UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Geology of the Cricket Mountains, Millard County, Utah

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1984

Open-File Report 84-683

Prepared in cooperation with the Utah Geological and Mineral Survey

Geology mapped by Lehi F. Hintze, 1981-83, in large part modified from mapping by students of the 1958 Brigham Young University summer geologic field course.

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

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DESCRIPTION OF MAP UNITS

Qe EOLIAN DEPOSITS (Holocene and Pleistocene)--Silt and fine sand derived mostly from valley-bottom lake and alluvial deposits; in places 10 m thick

Qlca LAKE, COLLUVIAL, AND ALLUVIAL DEPOSITS, UNDIVIDED (Holocene and Pleistocene)--Unconsolidated and semiconsolidated sediments. Well sorted Lake Bonneville silt, sand, and gravel and poorly sorted stream, fan, and slope-wash deposits; locally at least 60 m thick

Qac ALLUVIUM AND COLLUVIUM (Holocene and Pleistocene)--This map unit is used in few places to identify deposits in alluvial basins above highest Lake Bonneville shoreline. Consists of poorly sorted silt, sand, and gravel. Also used locally to separate landslide materials from Qlca. Qac in southwestern corner of Candland Spring quadrangle consists almost entirely of jumbled blocks of Dome Limestone and probably is the result of landsliding on a dip slope underlain by Chisholm Shale. Locally 20 m thick

Qoc OLD COLLUVIUM (Pleistocene)--Unconsolidated bouldery deposits on mountain flank 2 km east of Cruz. Lake Bonnneville shoreline cuts these deposits, locally about 15 m thick

Qbr BASALT OF BLACK ROCK (Pleistocene)--Dark-gray vesicular basalt composed chiefly of plagioclase with lesser clinopyroxene, olivine, and Fe-Ti oxides as described by Condie and Barsky (1972) who report a whole-rock K-Ar date of .97 m.y. Crecraft, Nash, and Evans (1981) give a 1.3 m.y. whole rock K-Ar date. Thickness 0-30 m. This basalt is directly overlain by the Bishop Tuff, age 0.6 m.y., exposed near BM 4922 1.1 km east of Black Rock as shown on the Black Rock 7½-minute quadrangle

QTs SEDIMENTS (Pleistocene-Pliocene)--Green and tan deposits of semi-consolidated silt, tuffaceous sand, and clay that are mostly concealed by surficial deposits east of Cricket Mountains. Map shows only best exposures along Beaver River and near State Highway 21. Base concealed; thickness unknown, but a least 50 m. These beds were probably laid down in a pre-Bonneville lake. They include the Huckleberry Ridge ash, dated by Izatt and Wilcox (1982) at 2.02 m.y. This ash is exposed in road cuts along Utah Highway 257 as noted on the southern part of the Cat Canyon quadrangle. This unit is in part equivalent to the unnamed marly limestone (QTl) of Steven and Morris (1983)

Tmd RHYOLITE AT MID-DOME (Pliocene)--Felsitic rhyolite dated at 2.5 m.y. by Crecraft, Nash, and Evans (1981, p. 10,305) who also give modal composition and major chemical analysis of this rhyolite

Tl LIMESTONE (Pliocene)--Indurated light brownish-gray lacustrine limestone that post-dates silicic volcanic rocks dated at 2.7 m.y. and is capped by basalt dated at 2.5 m.y. as noted by Crecraft, Nash, and Evans (1981, p. 10,304) and Whelan and Bowdler (1979, p. 82) in adjoining quadrangle to the south. As much as 30 m thick

Tcm RHYOLITE OF CUDAHY MINE (Pliocene)--Obsidian and felsitic lava flows and volcaniclastic material. Parts of some obsidian flows contain spherulites and lithophysae that characterize the well-known "snowflake" obsidian from this locality valued by prehistoric Indians and modern rock-hounds. Crecraft, Nash, and Evans (1981, p. 10,305) report that the rhyolite contains 76 percent SiO_2, and list quartz, sanidine, plagioclase, biotite, horneblende, augite, ortho-pyroxene, fayalite, magnetite, and ilmenite as scattered phenocrysts. Mehnert (1978, p. 6) reports age of 2.4 m.y. Thickness about 50-150 m

