



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 House Rock 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 House Rock 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 Vermilion Cliffs; varies from rubble to large segments of broken strata in which the beds have been disturbed so that rock units cannot easily be mapped; contains minor surficial sand.

Jn(s) Navajo sandstone

JK(a) Kayenta formation

Hms(s) Moenave formation

Hmd(s) Springdale sandstone member

Hcs(s) Chinle formation

Hcp(s) Petrified Forest member

Large torva-type landslide blocks from the Vermilion Cliffs in which the strata are essentially undisturbed except for downward and rotational movements; (s) indicates landslide block. Jn, Navajo sandstone; JK, Kayenta formation; Hms, Springdale sandstone member, and Hmd, Dinosaur Canyon member of the Moenave formation; and Hcs, Owl Rock member, and Hcp, Petrified Forest member of the Chinle formation.

UNCONFORMITY

Jn Navajo sandstone

White to shades of red, brown, and orange coarse- to fine-grained, cross-bedded 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 (caliche dolomite and dolomitic limestone) occur. Generally distinctive large- and medium-scale tangential crossbeds are prominent although parts of formation are nearly massive. Combed 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 lowest tangential crossbeds.

JK Kayenta formation

About 300 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. All of the sandstone consists of well-sorted subangular to rounded quartz grains with sparse mica very poorly to finely 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 located at the base of a siltstone slope immediately above the prominent sandstone cliff formed by the Moenave formation.

Hms Moenave formation

Springdale sandstone member, Hms, pale reddish-brown/ medium-grained massive sandstone about 160 feet thick, consisting of well-sorted rounded quartz grains with some mica flakes 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 Springdale ledge and the color differences between the Springdale and the Kayenta are used to separate the two units. 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, Hmd, predominantly red with minor gray spots and streaks, coarse- to fine-grained, thin- to thick-bedded calcareous to noncalcareous siltstone, about 100 feet thick, which forms a series of 10- to 15-foot ledges and slopes. About 35 feet from the base of the formation occurs a 15-foot bed of gray, yellow, and red, very thin to thin-bedded calcareous siltstone. An ostracod fossil zone occurs in the middle part of the 15-foot bed. 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.

Hcs 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, Hcs, is a variable unit about 150 feet thick consisting of: (1) interbedded and interless 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 sandstone 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 sandstone, 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; mudstone, about 4 percent, mostly in the upper part; and conglomeratic sandstone lenses, about 1 percent, are mostly in the middle and upper part. Exposures are generally limited to the southeastern part of the quadrangle. Petrified Forest member, Hcp, only upper part exposed; grayish-red purple/ with small spots of grayish-yellow green/ benthonic noncalcareous massive mudstone about 370 feet thick; weathers to light-gray rounded slopes with frothy surface. Isolated small outcrops of sandstone occur in the lower part of the member; the sandstone is white, massive, and coarse grained, consisting of angular well-sorted quartz grains well cemented by clay. Shinarump member, Hcs, usually poorly exposed, occurring only in northern part of the quadrangle. Near the northern boundary this unit is about 25 feet thick and composed of 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. Lenses of fine-grained massive sandstone consisting of angular well-sorted quartz grains, well cemented by silica. Sparse carbonate material occurs locally in the unit. Poor exposures of a few tens of feet of unconsolidated Shinarump occur in the central part of the quadrangle. Lower contact poorly exposed. Although this member is a uranium ore horizon no deposits are known in this quadrangle.

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Hm Moenkopi formation

Unmeasured, but probably about 370 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 formation weathers to a platy rounded slope with more resistant beds forming thin subbed ribs. Lower contact is placed at the base of red beds which rest unconformably upon the underlying limestone unit. The limestone surface has minor irregularities.

