CENOZOIC GEOLOGY OF THE PAPAGO INDIAN RESERVATION, PIMA, MARICOPA, AND PINAL COUNTIES, ARIZONA

(A Preliminary Summary)

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INTRODUCTION

This report briefly summarizes the Cenozoic geology of the Papago Indian Reservation, which includes about 4, 300 square miles, principally in central Pima County, Ariz. The summary is based on an investigation of the geology and ground-water resources of the Papago Indian Reservation made by the U. S. Geological Survey in cooperation with the Bureau of Indian Affairs.

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GEOLOGY

The Cenozoic rocks of the Papago Indian Reservation comprise a diverse series of sedimentary, intrusive, and volcanic sequences. The Cenozoic rocks generally rest with angular unconformity on Precambrian, Paleozoic, or Mesozoic intrusive or sedimentary rocks. Locally, the oldest Cenozoic rocks may represent a continuation of late Mesozoic deposition. Elsewhere, the younger Cenozoic rocks lie on intrusive or metamorphic rocks of possible late Mesozoic or early Cenozoic age. In many areas, the base of the Cenozoic rocks is not exposed.

The Cenozoic and associated rocks are divided into four arbitrary age groups--Quaternary and Tertiary, late (?) Tertiary, middle(?) Tertiary, and Cretaceous and Tertiary. These are further subdivided into 14 sedimentary or volcanic sequences and three episodes of intrusion. Although only three intrusive episodes are described, small intrusive bodies are associated with all periods of extrusion.

Evidence from this study cannot establish with certainty the age of any Cenozoic unit. Ages are presumed from lithologic, stratigraphic, and structural similarity to Cenozoic or Cenozoic(?) rocks in other parts of Arizona. Particularly in the case of the Cretaceous and Tertiary rocks, the sequence is based largely on fragmentary evidence, because the separate units are not exposed in sequence or their relationships are masked by fault or intrusive contacts.

The Cenozoic rocks exposed within the reservation have a distinct pattern of distribution. Tertiary and Quaternary alluvial deposits immediately underlie most of the broad north-trending intermontane basins, locally to depths of more than 1, 000 feet. The late(?) Tertiary volcanic rocks and associated sediments are best developed in the western third of the reservation, although there are smaller exposures in or near all mountain ranges. The greater part of the middle (?) Tertiary igneous and sedimentary rocks predominates in a broad north- to northwest-trending swath through the central and eastern parts of the reservation. The Cretaceous and Tertiary rocks are concentrated generally in the central and southeastern mountain ranges.

The igneous rocks range in composition from rhyolite to basalt, but the intermediate types--quartz latite to andesite--are most common. The classification of rocks which are so closely allied and which in many places appear to grade into each other presents considerable difficulty, particularly because extrusive rocks of practically identical composition and texture were erupted at different times.

The structures of the Cenozoic rocks within the mountain ranges may be either simple or comples. In general, the exposed parts of the alluvial deposits in the basin are undeformed. The younger volcanic rocks have been warped into open folds and broken by high-angle normal faults. The middle group of volcanic rocks was deformed more intricately; and the oldest group of volcanic rocks was deformed by folding, thrust faulting, and intrusion. In general, the mountain ranges in the western third of the reservation show a less complex structure than those in the central and eastern parts. This is due, in part, to the fact that only the younger volcanic rocks are present and the lower Cenozoic units are represented by an erosional hiatus extending to the underlying igneous or metamorphic complex.

The following table is a preliminary synthesis of the Cenozoic geology of the Papago Indian Reservation.

QUATERNARY AND TERTIARY ROCKS

Unit 1 - Younger alluvial deposits, principally those now in process of transportation; include bolson, adobe-flat, stream-channel, and talus deposits.

Unit 2 - Older alluvial deposits now being dissected; include upper parts of deposits partly filling intermontane basins; may be deformed locally.

UNCONFORMITY--following broad warping and normal faulting

LATE (?) TERTIARY ROCKS

Unit 3 - Thin basaltic and andesitic flows and interbedded sediments; locally more than 500 feet thick; equivalent to Batamote andesite in Ajo quadrangle (Gilluly, 1946).

Unit 4 - Conglomerate, sandstone, and mudstone grading downward into reworked tuffaceous deposits; local thin interbedded basaltic flows near base.

UNCONFORMITY--following folding and normal faulting

Unit 5 - Local, thick to thin alluvial deposits with andesitic flows and deposits of tuff near base; locally more than 1,000 feet thick.

Unit 6 - Felsic extrusive rocks; tuff, agglomerate, breccias, flows, and associated thin sediments; maximum thickness on reservation about 200 feet.

Unit 7 - Andesite porphyry flows; andesite characterized by large feldspar phenocrysts; some interbedded sediments; locally more than 1,000 feet thick; may be equivalent to Childs latite in Ajo quadrangle (Gilluly, 1946).

