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Reprinted for private circulation from
THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS BULLETIN
Vol. 51, N. 2, February, 1967

THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS BULLETIN
V. 51, NO. 2 (FEBRUARY, 1967), P. 235-243, 7 FIGS.

STRATIGRAPHY AND CORRELATION OF LATE PRECAMBRIAN ROCKS OF PILOT RANGE, ELKO COUNTY, NEVADA, AND BOX ELDER COUNTY, UTAH[1]

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ABSTRACT

Approximately 3,300 feet of metasedimentary rocks believed to correlate lithologically with Units C, D, E, F, and G of the late Precambrian McCoy Creek Group (Misch and Hazzard, 1962) is exposed in the Pilot Range. Unit G is disconformably overlain by Lower Cambrian Prospect Mountain Quartzite (restricted).

These Precambrian rocks were regionally metamorphosed to slate, argillite, phyllite, metasiltstone, and quartzite. The rocks of Unit G show the effects of subsequent static thermal metamorphism of biotite grade.

The Precambrian rock units have characteristic heavy-mineral assemblages that are useful in correlation.

Introduction

Approximately 3,300 feet of slate, argillite, phyllite, metasiltstone, quartzite, and conglomerate that are lithologically similar to Units C, D, E, F, and G of the late Precambrian McCoy Creek Group (Misch and Hazzard, 1962) is exposed in the Pilot Range of Nevada and Utah (Fig. 1, loc. 1).

A disconformity at the base of the overlying Lower Cambrian Prospect Mountain Quartzite (restricted)[3] (Misch and Hazzard, 1962; Woodward, 1963, 1965) forms the basis for the assignment of the underlying McCoy Creek Group to the late Precambrian.

Interest in these older rocks stems from their use in determining local structure, their bearing on the earlier tectonic and sedimentary history of the region, and their apparent stratigraphic control on ore deposition, *e.g.*, Unit F in the Cherry Creek district, Nevada (Fritz, 1960; Adair, 1964).

Misch and Hazzard (1962) first noted the presence of rocks of the McCoy Creek Group in the Pilot Range but did not examine them in detail. In an abstract, Blue (1963) reported the existence of 6,700+ feet of Proterozoic strata that he included in the Prospect Mountain Quartzite (non-restricted). Because he gives no lithologic descriptions, it is impossible to relate his Proterozoic rocks to the strata described in this paper. Judged from his reported thickness of Prospect Mountain Quartzite (non-restricted), it seems that he has placed the base of the Cambrian System within the Prospect Mountain Quartzite (restricted) of this report. The geologic map of northwestern Utah (compiled by Stokes, 1963) shows Prospect Mountain Quartzite (non-restricted) as being the oldest formation in the Utah part of the range. Some of the strata so designated are Precambrian and units of the McCoy Creek Group as described herein.

McCoy Creek strata in the Schell Creek and Southern Snake Ranges were regionally metamorphosed during Mesozoic time according to Misch (1960) and Misch and Hazzard (1962). They show that weak regional metamorphism extends upward through the Lower Cambrian, affecting the Prospect Mountain Quartzite (restricted) in the Schell Creek Range and the Pioche Shale in the Southern Snake Range.

Stratigraphy

Sections in the Pilot Range were measured with a Jacob staff and Brunton, and samples were collected along the northwest corner of Pilot Peak about 2 miles southeast of Bar O Ranch (Fig. 2). Although there are minor faults in the measured section, it appears to be the most complete and least faulted Precambrian section in the range. This section begins at the foot of the range where alluvium covers the base of Unit C

[1] Manuscript received, February 3, 1966; accepted, March 3, 1966.

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The writer expresses his gratitude to Peter Misch for critically reading the manuscript. The Research Allocations Committee of the University of New Mexico provided funds for thin sections used in this study.

[3] This term, defined by Misch and Hazzard (1962), is used to denote the dominantly quartzitic sequence containing only minor pelitic and semipelitic beds.

