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TRACE ELEMENTS
MEMORANDUM REPORT 1010

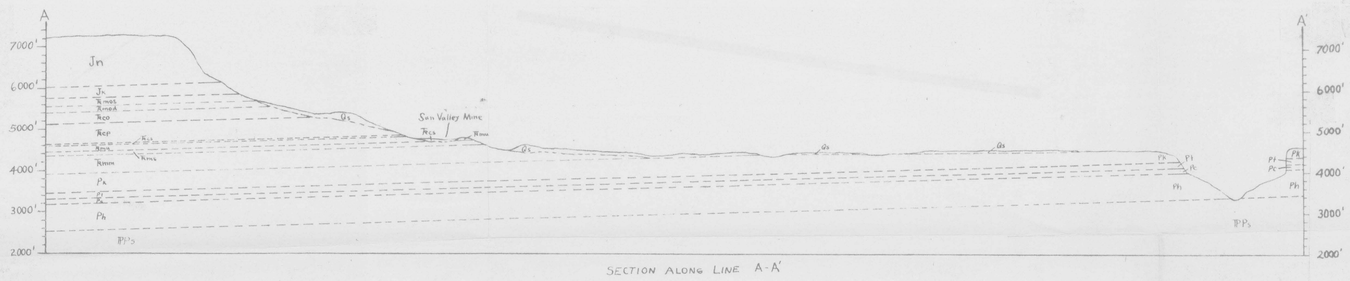
Geology mapped 1956

SCALE 1:24000

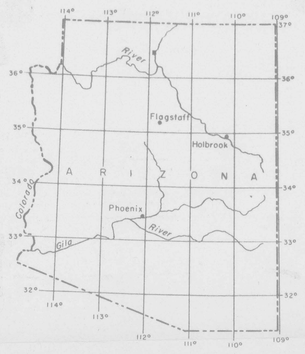
1 MILE

7000 FEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL



SECTION ALONG LINE A-A'



INDEX MAP OF ARIZONA SHOWING AREA OF THIS REPORT

PRELIMINARY GEOLOGIC MAP OF THE EMMETT WASH NE QUADRANGLE, COCONINO COUNTY, ARIZONA

by

Richard G. Petersen

EXPLANATION

Pleistocene and Recent — QUATERNARY

Qs

Surficial deposits

Reddish-brown to buff surficial sand, sand dunes, and landslide debris derived from the East Vermilion Cliffs. The landslide debris consists of rubble to large blocks of broken and disturbed strata from the Glen Canyon group and the Chinle formation.

UNCONFORMITY

Tfk — TERTIARY(?)

Fanglomerate

An indurated fanglomerate composed mostly of sand- to cobble-size, angular to subrounded limestone and chert fragments derived from the Kaibab limestone. The unit ranges in thickness from 2 to 70 feet and caps several buttes in this area.

Lower Jurassic and Lower Jurassic(?) — JURASSIC AND JURASSIC(?)

Jn

Navajo sandstone

Reddish-brown, brown, buff, and white, moderately sorted, predominantly medium-grained, crossbedded sandstone composed of subrounded to rounded quartz grains and 2 to 5 percent feldspar grains; generally poorly cemented but locally well cemented with iron oxide or calcite; forms cliffs in which prominent joints are common. Only the lower 1,200 feet of the Navajo sandstone is present in this quadrangle; in northern adjacent quadrangle complete sections are 1,700 feet thick. The lower contact of the unit is sharp and conformable.

Glen Canyon group

Lower Jurassic(?) — JURASSIC(?)

Jk

Kayenta formation

Alternating beds of predominantly reddish-brown siltstones and fine-grained sandstones. The sandstones are composed of well-sorted subangular to rounded quartz grains poorly cemented with iron oxide and noncalcareous clay; crossbedded in places; forms ledges and cliffs 10 to 30 feet high. The siltstone is thin-bedded, fissile, and weathers to gentle slopes 10 to 30 feet high; locally bleached to a yellowish gray. The formation is about 300 feet thick in this area. The bottom contact is sharp and conformable.

Upper Triassic(?) — TRIASSIC(?)

Ꞧmos
Ꞧmod

Moenave formation

The Springdale member, Ꞧmos, is a pale reddish-brown fine- to medium-grained sandstone composed of subrounded to rounded quartz grains with some mica; poorly cemented with noncalcareous clay and iron oxide; some beds crossbedded. Thin lenses (2 to 3 feet thick) of a siltstone-claystone conglomerate occur in the lower part of the unit. The member is about 150 feet thick and forms a prominent ledge; lower contact disconformable. Dinosaur Canyon member, Ꞧmod, consists of alternating beds of predominantly dark reddish-brown slightly to moderately calcareous siltstones and silty claystones. The siltstones weather to ledges and the claystones to slopes. One thin (1 to 2 feet) silty claystone bed in about the middle of the unit contains an abundance of fresh-water Ostracods. The unit is about 100 feet thick. The lower contact is sharp and conformable.

