfa) [RETAINED] andesitic volcanic rocks – lower Government Well Formation – Superstition Group Lavas that are equivalent to parts of the lower Government Well Formation in the

Hewitt Canyon area.

lower basalt (Tbl) [RENAMED] basalt – lower Government Well Formation – Superstition Group Mafic lava in the lower Government Well Formation.

rock avalanche or talus breccia (Tx) [RETAINED] rock avalanche or talus breccia – Whitetail Formation

Whitetail conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Spencer, J.E., and Richard, S.M., 1995b, Bedrock geologic map of the eastern half of the Mesa 30' X 60' quadrangle, east-central Arizona: Arizona Geological Survey Open-File Report 95-18, 1 sheet, scale 1:100,000.

Younger basalt (Tby) [RETAINED] younger basalt – Gila Group

Younger sediments (Tsy) [RENAMED] younger sedimentary rocks – Gila Group

Basalt, upper unit (Tbu) [RENAMED] basalt – Gila Group

Conglomerate (Tcu) [RETAINED] conglomerate – Gila Group

Sandstone (Tsu) [RETAINED] sandstone – Gila Group

Felsic to intermediate volcanic rocks (Tf) [GENERIC] felsic to intermediate volcanic rocks – Superstition Group OR **felsic to intermediate volcanic rocks – Gila Group**

Tuff and bedded pyroclastic deposits (Tt) [GENERIC] tuff and bedded pyroclastic deposits – Superstition Group OR **Apache Leap Tuff** OR **tuff and bedded pyroclastic deposits – Gila Group**

Apache Leap tuff (Tal) [REDEFINED] Apache Leap Tuff The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Tuff of Comet Peak (Ttc) [OBSOLETE] Apache Leap Tuff The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff and San Tan Tuff.

Superstition tuff (Tts) [OBSOLETE] Apache Leap Tuff The Apache Leap Tuff is now extended to a larger outcrop area that also includes all areas of tuff previously mapped as San Tan Tuff and tuff of Comet Peak.

Breccia associated with the Superstition tuff (Txt) [OBSOLETE] breccia – Apache Leap Tuff

Basalt (Tb) [GENERIC] basalt – Superstition Group OR **basalt – Gila Group**

Volcanic lithic sandstones and bedded pyroclastic rocks (Tvs) [RETAINED] volcanic lithic sandstones and bedded pyroclastic rocks – Gila Group

Clastic sedimentary rocks (Ts) [GENERIC] clastic sedimentary rocks – Superstition Group OR **clastic sedimentary rocks – Gila Group**

Volcanic and sedimentary rocks, undivided (Tu) [GENERIC] volcanic and sedimentary rocks, undivided – Superstition Group OR **volcanic and sedimentary rocks, undivided – Gila Group**

Mafic to intermediate volcanic rocks, lower unit (Tml) [OBSOLETE] lower Government Well Formation – Superstition Group (north) OR **Gila Group** (south) This unit includes rocks of the lower Government Well Formation – Superstition Group in the north and rocks of the Gila Group in the south.

Clastic sedimentary rocks, lower unit (Tsl) [RENAMED] clastic sedimentary rocks – Whitetail Formation Inclusion of this unit within the Whitetail Formation makes it unnecessary to refer to it as a lower unit.

Rock avalanche breccia, lower unit (Txl) [RENAMED] rock avalanche breccia – Whitetail Formation Inclusion of this unit within the Whitetail Formation makes it unnecessary to refer to it as a lower unit.

Hypabyssal intrusive rocks (Th) [GENERIC] hypabyssal intrusive rocks – Superstition Group OR **hypabyssal intrusive rocks – Gila Group**

Stuckless, J.S., 1969, The geology of the volcanic sequence associated with the Black Mesa caldera, Arizona: Tempe, Arizona State University, M.S. thesis, 79 p., 2 sheets, scale 1:24,000.

flow-banded rhyolites (Tr) [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Whitlow Canyon Formation – Superstition Group** Same as Tule Canyon Formation in most areas, but along the eastern edge of the Stuckless (1969) map this unit is equivalent to the Whitlow Canyon Formation.

glassy quartz latite (Tq) [OBSOLETE] upper Government Well Formation – Superstition Group OR **Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group**

late stage domes and lavas (text) **[OBSOLETE] upper Government Well Formation – Superstition Group** OR **Tule Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group**

Stuckless (1969) did not include this unit as part of the Geronimo Head Formation. The unit is interpreted as a series of post-cauldron domes, but it includes many lavas of varying composition and age, ranging from pre-cauldron Superstition Group lavas to post-cauldron lavas of the Coffee Flat Mountain Formation. Figuring prominently in Stuckless' (1969) discussion is the "intrusive" lava dome at Apache Gap (p. 42). Ferguson and Gilbert (1997), however, show that the lava at Apache Gap does not intrude the overlying sequence of bedded tuff.