Unit 8 - Andesitic and felsic volcanic rocks, principally flows; basal and interbedded sedimentary lenses include fine-grained deposits and limestone; locally more than 500 feet thick; fine-grained deposits are lithologically similar to Tertiary (?) lake beds in Tucson Mountains (Brown, 1939).

Unit 9 - Latite, trachyte, and dacite flows; include some intrusive bodies and alluvial lenses; locally more than 2,000 feet thick; basal conglomerate lithologically similar to Daniels conglomerate in Ajo quadrangle (Gilluly, 1946).

LOCAL UNCONFORMITIES

INTRUSIVE INTERVAL--Predominantly fine-to coarse-grained porphyritic and grantitoid rocks of silicic to intermediate composition; generally in small intrusive bodies but locally as stocks; may include more than one period of intrusion; may be in part equivalent to Units 8 and 9. This intrusive interval is associated with or followed by extensive deformation, particularly strike-slip movement, and some thrusting.

MIDDLE (?) TERTIARY ROCKS

Unit 10 - Local deposits ranging from coarse conglomerate to sandstone; well indurated or cemented by silica; some associated vulcanism; locally more than 2,000 feet thick; texturally and structurally similar to Locomotive fanglomerate (Gilluly, 1946).

Unit 11 - Predominantly andesitic flows, breccias, agglomerate, and tuff, including hornblende andesite porphyries and hornblende crystal tuffs; alluvial lenses, particularly near top; locally about 1,000 feet thick; in part lithologically similar to Sneed andesite and Ajo volcanics (Gilluly, 1946) which in this area are stratigraphically above the Locomotive fanglomerate (see Unit 10); also, in part lithologically similar to Diopside Andesite in Tucson Mountains (Brown, 1939).

Unit 12 - Quartz-latite, latite, dacite, and andesite flows, agglomerates and tuffs; felsic flows characterized by prominent quartz phenocrysts; interbedded volcanic conglomerate; thickness unknown, but thicknesses of more than 1,500 feet are suggested locally; lithologically similar to all Tertiary volcanic sequences in Tucson Mountains except the Diopside Andesite (see Unit 11) of Brown (1939).

UNCONFORMITY

INTRUSIVE INTERVAL--Large stocks of quartz monzonite and related granitic rocks; most commonly as fine-to coarse-grained porphyries; include numerous dikes, sills, and other small intrusive bodies; more than one period of intrusion may be involved, and intrusions in different areas may not be contemporaneous; rocks are possibly equivalent to Amole quartz monzonite and granite in Tucson Mountains (Brown, 1939) and Cornelia quartz monzonite in Little Ajo Mountains (Gilluly, 1946); intrusion associated with or followed by extensive deformation, including thrusting and metamorphism of intruded units.

CRETACEOUS AND TERTIARY ROCKS

Unit 13 - Sandstone, quartzite, mudstone, and pebble conglomerate; beds are maroon, reddish brown, olive-green, and gray; individual quartzite beds are clean and white; basal units locally prominent and include red basal conglomerate or red rhyolitic flows; locally more than 5,000 feet thick. This unit may be in part equivalent to the Recreation redbeds and Amole arkose in the Tucson Mountains (Brown, 1939), whose ages were considered to be Cretaceous and possibly early Tertiary by Kinnison (1958, Geology and ore deposits of the southern section of the Amole mining district, Tucson Mountains, Pima County, Arizona: Arizona Univ., Tucson, unpublished master's thesis). Bryner (1959, Geology of the south Comobabi Mountains and Ko Vaya Hills, Pima County, Arizona: Arizona Univ., Tucson, unpublished doctoral thesis) considered this unit to be of Cretaceous (?) age, but for reasons discussed below under the immediately older intrusive interval, the unit is here considered to be of possible early Tertiary age.

UNCONFORMITY

INTRUSIVE INTERVAL--Large intrusive masses of quartz monzonite and dioritic rocks which intrude Cretaceous (?) sediments; may be of at least two periods of intrusion. Bryner (op. cit.) considered these intrusions to be of possible Jurassic age. However, the intrusions invade thin-bedded arkosic sediments and quartzites lithologically similar to the lower part of the Amole group of the Tucson Mountains, which are at least in part of Cretaceous age (Kinnison, op. cit.). Consequently, these intrusions which also intrude unit 14 of post-early Cretaceous age, are considered here to be younger than Cretaceous.

Unit 14 - Andesitic and dacitic porphyry conglomerate and agglomerate; sedimentary part generally massive and poorly bedded strata which consist predominantly of angular fragments set in a volcanic matrix of similar composition; fragments may be locally several feet in diameter; locally more than several thousand feet thick, but part of the thickness may be due to repetition by faulting; locally called

"Silver Bell" conglomerate by Courtright (1958).

UNCONFORMITY

Cretaceous(?) and older rocks.

REFERENCES

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