Tch RHYODACITE OF COYOTE HILLS (Pliocene)--Zoned plagioclase phenocrysts, 1-2 mm in length make up 6-12 percent of this rock by volume according to Crecraft, Nash, and Evans (1981, p. 10,305) who also state that this is the least silicic felsic rock of the area, containing 71 percent SiO_2. K-Ar age is 2.7 m.y. At least 200 m thick in places

Tc CONGLOMERATE OF RED PASS (Paleocene?)--Well- to poorly-cemented conglomerate containing limestone, dolomite, and quartzite pebbles and cobbles in a matrix of red-weathering sandstone, siltstone, and shale. Contains no clasts of volcanic rocks. At Red Pass, in the Red Pass quadrangle where the formation derives its name, the lowest 30-50 m exposed consists of unconsolidated conglomerate in a clayey matrix; this is overlain by 25 m of conglomerate in a well-cemented sandy matrix, and in succession by 8 m of algal limestone that forms a rim-rock. Aurele La Rocque (letter March 14, 1959) identified the poorly preserved shells present here as the gastropods *Goniobasis* and *Hydrobia* and said that similar forms occur in both the North Horn and Flagstaff formations in central Utah. The uppermost 8 m at Red Pass consists of well-cemented limestone conglomerate that caps hill 5460.

This may be the same formation that Lemmon and Morris (1983, p. 5) designated as the Conglomerate of High Rock Pass. It may also correlate with the Claron Formation of the Iron Springs area in southern Utah. The red color of the matrix is similar to that of the Flagstaff, "Wasatch", and Claron formations in south-central and southwestern Utah. The conglomerate is very well exposed in the Cat Canyon quadrangle where the secondary road crosses a low divide marked 5294 2 km south of Cat Canyon Reservoir. Here the formation is 70 m thick; however, extent of exposures between hill 5286 and State Highway 257 suggest that as the conglomerate may be as much as 500 m thick there. At divide 5294 the lowest 30 m of conglomerate west of the road is made up almost entirely of Cambrian carbonate clasts, whereas the younger beds on the hill east of the road are nearly all made up of Prospect Mountain and Mutual quartzite clasts. This inverted succession reflects erosional unroofing of a source terrain composed of a normal Cambrian sequence of strata

Tcl LIMESTONE OF FILLMORE CANYON (Paleocene?)--White to very light gray limestone, mostly massive, vuggy and resistant, forming low hills; some parts are thin-bedded, non-resistant, and form poor exposures and have some layers that contain abundant impressions of small freshwater bivalves and high-spired gastropods. Best fossils occur in NE section 20, T 22 S, R 10 W. Limestone is 40-50 m thick near the head of Fillmore Canyon

Tbr BRECCIA OF CAT CANYON (Paleocene?)--Breccia consisting entirely of gray Cambrian carbonate rocks in fragments ranging from granule to boulder size but predominantly pebble size that are thoroughly cemented with a gray carbonate mineral. Appears to represent an indurated talus or rubble lying with angular unconformity on tilted Cambrian limestone and dolomite. Large masses of disrupted but semicoherent Cambrian strata on the west flank of hill 5843 in sections 5, 6, 7, and 8, T 23 S, R 9 W are thought to be landslide masses of the same age as the nearby breccias and are therefore included in this map unit. Breccia is as much as 50 m thick

Cn NOTCH PEAK FORMATION (Upper Cambrian)--Limestone, medium-dark-gray, thick-bedded to massive, forms cliff capping hill 5843 in Cat Canyon quadrangle. About 30 m present, but is only the lowest part of a regional thickness of some 500 m (Hintze, Miller, and Taylor, 1980)