Willow Springs basalt (Tgw) [RENAMED] basalt of Willow Springs – Gila Group Stuckless (1969) named Willow Springs basalt as youngest of three named members of Geronimo Head Formation and stated it was overlain by "lahars". He shows a single small outcrop about 2 miles southwest of Canyon Lake in the Willow Springs Canyon area west of Apache Gap. Renamed basalt of Willow Springs by Stuckless and Sheridan (1971) and Suneson (1976).

Black Mesa basanite (Tgb) [RENAMED] basalt of Black Mesa (Superstition Mts.) – Gila Group Same as basalt of Black Mesa (Superstition Mts.). Stuckless and Sheridan (1971) used "basanite of Black Mesa" and Sheridan (1978) used "basalt of Black Mesa" for this unit. Stuckless (1969) named Black Mesa basanite as a member of Geronimo Head Formation and showed extensive outcrops on top of Black Mesa continuously onto Hackberry Mesa, southwest of Geronimo Head.

Canyon Lake basalt (Tgc) [RENAMED] basalt of Canyon Lake – Gila Group Renamed basalt of Canyon Lake by Suneson (1976). Stuckless (1969) named Canyon Lake basalt as possibly the basal member of Geronimo Head Formation, and showed outcrops: a) east of Canyon Lake along Tortilla Creek; b) along north shore of Canyon Lake; and c) south of Mormon Flat Dam, northwest of Canyon Lake. He placed this unit as older than Willow Springs basalt and Black Mesa basanite.

epiclastic breccias [RENAMED] unit of Mesquite Flat – Gila Group Stuckless (1969) showed the areas later assigned to this unit as undifferentiated Geronimo Head Formation but recognized "epiclastic breccia unit" as integral part of Geronimo Head Formation. Renamed because the unit is composed mostly of pebbly sandstone and conglomerate. Breccia is a very minor component of the unit.

Geronimo Head formation AND **Geronimo Head Formation (Tg) [OBSOLETE] Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Original name for practically all silicic lavas of the northwestern Superstition volcanic field, including all of the Tule Canyon Formation, the Whitlow Canyon Formation near the town of Tortilla Flat, and much of the Coffee Flat Mountain Formation. The name was abandoned by Prowell (1984), who recognized that the lavas at Geronimo Head were younger than the lavas around Canyon Lake. Stuckless (1969) designated Geronimo Head as type locality for Geronimo Head Formation and showed extensive outcrops around Canyon Lake and Geronimo Head. He included three "lenses of mafic lavas" as members: Canyon Lake basalt, Black Mesa basanite, and Willow Springs basalt. He described the rest of the formation as "rhyolite ash-flow and epiclastic breccia unit" (epiclastic breccia of Mesquite Flat of Suneson (1976)). He also stated that the Geronimo Head Formation lies unconformably above the Apache Leap Formation (Superstition Tuff of Stuckless (1971) and Stuckless and Sheridan (1971)).

Apache Leap Formation (Ta) [OBSOLETE] Apache Leap Tuff Stuckless (1969) showed outcrops of Apache Leap formation around Canyon Lake and extensive outcrops south of Geronimo Head and Black Mesa. He incorrectly attributed the name Apache Leap Formation to D.W. Peterson (1968). This name was abandoned by Stuckless (1971) and Stuckless and Sheridan (1971) and replaced with Superstition Tuff. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

older dacite complex (Td) [RENAMED] upper Government Well Formation – Superstition Group Same as the upper Government Well Formation. Stuckless (1969) used the term "older dacite complex" for outcrops: a) between Geronimo Head and Hackberry Mesa; and b) to the west of Hackberry Mesa across Apache Trail and to the south past Goldfield surrounding Precambrian outcrops northeast of Goldfield.

older basalt (Tb) [RENAMED] basalt – lower Government Well Formation – Superstition Group Mafic lavas of the lower Government Well Formation. Stuckless (1969) used the term "older basalt" for the unit referred to as Weekes Wash basalt by Kilbey (1986).

arkosic conglomerate (Tc) [RETAINED] arkosic conglomerate – Whitetail Formation A viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field.

Stuckless, J.S., 1971, The petrology and petrography of the volcanic sequence associated with the Superstition caldera, Superstition Mountains, Arizona: Stanford, Stanford University, Ph.D. dissertation, 113 p., 1 sheet.

epiclastic breccia unit [RENAMED] unit of Mesquite Flat – Gila Group Stuckless (1971) showed the areas later assigned to this unit as undifferentiated Geronimo Head Formation but recognized "epiclastic breccia unit" as integral part of Geronimo Head Formation. Renamed because the unit is composed mostly of pebbly sandstone and conglomerate; breccia is a very minor component of the unit. Fanglomerate is a term that implies a specific depositional environment which may not apply to the entire sequence.

rhyolite conglomerate (Tc) [RETAINED] rhyolite conglomerate – Gila Group

Canyon Lake Member of the Superstition Tuff [OBSOLETE] Apache Leap Tuff Stuckless (1971) named Canyon Lake Member as the youngest of three members of Superstition Tuff, and showed outcrops around Canyon Lake to the south and east. Later shown to be the same age as the rest of the intracauldron Apache Leap Tuff based on detailed mapping (Skotnicki and Ferguson, 1995; Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998).

