Arizona Geological Survey Digital Geologic Map 14, Sheet 1 of 2
Reynolds et. al., 2001, White Tank Mountains

Geologic Map of the White Tank Mountains, Central Arizona

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Bedrock mapping by S. J. Reynolds and S. E. Wood (Arizona State University)
Quaternary geology modified from Field and Pearthree
(1991, Arizona Geological Survey, OFR 91-8)
Derived from digital database compiled by Steven E. Wood
Cartography by Steven E. Wood, Stephen M. Richard, and Stephen J. Reynolds

The White Tank Mountains are a mid-Tertiary metamorphic core complex located 65 kilometers west of Phoenix. Bedrock is composed of Proterozoic metamorphic and plutonic rocks, two late Cretaceous to early Tertiary plutons, and less abundant mid-Tertiary plutonic, volcanic, and sedimentary rocks. The range is surrounded by Quaternary deposits and surfaces that range in age from Recent to Early Pleistocene.

The oldest rocks are Early Proterozoic metamorphic rocks, consisting of banded gneiss and biotite schist (Xm), amphibolite (Xmm), and a pod of ultramafic rocks (Xu) and gabbro (Xug). These rocks are intruded by two foliated Proterozoic plutons, a tonalite (Xt) to the south and a granodiorite-granite (Xgd) to the north. The northern part of the range exposes a quartzofeldspathic gneiss (Xmf), in part composed of thin sills of pegmatite and granite probably related to the granodiorite-granite pluton. In the south, the tonalite invades the metamorphic rocks as sheetlike intrusions concordant to foliation in both rock types and locally takes on a gneissic appearance. Several generations of Proterozoic metamorphic fabric are documented, including a main northeast-trending, high-grade gneissic foliation (S1). This fabric is present in both Proterozoic plutons and is folded and overprinted by a later sillimanite-grade Proterozoic mylonitic fabric (S2) that is concentrated in an east-dipping, normal shear zone (Reynolds and DeWitt, 1991; Alter, 1994; Wood, 1998).

Two distinct plutons of probable Late Cretaceous to early Tertiary age intrude the Proterozoic rocks. To the northwest is an undeformed, medium-grained granodiorite with locally associated dioritic and granitic phases. The eastern flank of the range is composed of the light-colored White Tank Granite, which forms a large sill-like pluton and numerous smaller sills in the metamorphic rocks and tonalite. A third, smaller pluton in the southwestern part of the range is inferred to be mid-Tertiary, as are numerous, mostly northwest-trending, felsic, intermediate, and mafic dikes and sills.

Tilted mid-Tertiary volcanic and sedimentary rocks are preserved above a brittle detachment fault along the western edge of the range. Mid-Tertiary mylonitic fabrics, with a characteristic northeast-southwest-trending, streaky lineation are locally present in the Proterozoic rocks, White Tank Granite, and some mid-Tertiary dikes and sills. These fabrics are inferred to have formed as the White Tanks core complex, which is in the lower plate of the detachment fault, was brought to the surface from underneath the Union Hills to the northeast (Rehrig and Reynolds, 1980; Brittingham, 1985; Reynolds and Dewitt, 1991; Reynolds and Lister, 1987; Kruger and others, 1998). Younger, northwest-trending, high-angle faults, with some lateral displacement, cut across the range.

Quaternary alluvium around the range is divided into older, middle, and younger deposits and surfaces that document a complex history of erosion and aggradation. Younger deposits are lower in elevation, are less dissected by erosion, and have less developed caliche, desert varnish, and desert pavement than higher, older Quaternary deposits (Field and Pearthree, 1991).

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Map Units

- **Qy** — Young alluvium (Latest Quaternary; <10 Ka): active stream channels and floodplains
- **Qm2** — Younger middle alluvium (Late Quaternary; 10-100 Ka): surficial alluvial deposits in terraces and low surfaces above the active stream channels; moderately developed varnish and pavements
- **Qm1** — Older middle alluvium (Middle Quaternary; 50-1000 Ka): surficial alluvial deposits in terraces and surfaces well above active channels; well-developed desert varnish and pavements
- **Qo** — Older alluvium (middle to Early Quaternary; +1000 Ka): dissected alluvial deposits with well-developed caliche
- **Ti** — Intrusive rocks (middle Tertiary): fine- to medium-grained granitic to rhyolitic intrusions
- **Tg** — Granitic rocks (middle Tertiary): fine- to medium-grained granite
- **TKg** — White Tank Granite (Late Cretaceous to early Tertiary): light-colored biotite granite and two-mica granite, with associated granodiorite, pegmatite, and fine- to medium-grained felsite; main pluton and sills are locally overprinted by Tertiary mylonitic fabric
- **TKgd** — Granodiorite (Late Cretaceous to early Tertiary): medium-grained, biotite-hornblende granodiorite with diorite, granite, and porphyritic rocks; rock unit is undeformed
- **Xgr** — Granitic rocks and pegmatite (Proterozoic): cream-colored to greenish, coarse- to medium-grained granite and garnet-bearing pegmatite; contains some S2 foliation, but lacks S1
- **Xgd** — Granodiorite and Granite (Proterozoic): foliated to gneissic granodiorite and granite; locally porphyritic with K-feldspar phenocrysts; a locally important component of unit Xmf
- **Xt** — Tonalite (Proterozoic): foliated tonalite and granodiorite, with less abundant granite, diorite, and gabbro; locally gneissic with S1 foliation
- **Xfg** — Foliated Gabbro (Proterozoic): amphibole gabbro interpreted to be a local phase of the tonalitic pluton
- **Xug** — Gabbro (Proterozoic): amphibole-pyroxene gabbro, weakly foliated; associated with ultramafic rocks
- **Xu** — Ultramafic rocks (Proterozoic): medium- to coarse-grained, pyroxene-amphibole ultramafic and mafic rocks
- **Xm** — Undifferentiated metamorphic rocks (Proterozoic): foliated and banded layers of quartzofeldspathic gneiss, amphibolitic gneiss, and biotite schist, interlayered in some locations with strongly foliated tonalite, granodiorite, granite, and pegmatite
- **Xmf** — Quartzofeldspathic and granitic gneiss (Proterozoic): foliated to strongly banded gneiss with abundant felsic layers, some of which are granitic and pegmatitic sills probably related to unit Xgd
- **Xmm** — Amphibolitic gneiss (Proterozoic): foliated to strongly banded amphibolitic gneiss and amphibolite with abundant thin quartzofeldspathic layers; includes epidote-rich rocks in northern part of range

Dikes

- Felsic dike (Tertiary)
- Intermediate dike (Tertiary)
- Mafic dike (Tertiary)
- Composite, felsic-mafic dike (Tertiary)
- Mixed magma dike (Tertiary)
- White Tank Granite sill or dike (Late Cretaceous to early Tertiary)

Symbols

- Depositional or intrusive contact
- Fault
- Detachment Fault (concealed)
- Mid-Tertiary foliation with lineation
- Closely spaced cleavage
- Joint
- Proterozoic S2 foliation: mylonitic to crystalloblastic foliation with east-trending lineation
- Proterozoic S1 foliation: gneissic layering, foliation, and schistosity
- Line of geologic sections (see sheet 2)

0km 1km 2km 3km

1:24,000 Scale

Contour interval 20' south of 33° 30' and north of 33° 37.5' and 40' elsewhere. Base map from White Tank Mountains, White Tank Mountains NE, and Valencia 7.5' Quadrangles (USGS DRG files).

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