ORR FORMATION (Upper Cambrian)--This formation has been subdivided by Hintze and Palmer (1975) into the members used herein

Ꞓos SNEAKOVER LIMESTONE MEMBER--Light- to medium-gray, thin- to medium-bedded ledge-forming limestone. Lower half is muddy limestone and upper half includes many bioclastic layers bearing an *Elvinia* zone trilobite fauna. Thickness is 30 m

Ꞓocs CORSET SPRING SHALE MEMBER--Very poorly exposed greenish shale with few interbeds of very thin-bedded light-gray limestone. Unit is 12 m thick

Ꞓoj JOHNS WASH LIMESTONE MEMBER--Light- to dark-gray, thin- to medium-bedded mostly mottled and muddy limestone and dolomitic limestone with 5 m of oolitic limestone in middle; forms low ledges. Contains *Housia* trilobite fauna in upper 2 m. Thickness 30 m

Ꞓoc CANDLAND SHALE MEMBER--Poorly exposed olive-gray shale with interbeds of dark-gray, thin-bedded nodular limestone with abundant trilobites: *Tumicephalus* in lowest 10 m, *Bromella*? 15 m above base, *Prehousia alta* 30 m above base, and *Dunderbergia* 35 m above base. Member is 50 m thick and forms a slope

Ꞓob BIG HORSE LIMESTONE MEMBER--Ledge and cliff-forming, medium- to dark-gray or pinkish-gray limestone. Fine- to medium-grained, some beds bioclastic; includes 40 m of dolomite in middle, some of which consists of algal stromatolites and algal boundstone. *Crepicephalus* trilobite fauna collected 125 m above base of section where measured on hill 6012 above the limestone mines near Georges Pass on the Cat Canyon quadrangle. Member is 200 m thick

WAH WAH SUMMIT FORMATION (Upper Cambrian)--Members mapped here follow nomenclature outlined by Hintze and Robison (1975, p. 889)

€wsw WHITE MARKER MEMBER---Light-gray, fine-grained, medium- to thick-bedded limestone and dolomite that weathers to form the most prominent light-colored stratum on aerial photographs of the area. Abandoned limestone quarries near Georges Pass in the Cruz and Cat Canyon quadrangles are in this unit which is 50-70 m thick

€wsl LEDGY MEMBER--Ledge- and cliff-forming dark gray limestone and dolomite delimited above by white marker member and below by slope that develops on shaly Fish Spring Member of Trippe Limestone. Includes a few thin beds of laminated light-gray dolomitic algal boundstone. Member is 125 m thick

TRIPPE LIMESTONE (Middle Cambrian)--Members mapped here follow nomenclature outlined by Hintze and Robison (1975, p. 888)

€tf FISH SPRINGS MEMBER--Persistent slope-forming shaly unit that is seldom fully exposed but is readily identifiable by ubiquitous occurrence of very thin-bedded intraformational flat-pebble limestone conglomerate float. Yields *Eldoradia* trilobite fragments locally. Best exposure is in cut behind upper radio relay tower in section 9, T 23 S, R 9 W, on Cruz quadrangle. Member is 30 m thick

€tl LOWER MEMBER--Alternating dark-gray ledge-forming limestone and light-gray to white laminated to thin-bedded slope-forming dolomitic boundstone. Member is recognizable from a distance and on aerial photos by its predominantly light-toned ribbon banded appearance. About 200 m thick

€cm LIMESTONE OF CRICKET MOUNTAINS (Middle Cambrian)--No reliable way of mapping divisions within this thick and somewhat heterogeneous formation has been found. It consists mostly of dark gray calcilutite and calcisiltite commonly mottled with irregular patches of brownish-gray dolomitic limestone that appear to represent penecontemporaneous bioturbation of the limy mud. Light-gray, thin-bedded to laminated limy and dolomitic boundstone occurs sparsely in the upper two-thirds of the formation in beds up to 3 m thick. Attempts to use individual boundstone units as mapping boundaries met with failure because they pinch out laterally and cannot be reliably correlated from fault block to fault block.