younger silicic domes and lavas [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group Same as rhyodacite of Apache Gap. Stuckless (1971) incorrectly interpreted this unit to intrude surrounding rhyolitic lavas of the Tule Canyon Formation. Stuckless (1971) did not include this unit as part of Geronimo Head Formation. Stuckless (1971) used the same description for this unit as he used for the "late stage domes and lavas" unit from Stuckless (1969).

quartz latite and rhyolite domes and lavas (map) AND **rhyolite and quartz latite domes and lavas** (stratigraphic column) **(Tydl) [OBSOLETE] Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Most of this unit correlates with the Coffee Flat Mountain Formation – Gila Group, but some also correlates with various older lavas of the Superstition Group.

younger basaltic lavas AND **younger mafic lavas** AND **basalt** (text) **[GENERIC] basalt of Canyon Lake – Gila Group** OR **basalt of Willow Springs – Gila Group** OR **basalt of Black Mesa (Superstition Mts.) – Gila Group** Stuckless (1971) used these terms to refer to the younger basalts in general.

Canyon Lake basalt AND **basalt of Canyon Lake** AND **basalt (Tydl3) [RENAMED] basalt of Canyon Lake – Gila Group** Stuckless (1971) used the terms "Canyon Lake basalt" and "basalt of Canyon Lake" interchangeably. Renamed basalt of Canyon Lake by Suneson (1976). Stuckless (1971) referred Canyon Lake basalt to his "younger mafic lavas", did not include it as part of the Geronimo Head Formation, and placed this unit as younger than Willow Springs basalt and Black Mesa basanite. He also stated that Canyon Lake basalt is underlain by Canyon Lake Member, Superstition Tuff.

Apache Leap Formation [OBSOLETE] Apache Leap Tuff Stuckless (1971) abandoned the term Apache Leap formation in favor of Superstition Tuff for outcrops all over the Goldfield and Superstition Mountains including Apache Leap formation outcrops of Stuckless (1969), apparently due to Apache Leap Tuff usage of Peterson (1969). Stuckless (1969) used the term Apache Leap Formation to refer to the extensive outflow sheet to the southeast of the Superstition Mountains that had been described by Peterson (1969). The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Superstition Tuff AND **Superstition Formation [OBSOLETE] Apache Leap Tuff** Stuckless (1971) abandoned the term Apache Leap formation and adopted Superstition Tuff and divided it into three members (youngest to oldest): Canyon Lake Member, Dogie Spring Member, and Siphon Draw Member. He clearly differentiated the Dogie Spring Member (outcrops are furthest southeast of the three members) from the Apache Leap Tuff. Stuckless (1971) used Superstition Tuff and Superstition Formation interchangeably.

Dogie Spring Member of the Superstition Formation AND **Dogie Spring Member of the Superstition Tuff (Tsd) [OBSOLETE] Apache Leap Tuff** Name for an eastern outlier of Superstition Tuff within the Superstition Cauldron that was originally thought to be younger than Siphon Draw Member and older than Canyon Lake Member. Later shown to be the same age as the rest of the intracauldron Apache Leap Tuff based on detailed mapping (Skotnicki and Ferguson, 1995; Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998). Stuckless (1971) showed outcrops of Dogie Spring Member extending to the southeast of Geronimo Head.

Black Mesa basanite AND **basanite of Black Mesa** AND **basanite (Tydl2) [RENAMED] basalt of Black Mesa (Superstition Mts.) – Gila Group** Same as basalt of Black Mesa (Superstition Mts.). Stuckless and Sheridan (1971) used "basanite of Black Mesa" and Sheridan (1978) used "basalt of Black Mesa" for this

unit. Stuckless (1971) referred Black Mesa basanite to his "younger mafic lavas" and did not include it as part of the Geronimo Head Formation.

quartz latite domes and lavas [OBSOLETE] Superstition Group OR **Gila Group** Since this name appears in the idealized stratigraphic column (Figure 2) but not the map it is impossible to correlate it with other units. Note that this unit is listed separately from "rhyolite and quartz latite domes and lavas" on the stratigraphic column.

Willow Springs basalt AND **basalt of Willow Springs** AND **alkali olivine basalt of Willow Springs** AND **basalt (Tydl1) [RENAMED] basalt of Willow Springs – Gila Group** One of three basalt sequences interbedded with post-Apache Leap Tuff conglomerates in the northwestern part of the volcanic field, the others being basalt of Canyon Lake and basalt of Black Mesa (Superstition Mts.). Stuckless (1971) referred this unit to his "younger mafic lavas" also referred to as "younger basaltic lavas", did not include it as part of the Geronimo Head Formation and designated it as older than Canyon Lake basalt and Black Mesa basanite. Stuckless (1971) used the terms "Willow Springs basalt" and "basalt of Willow Springs" interchangeably. Renamed basalt of Willow Springs by Stuckless and Sheridan (1971) and Suneson (1976).

