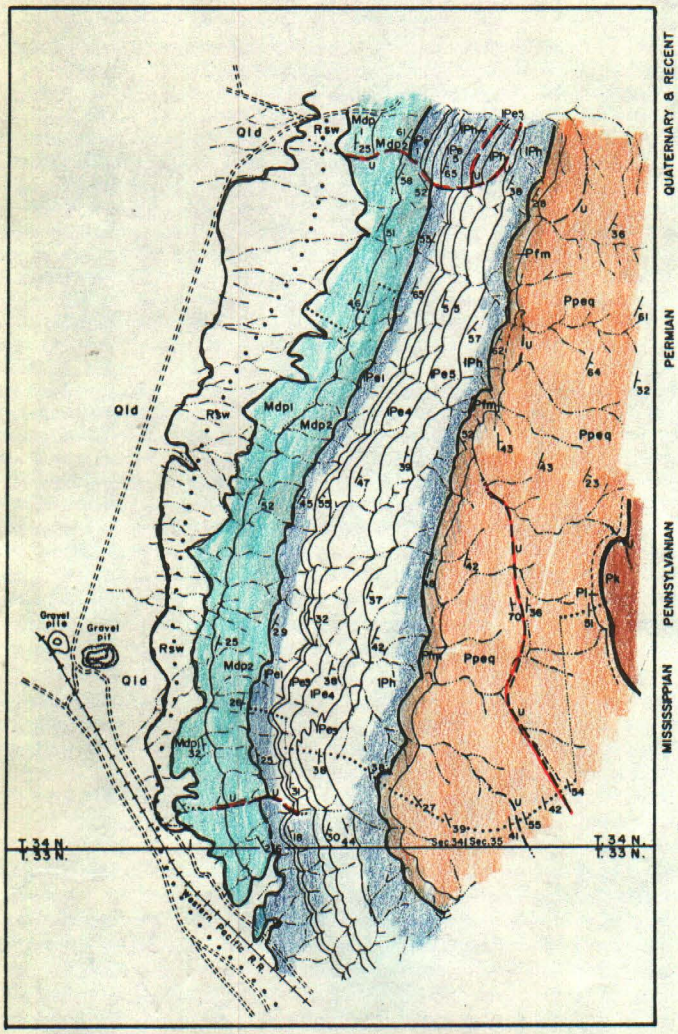


LEGEND

QUATERNARY & RECENT

- Rsw — Recent slope wash
- Qld — Quaternary lacustrine deposits

PERMIAN

- Pk — Kaibab Limestone
- Pl — Loray Formation
- Ppeq — Pequop Formation
- Pfm — Ferguson Mountain Formation

PENNSYLVANIAN

- IPh — Hogan Formation
- Pe5, Pe4, Pe3, Pe2, Pe1 — Ely Limestone

MISSISSIPPIAN

- Mdp2, Mdp1 — Diamond Peak Fm.

Stratigraphic Section

Pequop Fault concealed

True North 17° Magnetic North

GEOLOGIC MAP OF PART OF CENTRAL PEQUOP MOUNTAINS, ELKO COUNTY, NEVADA

GERALD B. ROBINSON JR.

1961

2000 0 2000 Feet

SCALE

TEXT-FIGURE 3.—Geologic map of part of central Pequop Mountains, Elko County, Nevada.

Mississippian-Pennsylvanian Systems

Chainman Shale

Chainman Shale is not exposed in the map area, but crops out a few miles to the north. However, the lowest exposures of the Diamond Peak Formation shown on the geologic map approximate the contact with the Chainman Shale (Text-figure 3). Chainman Shale exposed to the north consists of interbedded chocolate-brown to black siliceous shale and siltstone, orthoquartzite, and siliceous small pebble-conglomerate; shale predominates. Bedding in the formation varies from thin and platy to thick. The formation is 1,200 to 1,500 feet thick five miles to the north (Bissell, 1960, personal communication). Contact with the overlying Diamond Peak Formation appears gradational, the predominance of shale distinguishing Chainman lithology.