The Limestone of Cricket Mountains is well exposed on the east flank of Poison Mountain in the Candland Spring quadrangle where a light-brownish-gray coarsely crystalline dolomite forms a conspicuous band from 200 to 300 m above the base of the formation. This dolomite is not present 16 km to the south in Cat Canyon where the equivalent horizon consists of mottled limestone and some laminated boundstone. The Limestone of Cricket Mountains is here defined as all strata between the top of the Whirlwind Formation and the base of the lower member of the Trippe Limestone. The Whirlwind Formation can always be surely identified by the presence of *Ehmaniella*--bearing limestone nodules in the slopes it forms; the Trippe Limestone can also always be positively identified by *Eldoradia*--bearing nodules in its upper member; the lower member of the Trippe Limestone forms a conspicuously light-banded appearance because of the numerous boundstone layers it contains.

The interval occupied by the Limestone of Cricket Mountains is equivalent to the Marjum, Wheeler, and Swasey formations of the House Range area 60 km to the northwest, and to the Pierson Cove, Eye-of-Needle, and Swasey formations of the Wah Wah Mountains 60 km to the southwest. The basal dark-gray limestone cliffs of the Limestone of Cricket Mountains are similar in most respects to the cliff-forming Swasey Limestone of the House and Wah Wah ranges and the Swasey name would have been extended into the Cricket Mountains area except for the absence of a consistent way to identify the top of the Swasey in the area. This basal Swasey-equivalent portion of the formation is mostly dark-gray mottled lime mudstone, locally cross-bedded, and it includes a few horizons that are oolitic or pisolitic. The basal cliff ranges from 35 to 180 m in thickness. At Poison Mountain where the basal cliff is 85 m thick the succeeding 125 m is mostly medium-to dark-gray bioturbated lime mudstone that forms ledge and slope topography. This is overlain by 100 m of light brownish gray cliff-forming coarse-grained dolomite. That is overlain by dark gray limestones with some light gray boundstone interbeds that form the backslope of Poison Mountain. The entire Limestone of Cricket Mountains is not present in any completely exposed or unfaulted section but it appears to be about 600 m thick

Ꞓw WHIRLWIND FORMATION (Middle Cambrian)--Predominantly light-olive-gray slope-forming shale with interbeds of thin bedded limestone of two types: a coquina of heads of the small trilobite *Ehmaniella*; intraformational silty limestone flat-pebble conglomerate that commonly shows mudcracks or trace fossil trails. Typically forms a slope underlain by yellowish soil between more massive adjacent limestone units. 60-80 m thick

Ꞓd DOME LIMESTONE (Middle Cambrian)--Cliff-forming limestone; basal third is medium-dark-gray, weathering with zebra-banded stripes, fine grained, thin- to medium-bedded, and forms dark ledges above upper Chisholm Shale slope. Middle third forms lower part of massive light-gray cliff and is mostly calcisilitite with 10 percent oolitic beds and numerous horizons of secondary dolomite having a mottled appearance. Upper third in Headlight Canyon is medium- to light-gray calcilutite with 20 percent intercalcated bands of medium-dark-gray calcisiltite, forming the upper banded part of the Dome cliff. In the Candland Spring quadrangle, from Poison Mountain northward, the upper third of the Dome contains much thin- to medium-bedded dolomitic algal boundstone that forms a ledge and slope topography atypical of the Dome. These boundstones are well exposed near the mine near road junction 5220 in Section 19, T. 21 S, R 9 W. Dome Limestone ranges in thickness from 70 to more than 100 m