Geronimo Head Formation (Tgh) [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Original name for practically all silicic lavas of the northwestern Superstition volcanic field, including all of the Tule Canyon Formation, the Whitlow Canyon Formation near the town of Tortilla Flat, and much of the Coffee Flat Mountain Formation. The name was abandoned by Prowell (1984), who recognized that the lavas at Geronimo Head were younger than the lavas around Canyon Lake. Stuckless (1971) stated that the Geronimo Head Formation is interbedded with his Superstition Tuff and removed the Canyon Lake basalt, Black Mesa basanite, and Willow Springs basalt as members.

Siphon Draw Member of the Superstition Formation AND **Siphon Draw Member of the Superstition Tuff (Tss) [OBSOLETE] Apache Leap Tuff** Same as the main portion of the intracauldron Apache Leap Tuff in the southwestern Superstition Mountains. Originally interpreted to be the oldest of three members of the Superstition Tuff, but later shown to be the same as the rest of the Apache Leap Tuff based on detailed mapping (Skotnicki and Ferguson, 1995; Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998).

older dacite complex (Tod) [RENAMED] upper Government Well Formation – Superstition Group Same as the upper Government Well Formation. Stuckless (1971) used the term "older dacite complex" for outcrops: a) between Geronimo Head and Hackberry Mesa; and b) to the west of Hackberry Mesa across Apache Trail and to the south past Goldfield surrounding Precambrian outcrops northeast of Goldfield.

older basalt AND **older basalts (Tb) [RENAMED] basalt – lower Government Well Formation – Superstition Group** Mafic lavas of the lower Government Well Formation. Stuckless (1969) used the term "older basalt" for the unit referred to as Weekes Wash basalt by Kilbey (1986).

arkosic conglomerate (Ta) [RETAINED] arkosic conglomerate – Whitetail Formation A viable subdivision of the Whitetail Formation in the northwestern part of the volcanic field.

Stuckless, J.S., and O'Neil, J.R., 1973, Petrogenesis of the Superstition-Superior volcanic area as inferred from strontium and oxygen isotope studies: Geological Society of America Bulletin, v. 84, no. 6, p. 1987-1997.

glassy rhyolite dome (sample AP-27a) **[RENAMED] rhyolite – Tule Canyon Formation – Superstition Group** This is the rhyolite dike contained within the Geronimo Head Formation of Stuckless and Sheridan (1971).

glassy quartz latite dome (samples AP-213, AP-219) **[?]** *possibly* **Coffee Flat Mountain Formation – Gila Group** No location given for these samples.

glassy rhyolite dike (samples T-111, T-944) **[?]** *possibly* **Tule Canyon Formation – Superstition Group** No location given for these samples.

devitrified quartz latite dome (samples AP-217, AP-212) **[?]** *possibly* **Coffee Flat Mountain Formation – Gila Group** No location given for these samples.

devitrified quartz latite lava (sample AP-200) **[RENAMED] quartz latite lava – Coffee Flat Mountain Formation – Gila Group**

basanite no 1, Black Mesa (samples 8102, 8110, 8146) AND **basanite no. 2, Black Mesa** (samples 8111, 8147) **[RENAMED] lower and upper flow units – basalt of Black Mesa (Superstition Mts.) – Gila Group** Apparently these terms refer to lower and upper lava flows of the basalt of Black Mesa

(Superstition Mts.), but we could not determine which referred to the lower flow and which referred to the upper flow.

ash flow, Geronimo Head Formation (samples AP-215, AP-240) **[OBSOLETE] tuff – Coffee Flat Mountain Formation – Gila Group**

Superstition Tuff, Canyon Lake Member (samples AP-234, AP-235) **[OBSOLETE] Apache Leap Tuff** This unit was originally thought to be a younger division of the Superstition Tuff, but later it was shown, based on detailed mapping (Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998), to be the northern outflow sheet of the Apache Leap Tuff.

Superstition Tuff, Dogie Spring Member (samples AP-207, AP-205, AP-208) **[OBSOLETE] Apache Leap Tuff** Name for an eastern outlier of Apache Leap Tuff within the Superstition Cauldron that was originally thought to be younger than Siphon Draw Member and older than Canyon Lake Member. Later shown to be the same age as the rest of the intracauldron Apache Leap Tuff based on detailed mapping (Skotnicki and Ferguson, 1995; Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998).

Superstition Tuff, Siphon Draw Member (samples AP-236, AP-245, AP-232) **[OBSOLETE] Apache Leap Tuff** Same as the main portion of the intracauldron Apache Leap Tuff in the southwestern Superstition Mountains. Originally interpreted to be the oldest of three members of the Superstition Tuff, but later shown to be the same as the rest of the Apache Leap Tuff based on detailed mapping (Skotnicki and Ferguson, 1995; Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998).

