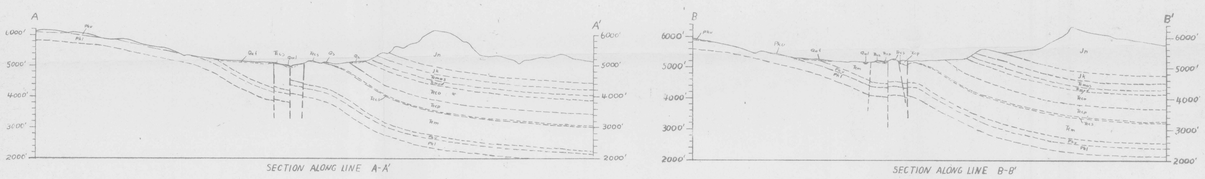
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

THIS MAP CONCERNS WORK DONE BY THE U.S. GEOLOGICAL SURVEY ON BEHALF OF THE DIVISION OF RAW MATERIALS OF THE U.S. ATOMIC ENERGY COMMISSION

TRACE ELEMENTS
MEMORANDUM REPORT 1007



PRELIMINARY GEOLOGIC MAP OF THE HOUSE ROCK SPRING NE QUADRANGLE, COCONINO COUNTY, ARIZONA

BY

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Mapped by the Geological Survey 1954

Topography by multiplex methods from aerial photographs taken 1951

Symbols and other detail as shown for 1:62,500 scale publication

SCALE 1:24000

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

EXPLANATION

Qal — Alluvium

Modern fluvial deposits of silt, sand, and cherty limestone gravel.

Qaf — Alluvial fan

Coalescing alluvial fans formed by streams draining the Kaibab Plateau consisting of poorly sorted cherty angular limestone gravel and limestone boulders the basal part of which may be consolidated. The outcrop area is restricted to the west side of Coyote Valley where the thickness varies from a few feet to several tens of feet.

Qs — Sand

Reddish-brown eolian and fluvial sand, derived from the Vermilion Cliffs, is gradational into landslide debris and restricted to east side of Coyote Valley. Varies from a few feet to several tens of feet in thickness.

Qsd — Slide debris

Boulders and large blocks of angular debris from the Glen Canyon group and Chinle formation in the landslide area along the cliffs east of Coyote Wash in the northeastern corner of map. Contains minor surficial sand.

Recent — QUATERNARY

UNCONFORMITY

Jn — Navajo sandstone

White to shades of red, brown, and orange coarse- to fine-, dominantly medium-grained, crossbedded sandstone, approximately 1,700 feet thick, consisting of subrounded to well-rounded frosted quartz grains generally very poorly to firmly cemented, but locally well cemented with iron oxide; locally calcite cement is present. Very locally lenses of sandy carbonate rock (calcitic dolomite and dolomitic limestone) occur. Generally, distinctive large- and medium-scale tangential crossbeds are prominent although parts of formation are nearly massive. Contorted crossbeds occur in numerous small widespread areas. Topographically the formation forms rounded knolls and cliffs with prominent joints. Outcrop is widespread. Much of the area is covered by sand usually a few feet thick, but locally as much as a few tens of feet thick. Lower contact is sharp, marked by the lowest tangential crossbeds; in places the almost massive part is difficult to distinguish from the upper part of the Kayenta formation.

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

Jk — Kayenta formation

About 280 feet of alternating beds of moderate reddish-brown/ with thin layers of light greenish-gray/ siltstone and similarly colored fine-grained sandstone. The sandstone forms ledges 10 to 40 feet thick and the interbedded parts that are dominantly siltstone form slopes of similar dimension. In the middle part of the formation, prominent beds of white fine-grained sandstone about 1 foot thick occur in the southern part becoming inconspicuous in northern part. All of the sandstones consist of well-sorted subangular to rounded quartz grains with sparse mica very poorly to firmly cemented; noncalcareous clay and iron oxide cement the reddish-brown sandstone; calcite and dolomite cement the white sandstone. The siltstone is thin bedded and in places crossbedded on a small scale; the sandstone is thin to thick bedded, ripple marked and crossbedded on a small scale in the lower part and on a medium scale at the top. The Kayenta formation forms a ledgy slope in contrast to the cliffs formed by the Navajo. The lower contact is sharp and conformable and is located at the base of a siltstone slope immediately above the prominent sandstone cliff formed by the Moenave formation.