Ꞓc CHISHOLM FORMATION (Middle Cambrian)--A three-part formation consisting of a lower shale 8-15 m thick, a middle limestone that comprises most of the formation and an upper shale about 5-15 m thick. This formation is so easily and unequivocally identifiable that it serves as a key reference horizon in mapping. The lower shale is dark olive gray and includes a few thin beds of limestone that are a coquina of Glossopleura trilobite fragments. Loose pieces of this olive-weathering trilobite hash can be found on any slope where the lower shale occurs. The middle part of the Chisholm is dark-gray, thin-to thick-bedded limestone characterized by numerous oncolitics and pisolites. The upper shale is olive-gray to reddish-brown and forms an ever-present slope at the base of the Dome Limestone ledges and cliffs. Chisholm Formation is 50-80 m thick

HOWELL LIMESTONE (Middle Cambrian)--Members as mapped follow subdivisions discussed by Hintze and Robison (1975, p. 884)

Ꞓhu UPPER MEMBER--This member exhibits considerable variation in the Cricket Mountains. In the south near Headlight Canyon it is a medium-gray calcisiltite containing rod-shaped or branching bodies and forming a massive cliff. From the Candland Spring quadrangle northward this member includes thin-bedded fine-grained sandstone that weathers reddish-, yellowish-, and brownish-gray and commonly shows interference ripple marks; light to dark gray dolomitic boundstone beds are present as well. In this area it forms ledge and slope topography. Member is 30-50 m thick

Ꞓhm MILLARD MEMBER--Characterized by dark-gray calcisiltite, generally forming ledges or cliffs and typically bearing pisolites or oncolites. Contains variable proportions of shale and fine grained sandstone or quartzite interbeds similar to those in underlying Tatow Member. Contact between Tatow and Millard members placed at base of lowest major (10 m or more) dark-gray ledge or cliff-forming unit. General appearance of Millard Member from a distance is dark-gray ledges, slopes, and cliffs. Glossopleura trilobite fragments obtained 30 m above base of member near Petes Knoll, Section 35, T 22 S, R 11 W. Thickness 60-75 m

PIOCHE FORMATION (Middle and Lower Cambrian)--Members as mapped follow subdivisions discussed by Hintze and Robison (1975, p. 882-3)

€pt TATOW MEMBER--Transitional between limestone-free lower member of the Pioche Formation and predominantly carbonate Millard Member of the Howell Limestone. Base of Tatow taken at lowest bed (commonly 1-2 m thick) of limestone or dolomite in the Cambrian section. Tatow Member generally weathers rusty orange-brown making it easy to identify from a distance from the dark brown lower Pioche and the dark gray Millard Member. Mexicella mexicana, Paralbertella bosworthi?, and Volocephalina connexa were identified by R. A. Robison (letter, June 2, 1982) from 2 m above the base of the member near Petes Knoll, Sec. 35, T. 22 S., R. 11 W. Member is 25-35 m thick

LOWER MEMBER--Interbedded dark-brown, brownish-gray, or reddish-brown quartzite and dark-greenish-gray micaceous siltstone. Member shows in dark shades on aerial photos and forms more rounded ledge-slope topography than adjacent units. A hematite-rich iron stone layer 1-2 m thick, has been noted by Bullock (1970, p. 69) as a potential iron ore and is shown in places on the map by -I- symbol. It shows up on aerial photos as a discontinuous thin dark stratum about 50-60 m above the base of the formation which was taken at the lowest occurrence of significant beds of brownish or greenish-gray micaceous siltstone or quartzite. Lower member is 200-230 m thick

€pm PROSPECT MOUNTAIN QUARTZITE (Lower Cambrian)--Grayish pink vitreous orthoquartzite ranging from very fine to coarse-grained with scattered thin quartzite pebble conglomerate beds. It is thick-bedded to massive and commonly shows cross bedding. It weathers to form reddish-brown ledges and cliffs that make up the western front of the range. Maximum exposed thickness in this range is about 1000 m. The exposed strata correspond only to the upper member of the formation as mapped by Lemmon and Morris (1983) in the next quadrangle to the south where they reported a total thickness of 2200 m and mapped a 10 m basalt flow present about 500 m above the base. This flow is inferred to be present in the subsurface beneath the Cricket Mountains and is represented on cross sections as €pmb

p€m MUTUAL QUARTZITE (Upper Proterozoic)--Dark red quartzite mapped by Lemmon and Morris (1983) in adjacent quadrangle to the south and inferred on cross sections to be present in the subsurface here

STRUCTURE

As noted early in this century by Burling (1912), the Cricket Mountains consist primarily of uncomplicated eastward-tilted strata cut by north-trending normal faults. As shown on the accompanying maps and cross-sections, the oldest rocks are exposed on the west side of the range and the youngest Cambrian strata are on the southeastern edge.