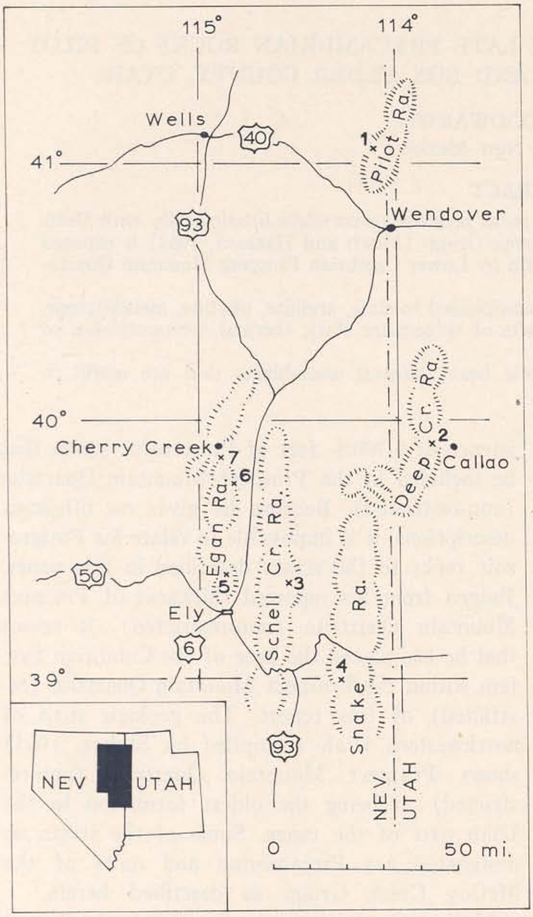

FIG. 1.—Index map, eastern Nevada and western Utah. Numbers refer to locations mentioned in text and correlation chart.

and it ends near the crest at the contact with Lower Cambrian Prospect Mountain Quartzite (restricted); the Precambrian formations appear to be conformable, one with another, and are concordant but disconformable beneath the Prospect Mountain Quartzite (restricted) (Fig. 3).

Terms to describe thickness of stratification are those of McKee and Weir (1953), and the particle-size classification used is that proposed by Wentworth (1922).

Unit C.—This unit is poorly exposed, its presence being detected from phyllite fragments among float of quartzite derived from Unit D above. Neither the base nor the upper contact of Unit C is exposed; the distribution of float suggests that approximately 200 feet is present.

Unit C is composed principally of platy, greenish and gray, spotted phyllites with minor dark greenish gray, fine-grained quartzite intercalations.

The phyllite contains thin laminae rich in quartz silt which apparently represent original beds (s_1). Schistosity (s_2), parallel with bedding, is defined by sericite and chlorite. Idiomorphic opaque minerals have pushed aside the schistosity and give the phyllite a spotted appearance. In the quartzite, the clastic character of the quartz grains is preserved in a chlorite and sericite matrix.

Lithologic correlatives of Unit C have been described from the Southern Snake and Schell Creek Ranges (Misch and Hazzard, 1962) and from the Egan Range (Fritz, 1960; Woodward, 1963).

Unit D.—The base of this cliff-making formation is covered by quartzite talus; therefore, the lower contact is placed at the highest occurrence of phyllite float of Unit C. Numerous fractures, slickensides, and quartz veins indicate minor deformation within the unit; thus, the true stratigraphic thickness may be slightly greater or less than the measured 535 feet.

The lower 410 feet consists of thick-bedded, light gray, medium-grained to gritty quartzite. Grain size increases upward and the upper part of this unit contains abundant light gray, subrounded quartz granules. Also, the upper part of the formation contains two 25-foot zones of bench-forming green slate separated by 60 feet of thick-bedded, cliff-making greenish grit. This grit contains clear to whitish, subrounded quartz granules set in medium- to fine-grained green quartzitic matrix. The top of the formation occurs on a 15-foot grit sequence similar to the one below it.

