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PRECAMBRIAN, PALEOZOIC, AND MID-TERTIARY SEDIMENTATION IN SOUTHWEST PINAL COUNTY AND ADJACENT PART OF MARICOPA COUNTY, ARIZONA *

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ABSTRACT

Numerous outcrops of sedimentary units were found in west-central Arizona during reconnaissance mapping of southwestern Pinal County and the southeastern corner of Maricopa County. The rock units are Younger Precambrian, Paleozoic, and mid-Tertiary in age. The Precambrian and Paleozoic rocks are virtually unmetamorphosed and extend at least twenty-five miles west of previous described units of this age.

The described Apache Group (Younger Precambrian) comprises (ascending) Scanlan Conglomerate, Pioneer Shale, Barnes Conglomerate, Dripping Spring Quartzite, Mescal Limestone, and unnamed basalt. In the area mapped, basalt and Mescal were removed by erosion prior to the deposition of the Younger Precambrian Troy(?) Quartzite.

Post-Apache Group differential structural movement apparently continued during deposition of the Troy(?) Quartzite and the Cambrian Bolsa(?) Quartzite. Westward both the Troy(?) and Bolsa(?) thin rapidly, with the Bolsa(?) grading upward into characteristic beds of the Middle and Upper Cambrian Abrigo Limestone. Structural activity subsided prior to the deposition of Devonian Martin Limestone and subsequent Mississippian Escabrosa Limestone and Pennsylvanian Naco Limestone.

Cretaceous and early-Tertiary sedimentary and volcanic units are known in Southern Arizona, but they are not recognized within the area described. However, Laramide (Late Cretaceous-Early Tertiary) granite and diorite were emplaced. Erosion was probably dominant during post-Paleozoic time and is known to have been interrupted at least once, during the mid-Tertiary, when widespread conglomerate was deposited. The conglomerate contains subrounded fragments of all previous rock units including the Cretaceous and Laramide rocks. Imbrication of the pebbles indicate the streams that deposited the conglomerate flowed from the south and southwest.

*NOT FOR PUBLICATION

INTRODUCTION

The topic of this paper is the outcrops of Precambrian, Paleozoic, and mid-Tertiary sedimentary rocks mapped in the Table Top Mountain and Sand Tank Mountain areas in west-central Arizona.

The Precambrian and Paleozoic outcrops are some of the most southwestward exposures of virtually unmetamorphosed and decipherable units in Southern Arizona. Stratigraphic sections were not measured and fossils were not collected for formal identification of the outcroping units in the Table Top-Sand Tank region. However, the formation age and nomenclature designation is based on visual characteristics and comparison with the more fully developed and complete sections to the southeast. From this region, the nearest published maps with stratigraphic sections and discussions are in the Vekol Mountains fifteen miles to the south and southeast (Carpenter, 1947), and the Slate Mountains thirty miles to the southeast (Hogue, 1940; Hammer, 1961). Heindl and McClymonds have published several general reports and a detailed stratigraphic description on portions of the Vekol-Slate Mountains within the Papago Indian Reservation (McClymonds, 1959; Heindl and McClymonds, 1964; and McClymonds and Heindl, 1965).

Permission for presentation of this paper has been granted by ASARCO and is gratefully appreciated.

YOUNGER PRECAMBRIAN ROCKS

The Younger Precambrian sedimentary rocks recognized in the region are part of the Apache Group and the Troy(?) Quartzite. The Apache Group, in many parts of southern Arizona, is comprised of, ascending, the Scanlan Conglomerate, Pioneer Shale, Barnes Conglomerate, Dripping Spring Quartzite, Mescal Limestone, and an unnamed basalt. All of the Apache Group units, except the Mescal Limestone and the unnamed basalt, are present in the discussion area.

APACHE GROUP

Scanlan Conglomerate

Conglomerate beds composed of pebbles and cobbles of various rock fragments set in a fine-to-coarse-grained matrix are found in many places west of the Vaiva Hills and south of Table Top. The matrix and pebbles most often reflect the underlying schist and granite basement of the area. The Scanlan Conglomerate is generally less than three feet thick although in one area it is ten feet thick.

Conglomerate of the Scanlan-type was not observed in the Sand Tank area, but the Scanlan may be present in areas where the lower part of the Pioneer Shale is covered by debris and alluvium.

In the Vekol Mountains, the Scanlan Conglomerate is of very local occurrence and generally is only a few inches in thickness. Scanlan was not observed in the Slate Mountain studies.