Lower Jurassic(?) — Glen Canyon group

Trmos / Trmod — Moenave formation

Springdale sandstone member, Trmos, pale reddish-brown/ medium-grained massive sandstone about 200 feet thick, consisting of well-sorted rounded quartz grains with some mica flakes is poorly to well cemented with noncalcareous clay and iron oxide. Large crescent-shaped areas of yellow staining, probably iron oxide are characteristic. Lenticular stringers of conglomerate with angular sandstone and siltstone pebbles, crossbedded in part, occur most commonly near the base. The prominent ledge formed by the Springdale member and the color differences between the Springdale and the Kayenta are used to separate the two units. The basal contact is gradational and is placed at the top of the uppermost continuous even-bedded strata of the Dinosaur Canyon member. Dinosaur Canyon member, Trmod, predominantly red with minor gray spots and stringers, coarse- to fine-grained thin- to thick-bedded, calcareous to noncalcareous siltstone about 170 feet thick, forms a series of ledges and slopes. The lower contact is sharp and regular, and occurs at the base of a red ledgy siltstone and at the top of the rounded slopes of the Chinle formation.

Upper Triassic — TRIASSIC(?)

Trcc / Trcp / Trcs — Chinle formation

The Chinle formation stands out prominently from the other rock units because of its characteristic rounded slopes, dark-red upper part and gray lower part. Owl Rock member, Trcc, a variable unit about 470 feet thick consists of: (1) interbedded and interlensed fine- to medium-grained massive to crossbedded sandstone in shades of red, brown, and green composed of poorly to well-sorted rounded quartz grains with feldspar and biotite grains, which are very poorly cemented to firmly cemented with calcareous to noncalcareous clay; (2) massive calcareous to noncalcareous clayey siltstone and mudstone characteristically dark reddish-brown/ but also occurring in shades of red, brown, and gray with green spots; and (3) conglomeratic sandstone with angular to rounded variable sized fragments of mudstone, sandstone, siltstone, and earthy limestone well cemented by calcite. Siltstones comprising about 80 percent of the unit are mostly in the lower part; sandstones, about 15 percent, are mostly in the middle part; mudstones, about 4 percent, are mostly in the upper part; and conglomeratic sandstone lenses about 1 percent are mostly in the middle and upper part. Petrified Forest member, Trcp, a variable unit about 380 feet thick consists of mudstone, sandstone, and siltstone. The mudstone is massive noncalcareous bentonitic, and gray in the middle part of the member and variegated gray, red, and yellow in the lower middle part; weathers to a frothy rounded slope. The sandstone in the lower and upper part is generally gray; upper sandstone beds also contain red stringers of noncalcareous fine- to coarse-grained sandstone which consists of angular to subrounded quartz grains with minor biotite; lower sandstone beds are conglomeratic, very poorly to firmly cemented, and contain woody material. A few feet of mottled grayish-red, pale greenish-yellow/ and dusky yellow/ massive siltstone is present at the base of the member. The lower contact is conformable, but generally not well exposed. Exposures are mostly in the northern part of the quadrangle. Shinarump member, Trcs, a very light gray coarse- to very coarse grained, in places conglomeratic, massive to crossbedded sandstone consisting of angular to subrounded, well to poorly sorted quartz grains very poorly to firmly cemented with calcite and clay; the pebbles are rounded quartzite with rare siltstone. A lens of siltstone about 5 feet thick occurs in the middle part of the member in the northern part of the quadrangle. Limited, poor exposures of limy, poorly cemented sandstone occur in the southern part. In the northern part the thickness ranges up to 50 feet; thinning occurs to the south where the member is commonly absent. No channel filling was observed at the lower contact. The lower contact is sharp and unconformable, placed at the base of the sandstone. Although this member is a uranium ore horizon no deposits are known in this quadrangle.

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Upper Triassic — TRIASSIC

Trm — Moenkopi formation

Unmeasured, but probably about 750 feet of poorly exposed reddish-brown, with grayish-green beds and spots, very thin to thin-bedded calcareous ripple-marked, in part, gypsiferous siltstone and clayey siltstone; the unit weathers to a platy rounded slope with more resistant beds forming thin subdued ribs. The lower contact is placed at the base of red beds which rest unconformably upon the underlying limestone unit; the limestone surface has minor irregularities.