Well-aligned sericite and chlorite in the slates define a schistosity (s_2) that is parallel with bedding (s_1). Locally s_2 has been isoclinally microfolded with shears (s_3) developed along the limbs. In the quartzite contiguous quartz clasts are incipiently sutured, although clastic texture generally is well-preserved because of the presence of interstitial sericite and chlorite.

Unit D is lithologically correlative with the Willard Creek Quartzite of the Southern Snake Range and Unit D of the McCoy Creek section in the Schell Creek Range (Misch and Hazzard, 1962). A comparison of lithologic character with

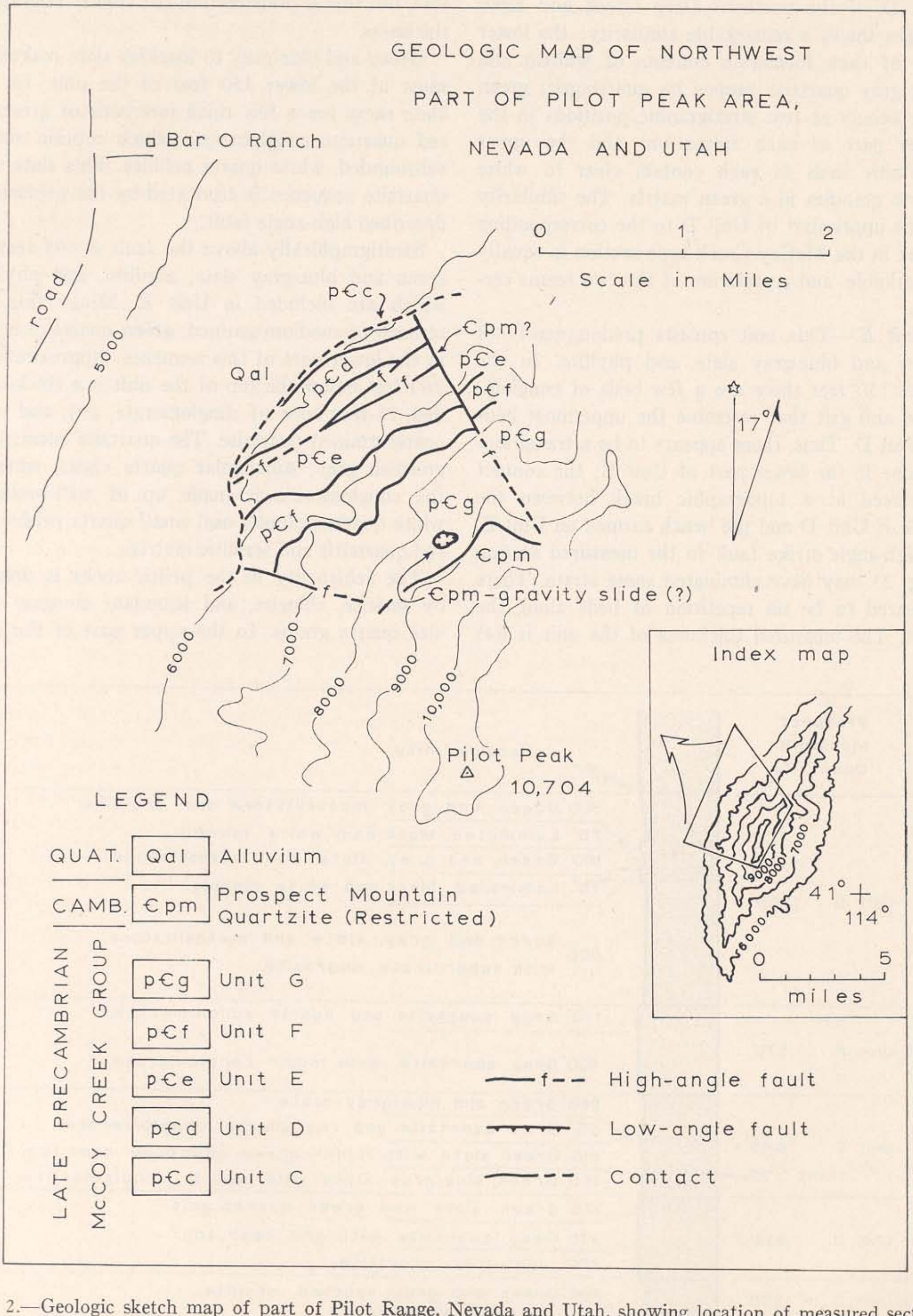

FIG. 2.—Geologic sketch map of part of Pilot Range, Nevada and Utah, showing location of measured section of late Precambrian rocks.