Pioneer Shale

Maroon siltstone and mudstone, containing cream-colored reduction spots typical of the Pioneer Shale, crop out in many localities in the Table Top-Sand Tank region. The Pioneer is especially well exposed in the belt of Precambrian sediments west of the Vaiva Hills. Pioneer is also exposed underlying the volcanic flows capping Table Top Mountain and extending south in isolated outcrops on past Little Table Top Mountain.

In the Sand Tank area, the Pioneer Shale is noted in scattered outcrops south and west of Johnson Well and also northeast of Maricopa Peak.

Barnes Conglomerate

Well-rounded ellipsoidal quartzite and vein-quartz pebbles with a well-cemented sandy arkosic matrix characterizes the Barnes Conglomerate. The Barnes attains a maximum thickness of ten feet in the Vaiva Hills exposures, but elsewhere it is four to five feet thick. In the Vekol Mountains, the Barnes approaches a thickness of twenty feet but is very thin to absent in the Slate Mountains.

Fragmental float material of Barnes Conglomerate is abundant in the drainages of the Table Top area, but float or outcrop was not found in the Sand Tank area.

Dripping Spring Quartzite

Massive beds of cream to light orange quartzite and siltstone crop out between the Vaiva Hills and Table Top Mountain. The massive beds assigned to the Dripping Spring may be 1,000 feet thick in this area. Thinner sections were found further west on Table Top Mountain, Little Table Top Mountain, and in the Apache Group sediment area southeast of Little Table Top Mountain.

In the Sand Tank region, southwest of Johnson Well, the Dripping Spring Quartzite is less than 200 feet thick and is a reddish quartzite unit overlying Pioneer Shale. Quartzites assignable to the Dripping Spring are absent in the exposures northeast of Maricopa Peak.

Measured thickness of Dripping Spring ranges from 800 to 1,200 feet in the Vekol and Slate Mountains area.

Mescal Limestone and Unnamed Basalt

The uppermost sedimentary unit of the Apache Group is the Mescal limestone which is often capped by an unnamed basalt. The Mescal and the thin to missing basalt is between 200 and 300 feet in thickness in the Vekol-Slate Mountains region. In the Table Top-Sand Tank region assignable Mescal was not found between the underlying Dripping Spring Quartzite and the overlying Precambrian Troy(?) Quartzite and Paleozoic units.

PRE-TROY UNCONFORMITY

A regional pre-Troy unconformity, as discussed by Shride in U.S.G.S. Professional Paper 566 - Younger Precambrian Geology in Southern Arizona - is expressed in southwestern Arizona by the following features:

1. The absence of the unnamed basalt in the Slate Mountains.
2. The thin to missing basalt and the marked channeling of the Mescal Limestone in the Vekol Mountains.
3. The missing basalt and Mescal in the Table Top-Sand Tank region.
4. The thinning of the Dripping Spring Quartzite between Table Top and Johnson Well and its absence further west in the Sand Tank area.
5. The apparent thinning of the Pioneer Shale westward in the Sand Tank area.

TROY(?) QUARTZITE

In the Table Top area a 600-foot sequence of yellow-buff quartzite beds, assigned to the Troy(?) Quartzite, containing abundant quartz granules and interstitial feldspar, is found between the orange quartzite-siltstone Dripping Spring sequence and the overlying sandy-limey beds containing intraformational conglomerates of probably Cambrian age. In the southern part of the Table Top area diabase has intruded the Dripping Spring unit, but cover prevents the observation of any Troy(?)-diabase relationships. Nearby, isolated outcrops of Abrigo-type (Cambrian) limestones overlie the Troy(?) exposures.

In the Sand Tank area, southeast of Johnson Well, similar white to buff sandstone-quartzite units containing moderate to abundant pebble layers, interstitial clay spots, and some cross-bedding features overlie Pinal Schist. Southwest of Johnson Well they rest on Dripping Spring Quartzite. Northeast of Maricopa Peak, the sandstone-quartzite units were deposited on Pioneer Shale.

The different rock units -- Dripping Spring Quartzite, Pioneer Shale, and Pinal Schist -- which the Troy(?) Quartzite was deposited attests to the pre-Troy erosion forces active in this portion of the Sand Tank area.

PRECAMBRIAN-CAMBRIAN BOUNDRY

The break between Precambrian and Cambrian time, with the assignment of formational units, has long been a speculated problem in central and southern Arizona.

In east-central Arizona, Shride (1961,1967) and Krieger (1961), on the basis of lithology, structural relationship with the diabase, and the presence or absence of fossils, have been able to assign the post-Apache group sandstones and quartzites to the Precambrian Troy Quartzite, the Cambrian Bolsa Quartzite, or to the sandstone units of the Cambrian Abrigo Formation.