UNCONFORMITY

Hku Upper Kaibab

Hkl Lower Kaibab

Upper Kaibab, Hku, variable unit about 130 feet thick with general tan color consisting of limestone, siltstone, and sandstone with some cherty beds. The dolomitic limestones are shaly to coarsely crystalline grayish-yellow, 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 and 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 base. A basal 10-foot bed consists of white highly fractured waxy cherty material which in places is limonite stained and resembles gossan. The flinty 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, Hkl, consists of a sequence of alternating beds of limestone and sandstone about 270 feet thick. The limestone is shaly to finely crystalline, white at the top becoming gray yellow at the 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), occurs in a 15-foot bed 40 feet above base and as a 65-foot bed near middle of unit. Both sandstone and limestone weathers light gray; the chert beds are prominent. The lower contact is sharp and conformable at the contact between the shaly limestone and the gypsum beds of the Torowasp formation.

Ht Torowasp formation

Predominantly limestone and gypsum with some beds of sandstone and siltstone about 230 feet thick. Upper 145 feet is white to gray massive to irregular bedded gypsum with 1- to 10-foot beds of white to yellowish-orange/ massive sandstone consisting of well-sorted fine-grained angular quartz grains cemented by carbonate (calcareous and dolomitic) in the middle part. Below the gypsum is about 60 feet of yellowish-gray thick-bedded fine-grained limestone very similar to the lower part of the Kaibab limestone. The basal unit is a 25-foot bed of yellowish-gray very calcareous massive siltstone with shaly limestone beds and some coarse rounded frosted quartz grains. Indistinct fossil casts are present. The basal contact is sharp at top of red beds of the Hermit shale.

Hh Hermit shale

Incomplete exposure, reddish-brown with grayish-orange beds, massive siltstone with coarse rounded frosted quartz grains. Colors determined by comparison with rock-color chart (Goddard, E. W., 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; queried where doubtful or probable; U, upthrown side; D, downthrown side)