Because the exposed structure of the range is so simple, it is perhaps surprising to realize that the Cambrian strata are all allochthonous as shown on the state geologic map by Hintze (1980). The base of the overthrust plate is exposed in the Frisco Peak quadrangle (Hintze, Lemmon, and Morris, 1984) and the upper plate rocks can be traced continuously from there into the Cricket Mountains. Verification of the thrust relationship by a well drilled in the Neels quadrangle was noted by Welsh (1983).

The only part of the range that exhibits steep dips is located on the east side of the Candland Spring quadrangle south of Broadmouth Canyon in sections 7, 8 and 18, T. 22 S., R. 9 W. where the lower member of the Trippe Limestone trends northeastward nearly vertically for about 2 km. This structure appears to truncate Tbr and would thus be more likely related to late Tertiary Basin-Range block-faulting than to Mesozoic Sevier thrusting and folding.

Most of the Cambrian strata of the Cricket Mountains can be directly compared to similar beds in the House and Wah Wah ranges to the west as discussed by Hintze and Robison, 1975. Facies changes between these ranges are no greater than one would expect on the basis of their present geographical separation. On the other hand, Cambrian strata on the Crickets are considerably different in thickness and lithology than those exposed 30 km to the east in the south end of the Pavant Range as described by Davis (1983). The most obvious difference is the eastward diminution of the mappable shale units, particularly the Chisholm and the Whirlwind, and the consequent merging of the carbonate units in the Pavant exposures. Whether these facies changes are the result of original depositional processes or whether they reflect relative movement on thrust plates cannot be determined.

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EXPLANATION OF MAP SYMBOLS

CONTACT--Dashed where approximately located or inferred

HIGH-ANGLE FAULT--Dashed where approximately located or inferred; dotted where concealed; bar and ball on relatively downdropped side

RECENT FAULT SCARP--Dashed where approximately located; offsets Quaternary deposits. See Anderson and Bucknam, 1978, and Crone and Harding, 1984

FAULT FROM GRAVITY DATA--See Case and Cook, 1979, for survey data

SINKHOLES--Pipes or undrained depressions in lake sediments on Headlight Mountain and Borden quadrangles

LAKE BONNEVILLE SHORELINES--Only the most prominent bars and benches are identified with this symbol. Countless others exist.

STRIKE AND DIP OF BEDS
- Inclined
- Horizontal
- Vertical

TRAVERSE LINE OF STRATIGRAPHIC SECTION MEASUREMENT

EXPLANATION

Qe, Qlca, Qac	Holocene and Pleistocene	QUATERNARY
Qoc, Qbr	Pleistocene	QUATERNARY
QTs	Pleistocene and Pliocene	QUATERNARY
Tmd, Tl, Tcm, Tch	Pliocene	TERTIARY
Tc, Tcl, Tbr	Paleocene	TERTIARY
Єn, Єos, Єocs, Єoj, Єoc, Єob, Єwsw, Єwsl, Єtf		CAMBRIAN