The quartzites of the Table Top-Sand Tank region are separated into the Troy(?) Quartzite and Bolsa(?) Quartzite based on the criteria of Krieger (1961) and Peterson (1962, personal communication), and as summarized by Shride in Professional Paper 566.

PALEOZOIC ROCKS

In the Vekol area the Paleozoic rocks of Cambrian, Devonian, Mississippian, and Pennsylvanian age have been subdivided into formations and members by Carpenter. In the Table Top-Sand Tank region, the Paleozoic units recognized include the Cambrian Bolsa(?) Quartzite and Abrigo Limestone, the Devonian Martin Limestone, the Mississippian Escabrosa Limestone, and the Pennsylvanian Naco Limestone.

CAMBRIAN BOLSA(?) QUARTZITE AND ABRIGO LIMESTONE

In the Table Top area Bolsa-type sandstones and quartzites, ranging in color from cream to reddish-brown, appear to grade upward into sandy-limey beds characteristic of the Abrigo Limestone. Typical Abrigo Limestone, containing intraformational conglomerate beds, are recognized only in isolated outcrops south of Little Table Top Mountain.

The Cambrian sequence in the Table Top area rests on either the Troy(?) or the Dripping Spring and is overlain by the fossiliferous beds of the Devonian Martin Limestone. In general, the Cambrian rocks are less than 150 feet thick in the Table Top-Sand Tank region while they are in excess of 400 feet in the Vekol Mountains and 700 feet in the Slate Mountains.

In the Sand Tank area, a red-colored, indurated, vitreous, cross-bedded quartzite, of assigned Cambrian age, is found in three separate localities. In the outcrop belt northeast of Maricopa Peak, the quartzite rests on white to buff Troy(?) and underlies Devonian Martin Limestone. Around Johnson Well, the red quartzite rests on Troy(?) beds and grades upward into a sequence of limey quartzite beds before being covered by the Martin. Northeast of Johnson Well, the quartzite has deposited on Pinal Schist and is overlain by Martin.

DEVONIAN MARTIN LIMESTONE

Medium-bedded, medium-grey, fossiliferous limestones, typical of the Martin Limestone, is the most widely exposed unit in the Paloeozic outcrops between the Vaiva Hills and Table Top Mountain. Where the base is exposed, the Martin rests on the limey quartzites of the Bolsa(?) and Abrigo.

In the Sand Tank area, the Martin again contains abundant fossiliferous material such as crinoid stems, brachiopods, and lacy bryozoans. As mentioned previously, the limestone beds were deposited on the red cross-bedded quartzite of probable Cambrian age. The larger outcrops are east of Johnson Well but all exposures of Paleozoic rocks in the Sand Tank area contain some thickness of Martin Limestone.

The deposition of relatively pure limestone containing crinoids and bryozoa suggests that during Devonian time the Table Top-Sand Tank region was extensively covered by marine waters and the shoreline of the Devonian seas was located much further west.

Visual estimate of formational thickness suggest it is comparable to the 200-240 feet of Devonian units found in the Slate and Vekol Mountains.

MISSISSIPPIAN ESCABROSA LIMESTONE

More than 400 feet of Escabrosa limestone has been measured and described in the Vekol-Slate Mountain region, but only a few isolated outcrops were found in the Table Top-Sand Tank region. In the main outcrop belt west of Vaiva Hills are small outcrops of a massive-bedded, light grey limestone containing bulbrous chert, up to ten inches in thickness, which are often connected by thin chert zones along strike. The bulbrous chert bed units rest on Martin Limestone in the one exposure where the base was visible.

West of Johnson Well, in the Sand Tank area, the massive, grey, bulbrous chert units overlie bryozoan-bearing beds of the Martin Limestone. The contact between the two limestones is marked by a thin-bedded shale unit.

PENNSYLVANIAN NACO LIMESTONE

In the Table Top-Sand Tank region, rock units of assigned Pennsylvanian age are found only in one outcrop. Here, west of Johnson Well, the exposed units of alternating thin-bedded limestone and dark shale beds overlie the bulbrous chert limestone units of the Escabrosa. Based on the cyclic nature and appearance of the limestone and shale beds, this unit is correlated with the Pennsylvanian Naco Limestone found in the Vekol Mountains.

PALEOZOIC - TERTIARY BOUNDRY

Mesozoic volcanic or sedimentary rocks were not recognized in the Table Top-Sand Tank region although units of this age are known in the surrounding areas. Both Carpenter (1947) and Heindl (1965) describe several formations of probable late Mesozoic age in the Vekol Mountains including a conglomerate similar to the Glance Conglomerate of Cretaceous Age. Rocks of probable Mesozoic age are present in regions to the northwest in the Gila Bend Mountain and to the southwest near Ajo. Mesozoic units are not found in the Slate Mountains (Hogue, 1940; Hammer, 1961).