Vertical fault

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

Fault at structure contour datum surface

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

Structure contour

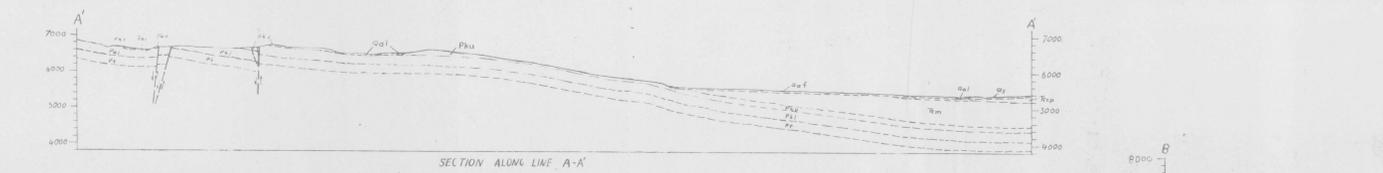
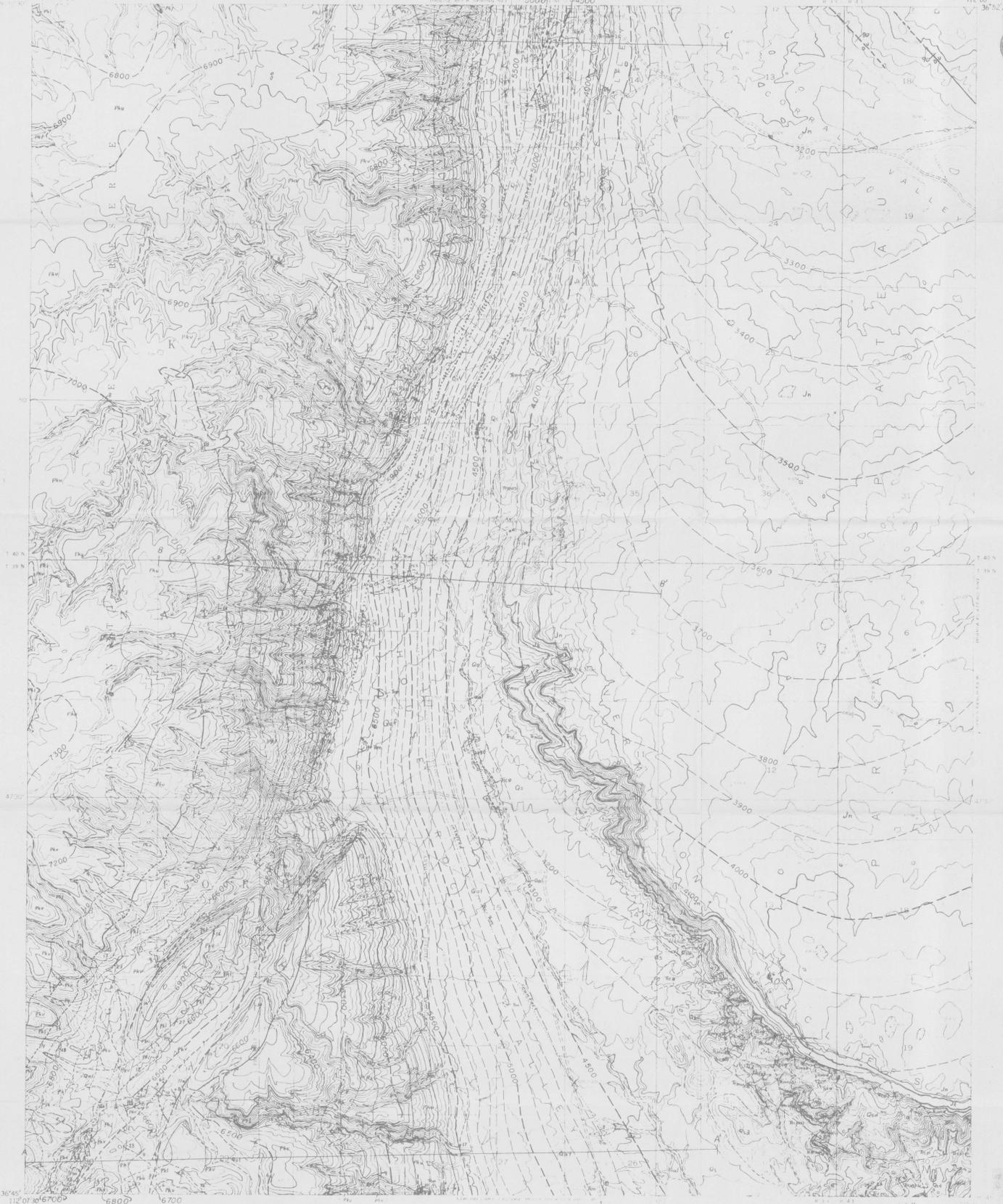
Drawn on base of upper Kaibab, dashed where approximately located; short dashes indicate projection above surface. Contour interval 100 feet. Datum is mean sea level. Data from adjacent quadrangles are used to locate contour lines.

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. A minor synclinal warp occurs near the eastern margin of the quadrangle. Steep faults subparallel to the monocline cut the fold with maximum displacements of about 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. In the northeast corner of the quadrangle is a northwest-trending fault zone that extends a few miles into the adjacent quadrangles. The fault zones which are generally poorly exposed consist of a basement 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.