Diamond Peak Formation

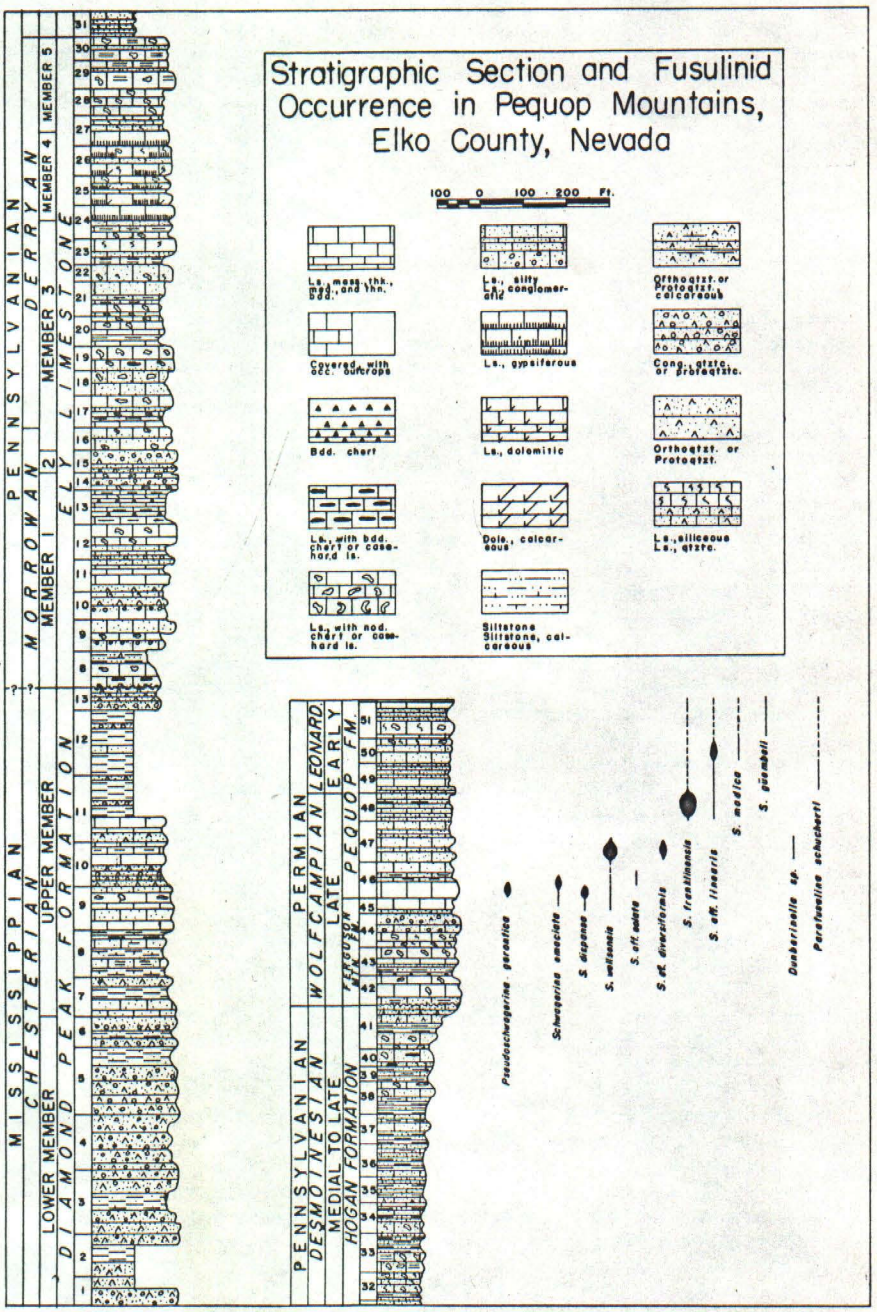
Hague (1883, pp. 268-270) described the Diamond Peak Formation as predominantly quartzite, but Nolan *et al.* (1956, p. 60) recommended that its name be changed to "Formation" because the sequence also contains considerable chert conglomerate, limestone, and shale. Nolan's recommendation has been followed in this study.

Steele (1960, p. 96) states that the formation varies in thickness from approximately 3,000 feet on Diamond Peak in the Diamond Range to less than 20 feet at Ferguson Mountain in the Goshute Range.