Apache Leap Tuff (samples AP-247, AP-245) **[REDEFINED] Apache Leap Tuff** The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

older dacite complex (sample AP-244) **[RENAMED] upper Government Well Formation – Superstition Group**

older basalt (sample AP-243) **[RENAMED] basalt – lower Government Well Formation – Superstition Group**

Stuckless, J.S., and Sheridan, M.F., 1971, Tertiary volcanic stratigraphy in the Goldfield and Superstition Mountains, Arizona: Geological Society of America Bulletin, v. 82, no. 11, p. 3235-3240.

younger rhyolite gravels [RENAMED] unit of Mesquite Flat – Gila Group

Canyon Lake Member, Superstition Tuff [OBSOLETE] Apache Leap Tuff The youngest of three members of Superstition Tuff, named for outcrops around Canyon Lake. Later it was shown, based on detailed mapping (Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998), to be the northern outflow sheet of the Apache Leap Tuff.

rhyolite and quartz latite lavas, domes, and dikes [RENAMED] Coffee Flat Mountain Formation – Gila Group

basanite lava, Black Mesa AND **basanite** AND **basanite of Black Mesa [RENAMED] basalt of Black Mesa (Superstition Mts.) – Gila Group** Sheridan (1978) used "basalt of Black Mesa" for this unit. Stuckless and Sheridan (1971) referred to basanite of Black Mesa, but did not specifically call it a member of Geronimo Head Formation. They also stated that this unit was dated by Damon (1969 sample PED-14-68) using the K-Ar method at 17.8 ± 3.1 Ma, however the LAT-LONG in Damon (1969) indicated that the material dated was basalt of Willow Springs and this LAT-LONG exactly matches a sample location of basalt of Willow Springs from Stuckless (1969).

Dogie Spring Member, Superstition Tuff [OBSOLETE] Apache Leap Tuff Name for an eastern outlier of Superstition Tuff within the Superstition Cauldron that was originally thought to be younger than Siphon Draw Member and older than Canyon Lake Member. Later shown to be the same age as the rest of the intracauldron Apache Leap Tuff based on detailed mapping (Skotnicki and Ferguson, 1995; Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998).

Geronimo Head Formation [OBSOLETE] Tule Canyon Formation – Superstition Group OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Original name for practically all silicic lavas of the northwestern Superstition volcanic field, including all of the Tule Canyon Formation, the Whitlow Canyon Formation near the town of Tortilla Flat, and much of the Coffee Flat Mountain Formation. The name was abandoned by Prowell (1984), who recognized that the lavas at

Geronimo Head were younger than the lavas around Canyon Lake.

quartz latite dome, Apache Gap [RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group

quartz latite lava, Goldfield Mountains (sample 8073) **[RENAMED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group**

Siphon Draw Member, Superstition Tuff [OBSOLETE] Apache Leap Tuff Same as the main portion of the intracauldron Apache Leap Tuff in the southwestern Superstition Mountains. Originally interpreted to be the oldest of three members of the Superstition Tuff, but later shown to be the same as the rest of the Apache Leap Tuff based on detailed mapping (Skotnicki and Ferguson, 1995; Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998).

older dacite domes [RENAMED] upper Government Well Formation – Superstition Group

arkosic conglomerate (White Tail (sic) **equivalent) [RENAMED] arkosic conglomerate – Whitetail Formation** For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Apache Leap Tuff [REDEFINED] Apache Leap Tuff The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Superstition Tuff (Ts) [OBSOLETE] Apache Leap Tuff Stuckless and Sheridan (1971) abandoned the term Apache Leap formation in favor of Superstition Tuff for outcrops all over the Goldfield and Superstition Mountains including outcrops of Apache Leap formation of Stuckless (1969), apparently due to Apache Leap Tuff usage of D.W. Peterson (1969). They divided the unit into three members: Canyon Lake Member, Dogie Spring Member, and Siphon Draw Member. They clearly differentiated the Dogie Spring Member (outcrops furthest southeast) from the Apache Leap Tuff of D.W. Peterson (1969).

rhyolite ash flows and epiclastic breccias of the Geronimo Head Formation [OBSOLETE] *probably* **Tule Canyon Formation – Superstition Group** This unit is briefly mentioned (p. 3228) and it probably correlates with the Tule Canyon Formation.

basalt of Willow Springs [RETAINED] basalt of Willow Springs – Gila Group One of three basalt sequences interbedded with post-Apache Leap Tuff conglomerates in the northwestern part of the volcanic field, the others being basalt of Canyon Lake and basalt of Black Mesa (Superstition Mts.). Stuckless and Sheridan (1971) stated that sample PED-14-68 of Damon (1969) (K-Ar 17.8 ± 3.1 m.y.) is a date for basanite of Black Mesa. They further stated that there is no age date available for basalt of Willow Springs, but LAT-LONG for PED-14-68 place it *precisely* on one of the five very small outcrops of basalt of Willow Springs, and this LAT-LONG exactly matches a sample location of "Willow Springs basalt" (basalt of Willow Springs) from Stuckless (1969).