Whether a large thickness of volcanic and sedimentary rocks of Mesozoic or early Cenozoic age were emplaced or deposited in the Table Top-Sand Tank region cannot be determined from the available evidence. However, the thickness of the Mesozoic rocks in the surrounding regions suggest that some of these rocks must have extended into the Table Top-Sand Tank regions and were subsequently removed by erosion before about middle Tertiary time. Intrusive activity during Laramide time is evident by the emplacement of diorites and granites in both the Table Top and Sand Tank areas.

Despite the amount of post-Pennsylvania and pre-middle Tertiary volcanism and sedimentation, present outcrops suggest that erosion must have been rather severe. The erosion completely removed the Mesozoic and early Cenozoic volcanic and sedimentary rocks, an unknown amount of Laramide granite and diorite, some of the Paleozoic and younger Precambrian strata, and Older Precambrian schist and granite. The erosion produced an irregular surface having considerable relief, upon which were deposited the sedimentary and volcanic rocks of middle Tertiary age.

MID--TERTIARY ROCKS

In the Table Top-Sand Tank region are numerous outcrops of tuffaceous conglomerates which contain fragments of Precambrian granite and schist, Precambrian and Paleozoic sediments, Mesozoic Cretaceous conglomerates, and various Laramide granites, latites, and volcanic porphyries. Everywhere the tuffaceous conglomerates underlie mappable units of flows and tuffs of andesitic, rhyolitic, and dacitic composition. The upper units of the conglomerate interbed with the lower flows of the volcanics and, in places, are highly deformed and tilted.

An excellent exposure of the conglomerate is at Antelope Peak on the north side of the Table Top area. On Antelope Peak the conglomerate was deposited on Precambrian granite but nearby it rests on Precambrian Pinal Schist. On Table Top Mountain, the conglomerate is very tuffaceous and displays considerable cross-bedding and was deposited on Pinal Schist, Pioneer Shale, and Dripping Spring Quartzite.

In the Sand Tank area, the tuffaceous conglomerate was deposited on Cambrian quartzite and Devonian limestone southeast of Johnson Well. Northeast of Maricopa Peak the conglomerate overlies Pinal Schist, Troy(?) Quartzite, Bolsa(?) Quartzite, Martin Limestone, and Laramide granite and diorite in various exposures. North of Freeman Underpass, and in the northwest part of the Sand Tank area, the conglomerate forms the basal unit and interfingers with the complex volcanic sequence which forms a thick capping on many of the mountains in the area.

Imbrication of the pebbles and cobbles and observation of the dip direction of the cross beds indicate that streams which deposited the conglomerate flowed from the south and southwest.

THANK YOU

REFERENCES

Carpenter, R.H., 1947, The geology and ore deposits of the Vekol Mountains, Pinal County, Arizona: Stanford University PhD thesis, 110 p.

Hammer, D.F., 1961, Geology and ore deposits of the Jackrabbit area, Pinal County, Arizona: Univ. Ariz., MS thesis, 156 p.

Heindl, L.A., 1965, Mesozoic formations in the Vekol Mountains, Papago Indian Reservation, Arizona: USGS Bull. 1194-G, p. G 1-G 9.

Heindl, L.A., and McClymonds, N.E. 1964, Younger Precambrian formations and the Bolsa(?)Quartzite of Cambrian age, Papago Indian Reservation, Arizona: USGS Prof. Paper 501-C, p. C43-C49.

Hogue, W.G., 1940, Geology of the northern part of the Slate Mountains, Pinal County, Arizona: Univ. Ariz. MS thesis 43 p.

Krieger, M.H., 1961, Troy Quartzite (Younger Precambrian) and Bolsa and Abrigo formations (Cambrian), northern Galiuro Mountains, southeastern Arizona: USGS Prof. Paper 424-C, p. C 160-C164.

McClymonds, N.E., 1959, Precambrian and Paleozoic sedimentary rocks on the Papago Indian Reservation, Arizona: Ariz. Geol. Soc. Guidebook II, Southern Arizona, p. 77-94.

McClymonds, N.E., and Heindl, L.A., 1965, Stratigraphic sections of Younger Precambrian and Paleozoic formations, Papago Indian Reservation, Arizona: USGS Open-file report, 101 p.

Shride, A.F., 1961, Some aspects of Younger Precambrian geology in southern Arizona: Univ. Ariz. PhD thesis, 234 p.

Shride, A.F., 1967, Younger Precambrian geology in southern Arizona: USGS Prof. Paper 566, 89 p.