Unit D of the northern Deep Creek and Egan Ranges shows a remarkable similarity: the lower part of each formation consists of whitish and light gray quartzite capped by quartz grit; green slate occurs at two stratigraphic positions in the upper part of each formation; and the upper quartzitic beds in each contain clear to white quartz granules in a green matrix. The similarity of the upper part of Unit D to the corresponding strata in the McCoy Creek type section is equally remarkable, and correlation of the two seems certain.

Unit E.—This unit consists predominantly of green and blue-gray slate and phyllite. In the lower 150 feet there are a few beds of conglomerate and grit that resemble the uppermost beds of Unit D. Thus, there appears to be a transitional zone in the lower part of Unit E; the contact is placed at a topographic break between the cliffs of Unit D and the bench formed on Unit E. A high-angle strike fault in the measured section (Fig. 2) may have eliminated some strata. There appeared to be no repetition of beds along the fault. The measured thickness of the unit is 645 feet, but this is probably not the true stratigraphic thickness.

Green and blue-gray to blackish slate makes up most of the lower 150 feet of the unit. In the slate there are a few thick interbeds of green or red quartzite conglomerate which contain small, subrounded, white quartz pebbles. This slate and quartzite sequence is truncated by the previously described high-angle fault.

Stratigraphically above the fault is 495 feet of green and blue-gray slate, argillite, and phyllite which are included in Unit E. Minor thin interbeds of medium-grained, green quartzite occur in the lower part of this sequence. Approximately 260 feet below the top of the unit is a thick-bedded, 25-foot zone of conglomerate, grit, and very coarse-grained quartzite. The quartzite consists of greenish gray, subangular quartz clasts, whereas the conglomerate is made up of well-rounded, white quartz granules and small quartz pebbles in red quartzitic and sericitic matrix.

The schistosity in the pelitic rocks is defined by sericite, chlorite, and abundant elongate silt-size quartz grains. In the upper part of the unit