Suneson, N.H., 1976, The geology of the northern portion of the Superstition-Superior volcanic field, Arizona: Tempe, Arizona State University, M.S. thesis, 123 p., 2 sheets, scale 1:48,000.

basalt of Willow Springs (T_{bw}) [RETAINED] basalt of Willow Springs – Gila Group One of three basalt sequences interbedded with post-Apache Leap Tuff conglomerates in the northwestern part of the volcanic field, the others being basalt of Canyon Lake and basalt of Black Mesa (Superstition Mts.). Suneson (1976) used basalt of Willow Springs and did not include unit in Geronimo Head Formation. He showed five small outcrops west and northwest of Apache Gap.

younger basalt AND **younger basalts (T_{by}) [RENAMED] basalt – Gila Group** Suneson (1976) uses this name on Plate II (compilation tectonic map) to represent all of the post-cauldron basalts including basalt of Canyon Lake, basalt of Black Mesa (Superstition Mts.), and basalt of Willow Springs.

epiclastic breccia of Mesquite Flat (T_{em}) [RENAMED] unit of Mesquite Flat – Gila Group Original name for the post-cauldron sedimentary rocks in the northern part of the volcanic field. Renamed because the unit is composed mostly of pebbly sandstone and conglomerate; breccia is a very minor component of the unit. Suneson (1976) used epiclastic breccia of Mesquite Flat, did not specify a type locality, and did not include the unit in Geronimo Head Formation. On Plate I he showed 5 outcrops areas: a) 1/2 mile northwest of Mormon Flat Dam on north side of Salt River; b) north and northeast of Mormon Flat Dam; c) south of Mormon Flat Dam; d) Willow Springs basin, west of Apache Gap extending north and south and encompassing the 5 outcrops of basalt of Willow Springs; and e) the largest outcrop is north of Canyon Lake extending east to north of Mesquite Flat (and presumably south of Mesquite Flat). Suneson (1976)

used epiclastic breccia of Mesquite Flat, not included in Geronimo Head Formation, as opposed to Willow Springs breccia of Rettenmaier (1984), for outcrop west of Apache Gap extending north and south and encompassing the 5 small outcrops of basalt of Willow Springs.

rhyolite of Horse Mesa (T_{rh}) [OBSOLETE] Tule Canyon Formation – Superstition Group Younger lava(s) of the Tule Canyon Formation exposed at El Recortado north of Salt River. The lava is demonstrably separate and distinct from Malone's (1972) Horse Mesa rhyolite lavas based on petrography and mapping by Ferguson and Gilbert (1997), and Gilbert and Ferguson (1997). We recommend abandoning this name altogether to avoid confusion. Suneson (1976) used rhyolite of Horse Mesa for outcrops described by Malone (1972) and added: a) outcrops north and northeast of Canyon Lake on north side of Salt River; b) 2 smaller outcrops on south side of Salt River west of Black Cross Butte (southwest of Apache Lake); and c) outcrops 2 miles and 6 miles south of Sahuaro Lake in Goldfield Mountains.

basalt of Canyon Lake (T_{bc}) [RETAINED] basalt of Canyon Lake – Gila Group One of three basalt sequences interbedded with post-Apache Leap Tuff conglomerates in the northwestern part of the volcanic field, the others being basalt of Black Mesa (Superstition Mts.) and basalt of Willow Springs. Suneson (1976) was not clear about whether he considered this unit to be a member of Geronimo Head Formation. He showed outcrops south of Mormon Flat Dam on Plate I.

tuff on Goat Mountain [OBSOLETE] Apache Leap Tuff Outflow sheet of the Apache Leap Tuff north of Apache Lake. Suneson (1976) assigned the outcrop on Goat Mountain (tuff of Goat Mountain according to usage of Suneson and Sheridan (1975)) to Canyon Lake Member of Superstition Tuff, which he also referred to as Canyon Lake welded tuff.

Canyon Lake Member, Superstition Tuff (T_{sc}) AND **Canyon Lake welded tuff [OBSOLETE] Apache Leap Tuff** On Plate I Suneson (1976) shows outcrops of Canyon Lake Member of Superstition Tuff: a) north of Apache Lake Mountain (tuff of Goat Mountain according to usage of Suneson and Sheridan (1975)); b) northwest of Canyon Lake along Salt River; and c) 2 miles south of Sahuaro Lake about 1 mile west of Apache Gap. On Plate II (compilation tectonic map) Suneson (1976) shows additional outcrops on north, east, and south sides of Canyon Lake. Suneson (1976) also used the term Canyon Lake welded tuff for this unit in the text of the report. This unit was originally thought to be a younger division of the Superstition Tuff, but later it was shown, based on detailed mapping (Ferguson and Gilbert, 1997; Gilbert and Ferguson, 1997) and age dating (McIntosh and Ferguson, 1998), to be the northern outflow sheet of the Apache Leap Tuff.