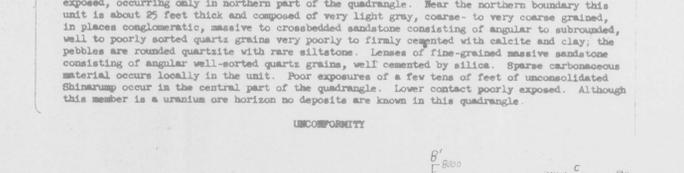
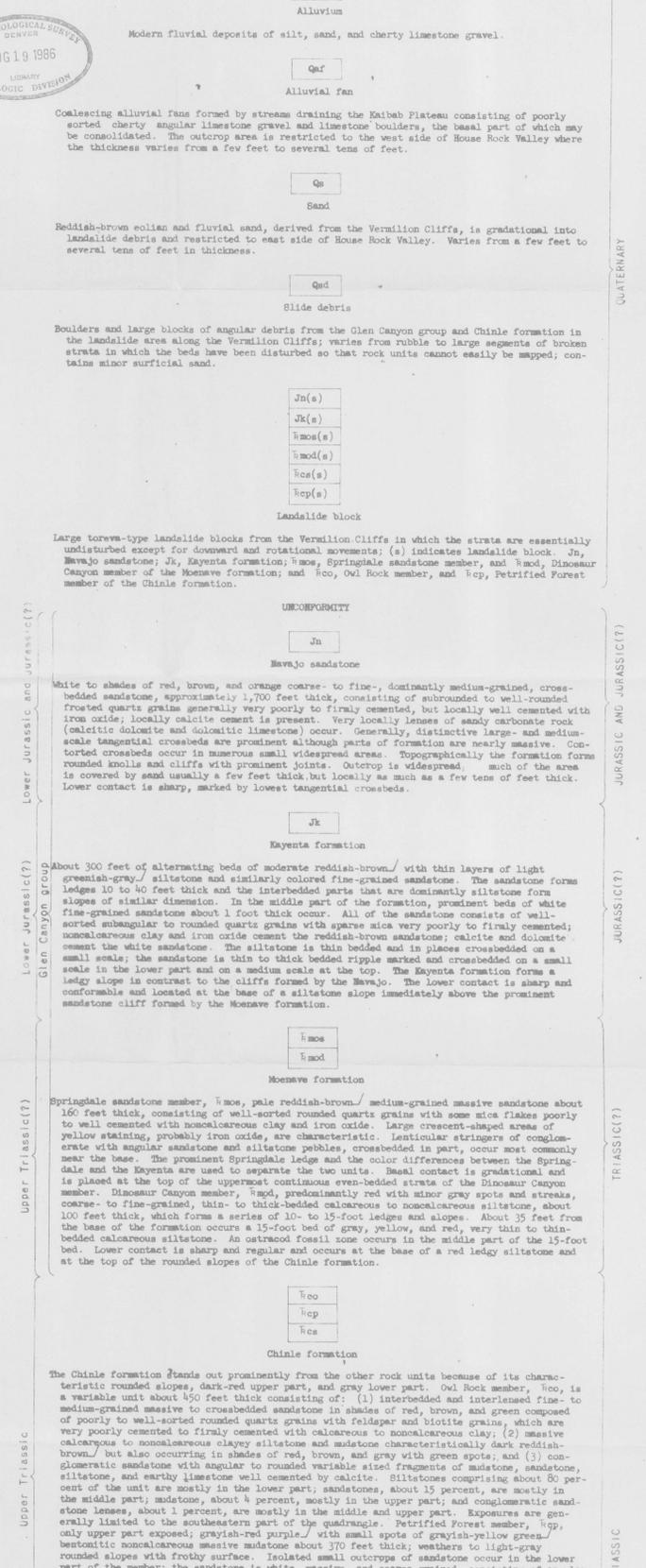
Literature cited

McKee, E. D., 1938, The environment and history of the Torowasp and Kaibab formations of northern Arizona and southern Utah: Carnegie Inst., Washington Pub. 107.



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

BY JOHN D. WELLS  
SCALE 1:24,000  
Mapped by the Geological Survey 1954  
Topography by multiple methods from aerial photographs taken 1953  
Dashed lines indicate approximate locations  
Symbols and other detail herein drawn for 1:62,500 scale publication  
APPROXIMATE MEAN DECLINATION 1954  
CONTOUR INTERVAL 40 FEET  
DATUM IS MEAN SEA LEVEL



SECTION ALONG LINE B-B

SECTION ALONG LINE C-C

LOWER AND MIDDLE(?) TRIASSIC  
QUATERNARY  
JURASSIC AND JURASSIC(?)  
TRIASSIC(?)  
TRIASSIC  
PERMIAN