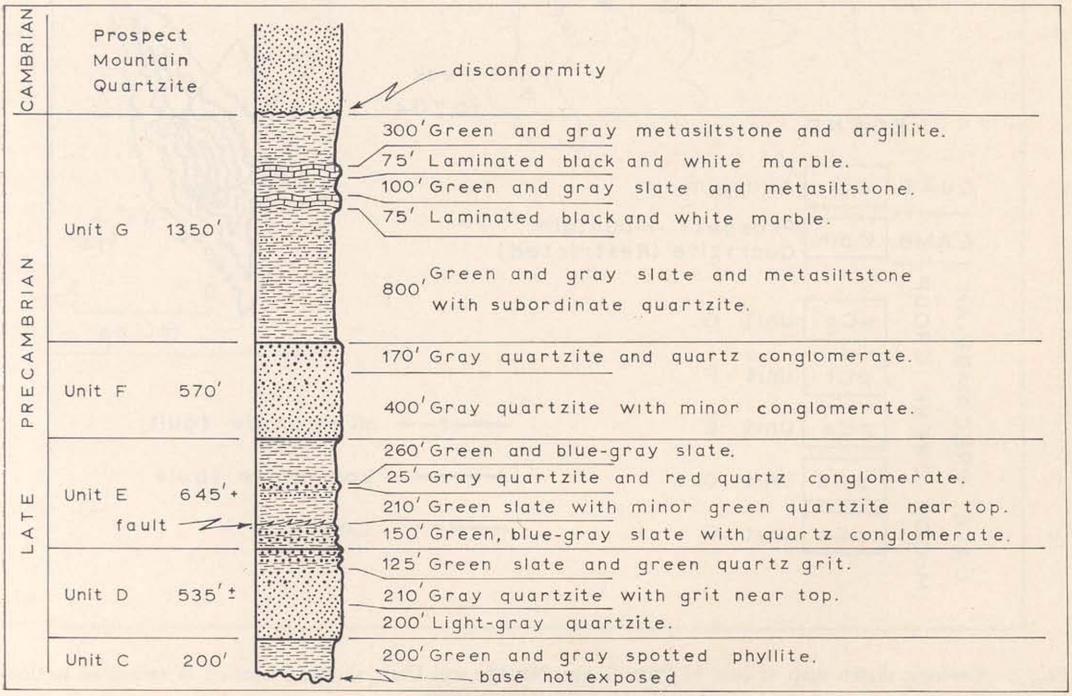

FIG. 3.—Columnar section of late Precambrian rocks measured along northwest corner of Pilot Peak in Pilot Range, Nevada and Utah. Thicknesses in feet.

the schistosity has been isoclinally microfolded and is cut by shears at 30° to the limbs of the microfolds. Clastic texture of quartzite and conglomerate is well-preserved by interstitial sericite and chlorite.

This unit is lithologically similar to the Strawberry Creek Formation and Unit E of the Southern Snake and Schell Creek Ranges, respectively (Misch and Hazzard, 1962), and to Unit E of the northern Deep Creek and Egan Ranges (Woodward, 1965).

Unit F.—Unit F is 570 feet thick and is composed entirely of resistant, cliff-making quartzite.

The lower 400 feet consists of thick- to very thick-bedded, coarse-grained to gritty, gray quartzite. A few thin layers composed of small white quartz pebbles occur within the quartzite.

Thick-bedded, coarse-grained to conglomeratic, gray quartzite predominates in the upper part of the unit. Increase in clast size and abundance of conglomerate beds toward the top of the unit is observed. Sub- to well-rounded, white quartz pebbles up to 4 centimeters across are conspicuous at the top of the cliff formed on Unit F.

Clastic texture is generally preserved by the presence of interstitial sericite although contiguous quartz clasts are commonly sutured, and locally pure quartzite shows granoblastic fabrics. The clasts are chiefly quartz with associated minor sodic plagioclase, microcline, and orthoclase. Minor sericite and traces of chlorite, biotite, zircon, tourmaline, and apatite are present.

There is a striking similarity between Unit F of the Pilot Range and typical Shingle Creek Quartzite of the Southern Snake Range (Misch and Hazzard, 1962) in the over-all thickness and the development of conspicuous conglomerate zones near the top of each unit. Other lithologic correlatives are Units F of the Schell Creek Range (Misch and Hazzard, 1962), the Deep Creek Range (Woodward, 1965), and the Egan Range (Fritz, 1960; Woodward, 1963).

Unit G.—Nearly 1,350 feet of slate, argillite, and metasiltstone, and subordinate marble and quartzite comprises this slope- and bench-forming unit.

Green and gray slate and metasiltstone make up the lower 800 feet of the unit. Some of the slate shows maroon flecks of unknown origin. Quartz-rich silty layers commonly alternate with slate layers giving rise to green and gray color

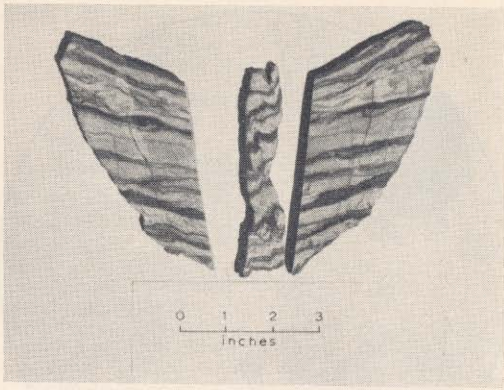

FIG. 4.—Black and white laminated marble of Unit G, McCoy Creek Group, Pilot Range, Nevada and Utah.

laminations. Thin interbeds of very fine-grained, gray quartzite occur sparingly in the upper part of this sequence.