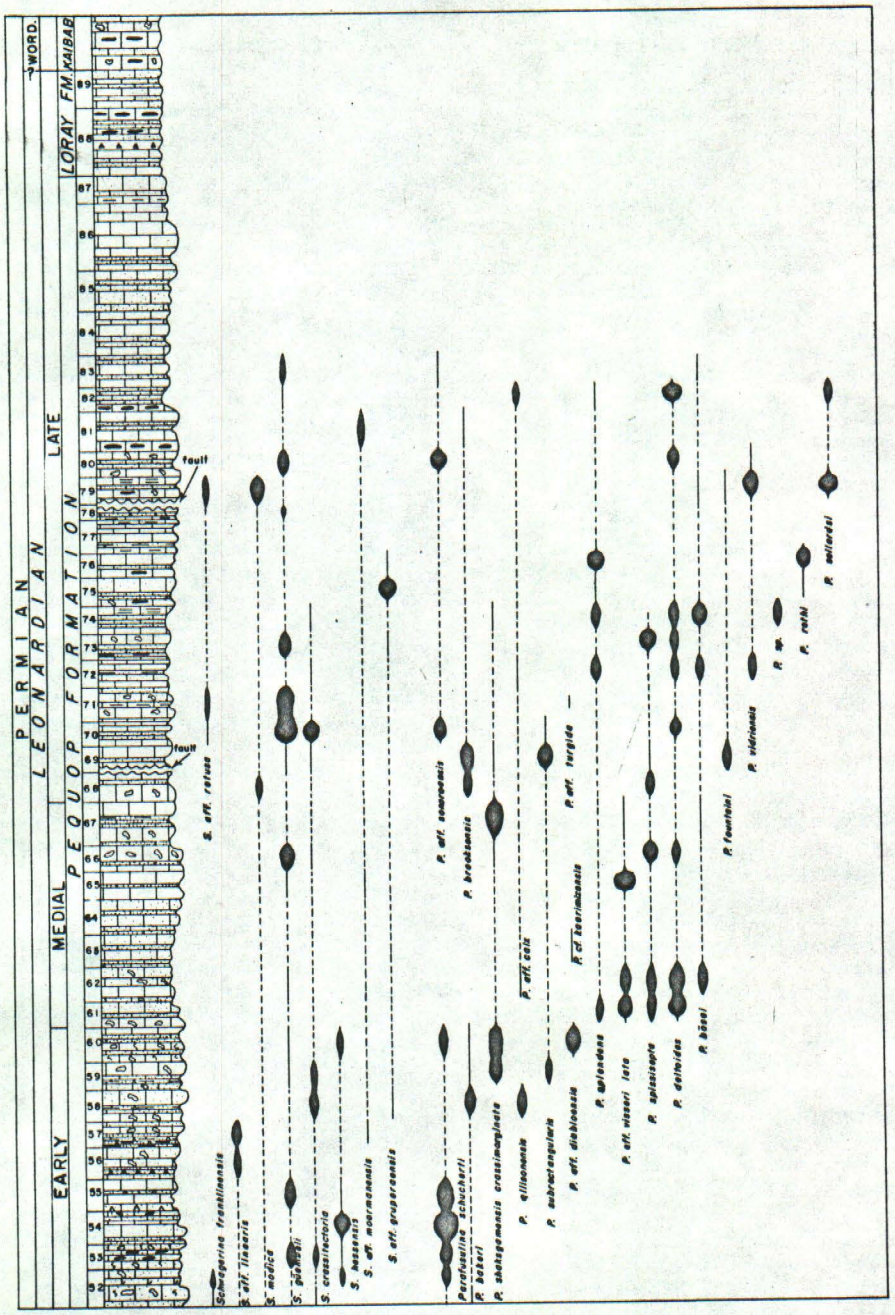
Lithology.—The Diamond Peak Formation is central Pequop Mountains is divisible into two members, the lower one consisting of interbedded protoquartzite, protoquartzitic medium to small pebble-conglomerate, and occasional siliceous shale to argillite. Most beds are strongly silica-cemented. Fine to medium-textured grains of quartz predominate in the protoquartzite; pebble-sized clasts of angular to subangular light gray, green-gray, and green-black chert fragments and rare to moderate quartzite fragments form the framework of the conglomerate. Shale near the top of the lower member is in part micaceous, and the protoquartzite beds commonly are cross-bedded. Bedding varies from laminated and thin-bedded in the shale to medium and thick-bedded in the conglomerate. Plant fragments were the only fossils noted in the measured section, although species of spiriferid brachiopods and bryozoans were noted in other parts of the map area.