Ɛtl

Ɛcm

Ɛw

Ɛd

Ɛc

Ɛhu

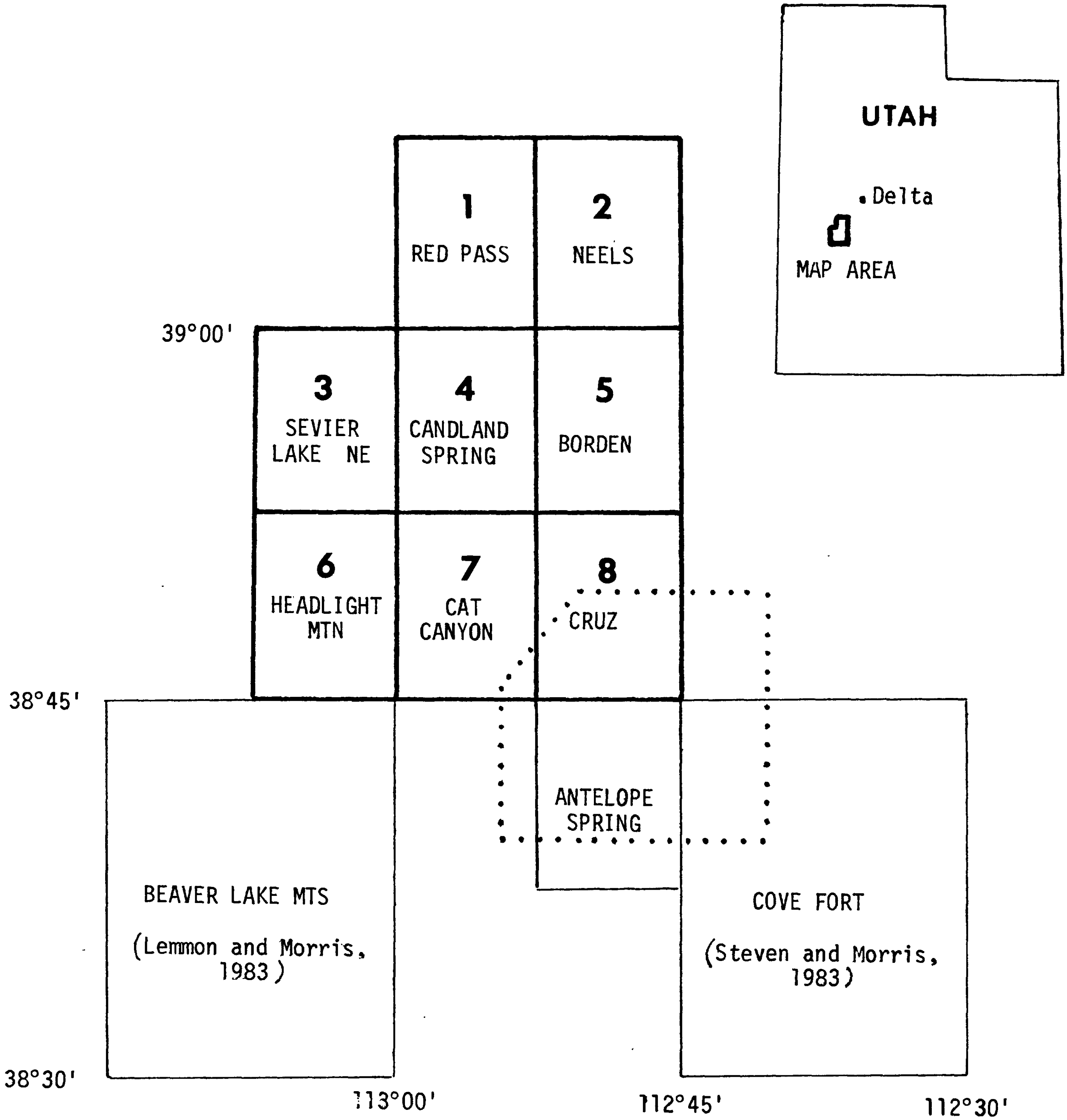
Ɛhm

Ɛpt

Ɛpl

Ɛpm Ɛpmb

pƐm PRECAMBRIAN



Index map showing the location of eight 7 1/2-minute quadrangles covering the Cricket Mountains in relation to adjacent areas covered by geologic maps. The Antelope Spring quadrangle was mapped by Whelan and Bowlder, 1979. Area within the dotted outline was covered by Crecraft, Nash, and Evans, 1981.