In the upper part of the unit there are two 75-foot units of black and white laminated marble separated by 100 feet of green and gray slate and metasiltstone. The marble is well-exposed and forms small cliffs. The marble forms the most distinctive markers in the Precambrian sequence (Fig. 4). The white laminae of the marble are pure calcite, whereas the black bands contain much chlorite, sericite, quartz silt, and opaque minerals in addition to calcite.

The upper 300 feet of the unit is slope-forming green and gray metasiltstone and argillite that form a steep slope. The upper contact is covered with brownish- and buff-weathering talus from the disconformably overlying Cambrian Prospect Mountain Quartzite (restricted). The distinctive white-weathering quartzite of Unit H, the uppermost unit of the type McCoy Creek Group, is absent here, as it was not seen in outcrop or as float.

Crystallization schistosity (s_2), microfolds, and polygonal arcs of mica indicate that the pelitic rocks of Unit G were synkinematically metamorphosed. Randomly oriented and non-deformed porphyroblasts of chlorite, biotite, and epidote that transect the schistosity show that the rocks were subsequently thermally metamorphosed under static conditions (Fig. 5).

Contact metamorphism of calcite-bearing argillaceous beds in Unit G in the central northern Egan Range and Southern Snake Range has re-

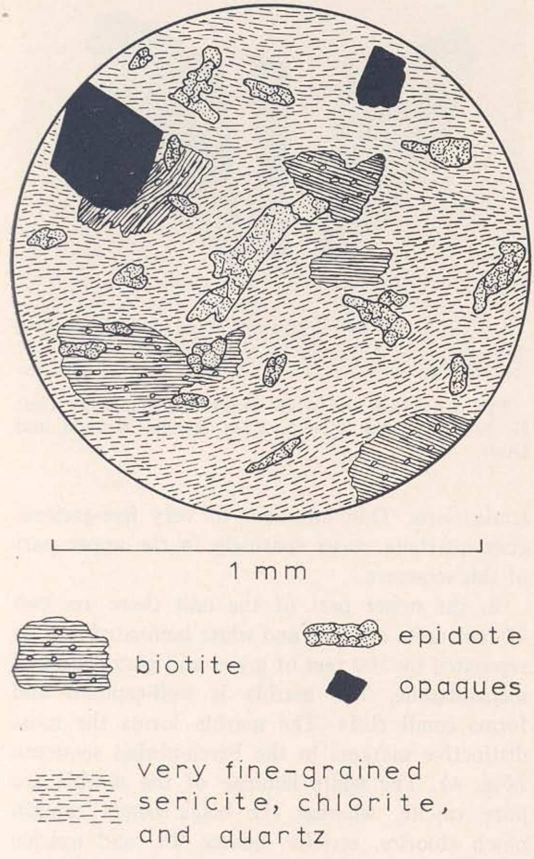

FIG. 5.—Sketch of thin section from Unit G showing porphyroblasts of biotite and epidote that transect schistosity and are not deformed.

sulted in the formation of porphyroblastic epidote (Misch and Hazzard, 1962).

Unit G is lithologically similar to Unit G of the Schell Creek Range and the Osceola Argillite of the Southern Snake Range (Misch and Hazzard, 1962), and to Formation G of the Egan Range and Unit G of the northern Deep Creek Range (Woodward, 1963, 1965). Green and gray color banding is characteristic of these several units, but is less prominent in the Pilot and Deep Creek Ranges than in the other areas. Carbonates are found as scattered crystals or thin lenses in pelitic layers of Unit G in the Egan and Southern Snake Ranges but are absent in the formation in the Schell Creek and Deep Creek Ranges. The distinct marble zones in the Pilot Range are unique and are thought to represent a significant facies change.