The upper member consists of various types of limestone in the lower three-fourths, and interbedded siliceous shale, protoquartzite, and fine pebble-conglomerate above. This member is easily differentiated on aerial photos from the lower one by its lighter color and finer texture. Although limestone of matrix to matrix-with-detrital sand, silt, and clay, to argillaceous limestone and matrix-with-skeletal varieties predominates in the lower three-fourth of the upper member, siliceous and quartzitic shale-argillite, calcareous shale, and orthoquartzite to protoquartzite form interbeds. Colors of light to medium blue-gray and yellow-brown to gray-brown predominate in the section. Bedding varies from thin to thick, with medium bedding in predominance. Fossils, with exception of occasional crinoid stems, brachiopods, and gastropods, are also rare.

The top one-fourth of the upper member is composed primarily of siliceous-argillitic shale, with interbeds of platy siliceous limestone, fine-grained orthoquartzite and protoquartzite, and chert and jasper pebble-conglomerate. Bedding is mostly thin and platy. Rocks considered time equivalent, and perhaps



TEXT-FIGURE 2.—Stratigraphic section and fusulinid occurrence in Pequop Mountains, Elko County, Nevada.



TEXT-FIGURE 2.—Continued

more representative of the upper one-fourth of the upper member were measured and studied about a mile farther south from the section herein described (Text-figure 3). They consist of interbedded siliceous and quartzitic limestone, cross-bedded calcareous orthoquartzite, and small pebble-conglomerate. It is this sequence to which some geologists refer to as "Illipah" Formation.

Thickness, age, and correlation.—Total thickness of Diamond Peak Formation in central Pequop Mountains is 1,431 feet. Of this thickness, 656 feet is assigned to the lower member and 775 feet to the upper member. The measured section is located approximately in Section 22, T. 34 N., R. 65 E., (Text-fig. 3).

Although there is no fossil evidence on which to justify the conclusion, possibly the Late Mississippian-Early Pennsylvanian time boundary occurs within the Diamond Peak Formation, hence, most, if not all the formation, can be assigned Chesterian age. This is done on the basis of stratigraphic position below the Early Pennsylvanian Ely Limestone, and on regional correlation of the formation with the type area to the south. Excellent discussions of age of the Diamond Peak Formation and of contiguous strata below and above are given by Sadlick (1960) and Steele (1960, p. 99).

As previously mentioned, some geologists may attempt to apply the name "Illipah Formation" to the upper part of the sequence in central Pequop Mountains, and if so, it would probably be to approximately the upper 320 feet. The writer declines to do this, however, on the basis of the distance involved between the area of outcrop of so-called Illipah Formation near Moorman Ranch in White Pine County, Nevada, and to the lateral variability of the sequence in central Pequop Mountains which results in lack of identifying features.

Pennsylvanian System

Ely Limestone

Lawson (1906, p. 295) named the Ely Limestone from outcrops in the Ruth Mining District near the town of Ely, White Pine County, Neveda. Spencer (1917, p. 26-27) and Pennebaker (1932) later redefined the formation, and Steele (1960, p. 100) still further restricted it as "stratigraphically above the Chainman Shale or Scotty Wash Quartzite, whichever is present, and below the regional Pennsylvanian unconformity." Inasmuch as a complete section of Ely Limestone is not continuously exposed in any one locality in Ruth Mining District, Steele (1960, p. 100) proposed a reference locality for the Ely Limestone approximately 30 miles west of the type section.

In this report the Ely Limestone of the Pequop Mountains region is described as lying stratigraphically above the Diamond Peak Formation and below a Medial Pennsylvanian silty limestone sequence referred to a separate formation.