Geronimo Head Formation (T_{gh} AND **T_{gt}** AND **T_{gl}) [OBSOLETE] Tule Canyon Formation – Superstition Group** OR **Whitlow Canyon Formation – Superstition Group** OR **Coffee Flat Mountain Formation – Gila Group** Original name for practically all silicic lavas of the northwestern Superstition volcanic field, including all of the Tule Canyon Formation, the Whitlow Canyon Formation near the town of Tortilla Flat, and much of the Coffee Flat Mountain Formation. The name was abandoned by Prowell (1984), who recognized that the lavas at Geronimo Head were younger than the lavas around Canyon Lake. Suneson (1976) removed epiclastic breccia of Mesquite Flat and basalt of Canyon Lake as members, but retained Geronimo Head Formation for large areas north of Mesquite Flat to Salt River and west of Apache Trail between Canyon Lake and Government Well except Willow Springs basin.

older rhyolite complex [RENAMED] Apache Leap Tuff Same as the Siphon Draw member, Superstition Tuff, which is now recognized as Apache Leap Tuff.

rhyodacite of Apache Gap (T_{ra}) [RETAINED] rhyodacite of Apache Gap – upper Government Well Formation – Superstition Group OR **dacite – upper Government Well Formation – Superstition Group** A relatively felsic-appearing suite of lava flows that occur at the top of the upper Government Well Formation in the northern part of the volcanic field. The lavas are characterized by light color (typically greenish gray) and a vitric or devitrified matrix. Like many other dacitic lavas of the upper Government Well Formation, these lavas contain 30-50% phenocrysts of plagioclase, biotite, and hornblende. The lack of a distinctive phenocryst assemblage when compared to most of the other lavas in the upper Government Well Formation makes it difficult to map the unit consistently and we advise that its use remain informal. Suneson (1976) did not specify a type section, but presumably he intended the type section to be at Apache Gap where in our formally defined type section of the Government Well Formation, the uppermost 170 meters is assigned to the informal unit rhyodacite of Apache Gap. Plate I (study area) of Suneson (1976) shows extensive outcrops: a) north of Canyon Lake mostly surrounding and to the north of El Recortado; b) east of Apache Lake on north side of Salt River; c) at Apache Gap; and d) 1 mile southwest of Apache Gap

on the west side of Apache Trail extending to the west off map area. In addition Plate II (compilation map) shows outcrops: a) 1/2 mile south-southeast of Apache Gap; b) 1/2 mile east of Apache Gap; c) in a narrow band extending 3 mile southwest from 1/4 mile south of Sahuaro Lake; d) in 3 areas approximately 6 miles southwest of Sahuaro Lake; and e) in several outcrop areas surrounding Horse Mesa including Fish Creek Canyon that were assigned to the Fish Creek trachyandesites and dacites by Malone (1972) and the latites of Fish Creek of Sheridan and Prowell (1986) and Sheridan (1987). Many of the exposures mapped by Suneson (1976) north of Salt River do not occur at the top of the upper Government Well Formation, but many other informal lava units in the upper Government Well Formation can also be shown to occur at various stratigraphic levels, and we consider this acceptable usage.

Siphon Draw Member, Superstition Tuff (T_{ss}) [OBSOLETE] Apache Leap Tuff Suneson (1976) referred to Siphon Draw Member of both the Superstition Formation and the Superstition Tuff, but Plate I (study area) included no outcrops. On Plate II (compilation tectonic map) he showed same outcrops as Stuckless and Sheridan (1971) with outcrops terminating northwest of the Superior area.

Superstition Formation AND **Superstition Tuff [OBSOLETE] Apache Leap Tuff** Suneson (1976) used Superstition Formation and Superstition Tuff interchangeably.

latite of Government Well (T_{lg}) [RENAMED] upper Government Well Formation – Superstition Group This unit includes only the intermediate lavas of the Government Well Formation. The formation can be divided into upper and lower divisions throughout most of the Superstition Mountains, but it may not be possible to continue these subdivisions farther east or south. The lower division corresponds to the mafic lavas at the base of the formation. Many viable informal local subdivisions have been recognized. Suneson (1976) made no mention of type locality, which presumably was Government Well, about 3 miles northeast of Goldfield. On Plate I he shows outcrops: a) on the west side of Apache Trail from Government Well south to Goldfield and beyond; and b) on the north shore of the eastern portion of Apache Lake. On Plate II he shows outcrops: a) on south shore of Apache Lake and around east side of Horse Mesa to Bronco Butte to south side and on top of Horse Mesa, including units assigned by Malone (1972) to Bronco Butte lahar; and b) corresponding to Stuckless (1969) "older dacite complex".

older basalt (T_{bo}) [RENAMED] basalt – lower Government Well Formation – Superstition Group Mafic lavas of the lower Government Well Formation. Suneson (1976) on Plate I gave age as Oligocene apparently based on stratigraphy. He showed outcrops along north shore of Apache Lake, and indicated a (probable) correlation with the outcrops that Kilbey (1986) later referred to as Weekes Wash basalt near the site of Goldfield. On Plate II (Suneson, 1976) correlates his "older basalt" with Malone's (1972) "Apache Lake basalts".

Whitetail Conglomerate (T_w) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Suneson, N.H., and Sheridan, M.F., 1975, Geology of the northern portion of the Superstition-Superior volcanic field, Maricopa and Pinal Counties, Arizona [abs.]: Geological Society of America Abstracts with Programs, v. 7, no. 7, p. 1185-1186.

tuff of Goat Mountain [OBSOLETE] Apache Leap Tuff Outflow sheet of the Apache Leap Tuff north of Apache Lake. Suneson and Sheridan (1975) used tuff of Goat Mountain for the tuff capping Goat Mountain, north of Apache Lake.