CORRELATION

Late Precambrian strata of the Pilot Range correlate well, on the basis of lithologic character and stratigraphic sequence, with units described from the Southern Snake and Schell Creek Ranges (Misch and Hazzard, 1962), from the northern Egan Range (Fritz, 1960), from the central northern Egan Range (Woodward, 1963), and from the northern Deep Creek Range (Woodward, 1965). Locations are shown in Figure 1, and the proposed correlation, in Figure 6.

Counts of non-opaque heavy minerals from approximately 40 thin sections each from the Pilot, northern Deep Creek, and central northern Egan Ranges suggest that the proposed correlation based on lithologic character is probably correct. Relative abundances of zircon, tourmaline, and apatite are shown in histogram form in Figure 7.

Lithologic differences ascribed to facies changes are briefly summarized.

1. Conglomerate in the upper part of Unit D in the Pilot Range contains slightly smaller clasts than in other described sections of the formation.

2. Local channel conglomerate beds are present in Unit E in the Schell Creek Range (Misch and Hazzard, 1962) and probably in the Egan Range (Fig. 7), but are absent in the other described areas. It is not known whether the conglomerate in the upper part of Unit E in the measured section in the Pilot Range is a channel filling or a laterally extensive layer, as the rocks are poorly exposed.

3. Unit F thickens markedly from 570 feet in the Pilot Range and 575 feet in the northern Deep Creek Range to 1,775 feet in the Egan Range (loc. 5). There is an accompanying decrease in grain size westward, the Egan Range section being slightly less conglomeratic than the eastern correlatives.

4. Minor calcite and (or) dolomite crystals are found in a few pelitic beds of the Osceola Argillite of the Southern Snake Range (Misch and Hazzard, 1962) and Unit G of the Egan Range. No carbonate was observed in Unit G of the northern Deep Creek Range, but this may be the result of erosion of the upper part of the unit prior to deposition of the Prospect Mountain Quartzite (restricted). Thus, the marble in the Pilot Range indicates a notable increase in carbonates in Unit G toward the north.

5. Thick conglomerate beds in Unit G in the

Pilot Range (this report) 1	Northern Deep Creek Ra. (Woodward, 1965) 2	Schell Creek Range (Misch & Hazzard, 1962) 3	Southern Snake Range (Misch & Hazzard, 1962) 4	Cent. Northern Egan Range (Woodward, 1963) 5	Northern Egan Range (after Fritz, 1960) 6, 7
Prospect Mountain Quartzite, Cambrian					
		Unit H 800	Stella Lake Quartzite 800	Formation H 100	
Unit G 1350	Unit G 860	Unit G 400	Osceola Argillite 800	Formation G 1400	Unit G 250
Unit F 570	Unit F 575	Unit F 900	Shingle Creek Conglomeratic Qtzite 500	Formation F 1775	Unit F 600
Unit E 645	Unit E 990	Unit E 1500	Strawberry Creek Fm 750	Formation E 1110	Unit E 820
Unit D 535	Unit D 825	Unit D 400	Willard Creek Qtzite 500	Formation D 455	Unit D 330
Unit C 200	Total 3250	Unit C 2200	Pre-Willard Creek Quartzite Formation 300	Formation C 2630	Unit C 2580
Total 3300			Total 3650		?
		Unit B 1800		Formation B 990	Total 4580
		Unit A 800		? Total 8455	
		Total 8800			

FIG. 6.—Proposed correlation of late Precambrian of Pilot, northern Deep Creek, Schell Creek, Southern Snake, and Egan Ranges. Letter symbols of strata described by Fritz (1960) in northern Egan Range are adjusted to those established by Misch and Hazzard (1962) in Schell Creek Range. Thicknesses are in feet.