Upper Triassic — TRIASSIC

Ꞧco
Ꞧcp
Ꞧcs

Chinle formation

The Owl Rock member, Ꞧco, consists of interbedded, moderately to highly calcareous siltstones and claystones. The siltstones which constitute a major part of the unit are predominantly pale reddish brown with some light greenish-gray beds. The claystones are less calcareous, mostly grayish red but bleached in places to pale green. Several thin (2 to 24 inches) beds of pale-red and light greenish-gray limestones and limestone-siltstone conglomerates occur throughout the middle and upper part of this unit and form ledges in the otherwise highly weathered slope. This unit measures 280 to 320 feet thick, but because of the many landslides which appear to originate in the Owl Rock member, the complete unit is exposed in only a few places. The Petrified Forest member, Ꞧcp, is composed almost entirely of a grayish red-purple to a grayish-red, noncalcareous, silty claystone. This claystone weathers to earthy, rounded hills and slopes. An irregular sandstone bed, forming a cliff about 40 feet high occurs 40 to 50 feet from the bottom of the unit. The sandstone is white, coarse-grained, and massive and is composed of angular to subangular, well-sorted quartz grains well cemented by noncalcareous clay. The lower 8 to 10 feet of the Petrified Forest member is gradational with the next underlying unit. The Shinarump member, Ꞧcs, is a unit of greatly variable thickness and composition. In many localities the Shinarump member is missing, and in others, the only indication of the unit is the presence of a few scattered quartzite pebbles at the base of the Petrified Forest member. Where a bedded deposit occurs, it is represented by a poorly sorted sandstone and conglomerate well cemented by white to yellow calcite and clay. The pebbles and cobbles of the conglomerate are predominantly quartzite and chert. This unit forms a ledge 5 to 20 feet thick. Locally, abundant carbonaceous material and petrified logs occur in the unit. In a few locations, some of the poorly cemented conglomerate has been weathered to sand and gravel. Locally the Shinarump member has filled channels in the Moenkopi formation up to 130 feet thick. In these localities, the member is composed from bottom to top, of: (1) a coarse quartzite-chert conglomerate; (2) a coarse-grained crossbedded grayish-green sandstone; and (3) a yellow- to reddish-gray siltstone-claystone bed containing scattered quartzite pebbles. Concentrations of uranium have been found in several of these channels in the area. The bottom contact of the member is sharp and disconformable.

UNCONFORMITY

Lower and Middle(?) Triassic — TRIASSIC

Ꞧmu
Ꞧms
Ꞧmm

Moenkopi formation

The Upper Red member, Ꞧmu, consists of alternating layers of dark reddish-brown siltstone and silty-claystone. Both the siltstone and the claystone are moderately calcareous and contain some mica flakes. The siltstone is massive blocky, ripple-marked, and forms vertical cliffs. The claystone is thin-bedded, highly gypsiferous, and forms ledges and earthy slopes. The member is about 160 feet thick with a sharp and conformable lower contact. The Shnabkaib member, Ꞧms, is a uniform light grayish-green highly gypsiferous micaceous noncalcareous thin-bedded clayey siltstone. This member is about 100 feet thick and weathers to vertical cliffs and slopes. The lower contact is conformable and sharp. The Middle Red member, Ꞧmm, is a uniform, pale reddish-brown highly gypsiferous noncalcareous thin-bedded ripple-marked siltstone. It forms a slope with an occasional resistant bed forming a ledge. The member is about 450 feet thick with a sharp but conformable lower contact. The Virgin limestone, Lower Red, and Timpoweap members are not present in this area.

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Aubrey group — PERMIAN

Pk

Kaibab limestone

The Kaibab limestone, Pk, is a variable unit of yellowish-gray limestones, silty and sandy limestones, and limy sandstones. The unit contains many marine fossils and some beds have abundant chert nodules. It weathers to blocky ledges and vertical cliffs. The unit is about 440 feet thick and the lower contact is sharp and conformable.

Pt

Toroweap formation

The Toroweap formation, Pt, is a white to buff calcite-cemented fine-grained sandstone. The quartz grains are clear to frosted and angular to subrounded; forms blocky ledges to massive, vertical cliffs. The unit is about 140 feet thick. The bottom contact is sharp and conformable.

Pc

Coconino sandstone

The Coconino sandstone, Pc, is composed of two major units; the upper 50 to 60 feet is a buff colored calcareous medium- to coarse-grained sandstone consisting of about 5 percent calcite and 95 percent frosted, subrounded to rounded quartz grains; the lower 160 feet is a buff to white well-sorted noncalcareous fine-grained sandstone composed of subangular to rounded clear quartz grains. The lower unit contains massive crossbeds. Both units form a continuous cliff in most places. The Coconino sandstone is about 220 feet thick and its lower contact is sharp and disconformable.

Ph

Hermit shale

The Hermit shale, Ph, is composed of alternating beds of massive- to thin-bedded brownish-red siltstones and fine-grained sandstones, with an occasional greenish-gray thin-bedded siltstone. The unit forms a slope, with some sandstones forming ledges. The Hermit shale is about 680 feet thick. The lower contact is sharp and unconformable.

UNCONFORMITY

PPs — PENNSYLVANIAN AND PERMIAN(?)

Supai formation

The Supai formation, PPs, is composed of alternating beds of red friable silty sandstone, red to buff crossbedded sandstone, and red calcareous sandstone with an occasional bed of bluish-gray limestone. (Outcrop of the Supai formation is inaccessible in this area. The description was taken from: Noble, L. F., 1922, A section of the Paleozoic formations of the Grand Canyon at Bass Trail: U. S. Geol. Survey Prof. Paper 131-B.)

Contact

(Dashed where approximately located)

D
U

High angle fault

(Dashed where approximately located; short dashes where indefinitely located; U, upthrown side; D, downthrown side)

12

Strike and dip of beds

7000

Structure contour

Drawn on base of the Navajo sandstone; dashed where approximately located; short dashes indicate projection above surface. Contour trends are influenced by controls in adjacent quadrangles. Contour interval 100 feet. Datum is mean sea level.

Uranium mine