Lower and Middle(?) Triassic — TRIASSIC

UNCONFORMITY

Pku / Pkl — Kaibab limestone

Upper Kaibab, Pku, a variable unit about 100 to 130 feet thick with general tan color consisting of limestone, siltstone, and sandstone with some cherty beds. Dolomitic limestones are shaly to coarsely crystalline yellowish-gray/ to grayish-orange/ beds 5 to 20 feet thick. A bed 60 feet above the base is grayish-orange/ with grayish-green/ specks; it weathers to a light-brown rough jagged surface, and forms a prominent persistent ledge throughout the quadrangle. Similar beds weather dark gray form less prominent ledges. Grayish-yellow/ to moderate reddish-brown/ thin to very thin bedded calcareous siltstone forms the usually covered slopes between the resistant ledges. Very pale orange/ very fine grained well-sorted angular grained, calcareous sandstone with varying quantities of white, irregular stringers and lenses of chert occurs about 10 feet above the base. A basal 10-foot bed consists of white highly fractured vuggy cherty material which in places is limonite stained and resembles gossan; the cherty bed weathers to a rubble covered slope. The lower contact is conformable and sharp at the base of the cherty zone. Abundant marine fossils are present locally. Lower Kaibab, Pkl, consists of a sequence of limestone and sandstone beds about 270 feet thick. The limestone is shaly to finely crystalline and white at the top becoming grayish yellow at base. The upper part contains chert nodules in layers and numerous marine fossils (McKee, 1938). A few layers in the lower part contain coarse, rounded frosted quartz grains. White very fine grained ripple-marked and faintly crossbedded sandstone, consisting of well-sorted angular quartz grains cemented by carbonate (both calcareous and dolomitic), makes up the lower half of the unit. Both sandstone and limestone weather light gray; the chert beds are prominent. The lower contact which is placed between the lower shaly limestone of the Kaibab limestone and gypsum beds of the Toroweap formation is sharp and conformable.

PERMIAN

Pt — Toroweap formation

Predominantly limestone and gypsum with some beds of sandstone and siltstone. Only the upper part is exposed; this part is white to gray massive to irregular bedded gypsum and massive sandstone consisting of well-sorted fine-grained angular quartz grains cemented by carbonate (calcareous and dolomitic).

/ Colors determined by comparison with rock-color chart (Goddard, E. N., and others, 1948, Rock-color Chart: National Research Council).

Contact

(Dashed where approximately located; short dashes where indefinitely located; dotted where concealed)

Fault, showing dip

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

Vertical fault

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

High angle fault

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

Strike and dip of beds

Horizontal beds

6400

Structure contour

Drawn on base of upper Kaibab; dashed where approximately located; short dashes indicate projection above surface. Contour interval 100 feet. Datum is mean sea level. Data from adjacent quadrangles are used to locate contour lines.

Structural geology

This quadrangle covers a central part of the East Kaibab monocline which is a north trending, north plunging structure about 130 miles long. In this quadrangle the monocline plunges about 2° N. and has about 3,300 feet of relief with the east side downthrown. The flexure is sharp with maximum dips of about 30°. Minor warps make the surface of the monocline undulatory. Steep faults subparallel to the monocline cut the fold with maximum displacements of nearly 300 feet. Some of the faults have the east side downthrown thus increasing the relief on the monocline while in others the reverse is true. The faults die out in short distances into sharp folds which in turn die out in short distances. Numerous small unmapped faults occur in the areas of intense faulting. In the southeast corner of the quadrangle is a northwest-trending fault zone that extends a few miles into the adjacent quadrangle. In the west-central part a fault zone trending northeast has the south side downthrown about 200 feet. The fault zones which are generally poorly exposed consist of a brecciated zone a few feet wide. Minor folds and associated faults in relatively incompetent beds of the Moenkopi and Chinle formations are thought to be the drag-fold type and not well represented in the competent beds above and below. Location and amount of displacement of concealed faults is uncertain. Coyote Buttes consist of highly fractured Navajo sandstone with most of the fractures trending subparallel to the monocline.

Literature cited

McKee, E. D., 1938, The environment and history of the Toroweap and Kaibab formations of northern Arizona and southern Utah: Carnegie Inst. Washington Pub. 492.