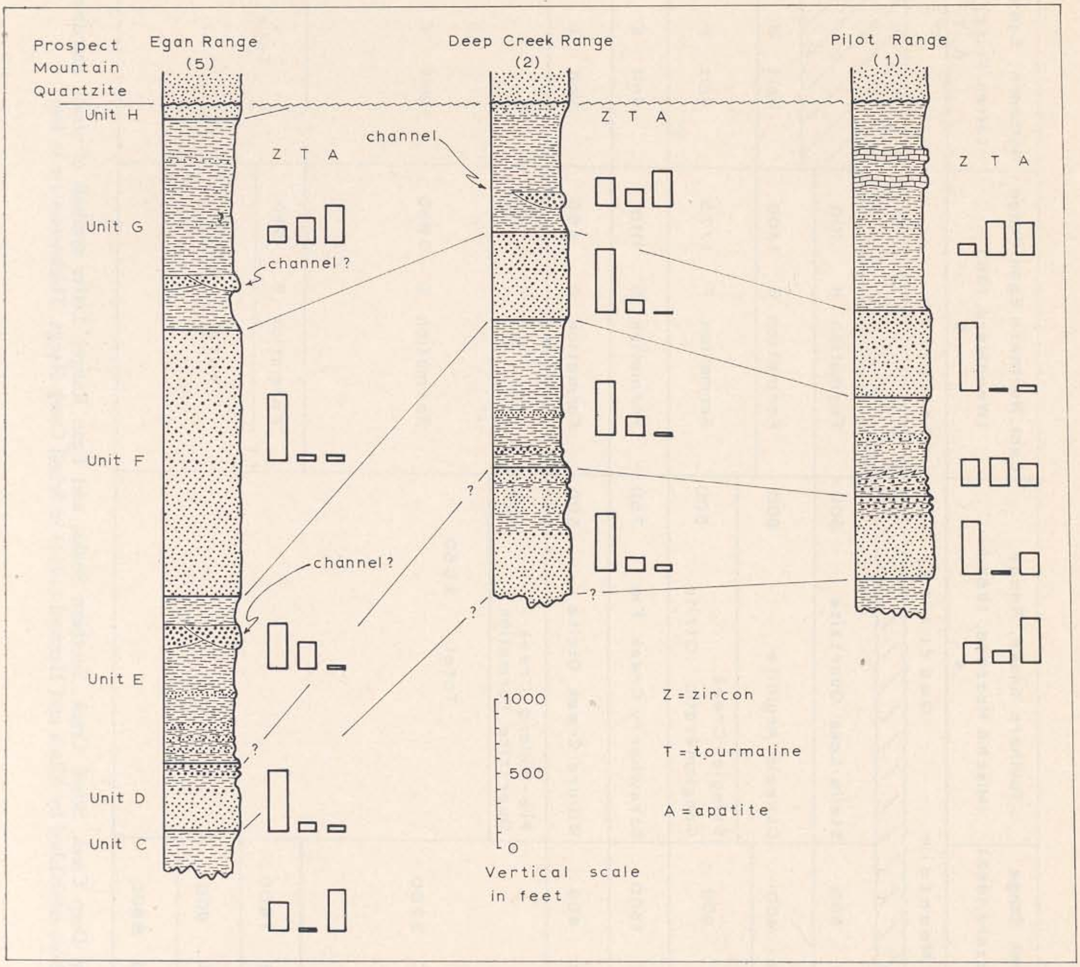

FIG. 7.—Detailed correlation of late Precambrian of Pilot, northern Deep Creek, and central northern Egan Ranges. Relative abundances of heavy minerals are shown at right of respective formations with total minerals counted from each unit = 100 per cent. Locations are shown in Figure 1.

Egan and Deep Creek Ranges appear to be discontinuous local channel fillings (Woodward, 1965). There is no such conglomerate in the unit in the Pilot Range or in the Schell Creek or Southern Snake Ranges (Misch and Hazzard, 1962).

The absence of the uppermost unit of the type McCoy Creek Group, Unit H (=Stella Lake Quartzite), in the Pilot and Deep Creek Ranges as well as locally in the Egan Range (Fig. 6), and general thickening of the group toward the west, suggest that there may be a regional disconformity between the late Precambrian rocks and the overlying Lower Cambrian Prospect Mountain Quartzite (restricted).

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