Siphon Draw welded tuff [OBSOLETE] Apache Leap Tuff Suneson and Sheridan (1975) used Siphon Draw welded tuff and did not mention its relationship to Superstition Tuff. Same as the Siphon Draw Member of the Superstition Tuff, later shown to be same as Apache Leap Tuff.

Theodore, T.G., Keith, W.J., Till, A.B., and Peterson, Jocelyn A., 1978, Preliminary geologic map of the Mineral Mountain 7 1/2-minute quadrangle, Arizona, including Analytical data for K-Ar ages for the Mineral Mountain 7 1/2-minute quadrangle, by S.C. Creasey: U.S. Geological Survey Open-File Report 78-0468, 1 sheet, scale 1:24,000.

conglomerate (Tc) [RETAINED] conglomerate – Gila Group Unit occurs in the southeast part of the map area.

water-laid tuff and sedimentary rocks (Tt) [RENAMED] bedded tuff and sedimentary rocks – Gila Group Distal post-Superstition cauldron volcanics.

rhyolite flows and intrusive rocks (Tr) [RENAMED] Sleeping Buffalo Rhyolite Member – Picketpost

Mountain Formation – Gila Group This unit is part of a large body later named "Sleeping Buffalo Rhyolite" by Creasey and others (1983) which is now considered a member of the Picketpost Mountain Formation.

intrusive rhyolite (Tir) [RETAINED] intrusive rhyolite – Picketpost Mountain Formation – Gila Group

rhyolitic obsidian (Tro) [RENAMED] obsidian – Sleeping Buffalo Rhyolite Member – Picketpost Mountain Formation – Gila Group This unit is part of a large body later named "Sleeping Buffalo Rhyolite" by Creasey and others (1983) which is now considered a member of the Picketpost Mountain Formation.

rhyodacite (Trd) [RETAINED] rhyodacite – Picketpost Mountain Formation – Gila Group A small body of this unit appears to intrude the intrusive rhyolite (Tri) map unit of Theodore and others (1978).

quartz latite (Tql) [RENAMED] Roadrunner Rhyolite Member – Picketpost Mountain Formation – Gila Group Creasey and others (1983) named the easterly continuation of this unit "Roadrunner Rhyolite" which is now considered a member of the Picketpost Mountain Formation.

olivine basalt (Tb) [RETAINED] olivine basalt – Gila Group A lava interbedded with post-Apache Leap Tuff sedimentary rocks in the southern part of the volcanic field.

quartz blowout (Tq) [RETAINED] quartz blowout – Gila Group Distal post-Superstition cauldron volcanics.

pebbly grit (Tpg) [RENAMED] pebbly granule sandstone – Gila Group Post-Apache Leap Tuff volcaniclastic sedimentary rocks in the southern part of the volcanic field.

older gravel (Tog) [RENAMED] gravel of Walnut Canyon – Gila Group Post-Apache Leap Tuff nonvolcaniclastic sedimentary rocks that directly overlie basement in the southern part of the volcanic field. Theodore and others (1978) indicate that this unit younger than the Apache Leap Tuff. A similar unit was mapped as older conglomerate (Tgo) in the easterly adjacent Teapot Mt quadrangle (Creasey and others, 1983) and later renamed gravel of Walnut Canyon by Dickinson (1995).

Apache Leap Tuff (Tal) [REDEFINED] Apache Leap Tuff This name was applied to the outflow sheet in the southeastern part of the volcanic field south of Superior. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

Whitetail Conglomerate (Tw) [RENAMED] Whitetail Formation For reasons of precedence and because the unit contains abundant lithologies other than conglomerate, the name Whitetail Formation is preferred.

Wilson, E.D., 1969, Mineral deposits of the Gila River Indian Reservation, Arizona: Arizona Bureau of Mines Bulletin 179, 34 p., 3 sheets, scales 1:12,000 and 1:125,000.

latite flows and pyroclastics (Tl) [RENAMED] Apache Leap Tuff Name for the Apache Leap Tuff in the Santan Mountains. The Apache Leap Tuff is now extended to a much larger outcrop area that also includes all areas of tuff previously mapped as Superstition Tuff, San Tan Tuff, and tuff of Comet Peak.

volcanic tuff, poorly stratified [OBSOLETE] Whitetail Formation Some of the lighter colored nonvolcaniclastic, pebbly sandstones in the Whitetail Formation of this area were interpreted as volcaniclastic sedimentary rocks by Sell (1968).

basalt flows and agglomerate [RETAINED] basalt flows and agglomerate – Superstition Group

basaltic plugs and dikes [RETAINED] basaltic plugs and dikes – Superstition Group In the Santan Mountains this unit is clearly associated with the basalt flows that underlie the Apache Leap Tuff, but in the Sacaton Mountains any correlation with Superstition volcanic field units is uncertain.

gravel, sand, and boulders [OBSOLETE] Whitetail Formation This unit consists of conglomerate and sandstone.