Lithology.—Ely Limestone in central Pequop Mountains is divisible into five distinct members (not formal designation):

Member 1 consists of interbedded bioclastic, argillaceous, silty-sandy, and siliceous-cherty limestone, with subordinate units of calcareous, quartzitic siltstone to orthoquartzite, and chert small pebble-conglomerate to conglomeratic limestone. Member 1 displays alternating ledges and slopes in general not as resistant as the overlying members. Fossils consist only of few crinoid stem fragments, brachiopods, and bryozoans. Chert is rare in the lower beds, but is present in one inch to three inch nodules to bedded bands in the upper beds. The lower boundary of member 1 is difficult to differentiate because of gradational relations with the underlying Diamond Peak Formation. It was chosen,

however, at the point in the section where limestone lithology predominates above.

Member 2 comprises a 50 foot thick conglomerate sequence with subordinate interbeds of sandy and pebbly limestone. These resistant beds appear distinctly on aerial photos as a darkened band. The sequence is persistant in thickness through the map area, and its boundaries are easily differentiated. Individual clasts in the conglomerate are of subround to angular granules and small pebbles of varicolored chert and quartzite.

Member 3 resembles member 1 in appearance, although it lacks the extreme clastic type of lithology present in the lower member. It consists mainly of micritic limestone, argillaceous limestone, silty and fine sandy limestone, and bioclastic limestone. Subordinate interbeds of shaly siltstone to orthoquartzite are also present. Bedding varies from thin and platy to massive; the bedding determines the physical weathering of alternating slopes and cliffs respectively. Fossils consist of crinoid debris, brachiopods, bryozoans, and a few corals. Chert, in the form of one inch to three inch nodules, lenses, and bands, is more prevalent in member 3 than in lower members. Its concentration ranges between five percent to ten percent. Member 3 boundaries are differentiated on the basis of the upper conglomerate bed of member 2 and the lower gypsiferous bed of member 4. It is persistant through the map area, but slightly thins and thickens locally due to the variability of the overlying gypsiferous member.

Member 4 has unique lithology in the usual normal marine type limestone of the Ely Limestone. It is composed of interbedded micritic limestone, dolomitic limestone to calcareous dolomite, gypsiferous limestone, hard siliceous limestone with fossil, silt, and fine-sand detritus. Locally, beds of hard, siliceous alabaster-like rock appear. Bedding varies from thin to massive, chert is rare to absent, and fossils consist of scattered crinoid stem fragments. The absence of fossils points to the high salinity which was present in the water at time of deposition. Lighter color of the member allows easy identification on aerial photos. The member is persistant through the map area, but is variable in thickness. Lower and upper boundaries were mapped respectively at points of first and last occurrence of abundant gypsiferous material. Locally this selection of boundaries is artificial, but throughout the larger area has utility.

Member 5 forms a nearly continuous cliff, although the lower 100 feet approximately forms a retreat slope. It consists of medium- to thick-bedded, aphanic to fine-crystalline limestone, argillaceous limestone, and silty fine-sandy limestone. It is this sequence which forms the prominent physiographic boundary between the slope and cliff-weathering Ely Limestone below and the slope-forming Hogan Formation above. Chert is present in concentration of five percent in the form of nodules, and fossils consist of crinoid stem fragments, bryozoans, and few fusulinids. The latter fossil is not visible on the rock surface, and hence, requires random sectioning of the rock for verification. The lower boundary of the member is placed at disappearance of abundant gypsiferous limestone, and the upper boundary is placed at the lithologic and physiographic change between the Ely Limestone and the Hogan Formation.

Thickness, age, and correlation.—Location of the measured section of Pennsylvanian Ely Limestone is in Section 34, T. 34 N., R. 65 E. Total thickness of the formation is 1,510 feet. Boundaries of the mapped members do not precisely coincide with time intervals considered to represent standard epochs of the Pennsylvanian. Therefore, it is necessary to list both thickness of rock series

and individual members. Representatives, but not necessarily all time span of Morrowan and Derryan (Atokan) age rocks are found in the stratigraphic section of Ely Limestone in central Pequop Mountains, of which approximately 605 feet is considered Morrowan equivalent and 905 feet Derryan age. Unfortunately, fusulinid control in the formation is very limited; however, a few specimens of *Profusulinella* sp. were located in unit 28 of the upper beds which date the beds as being Derryan age. Due to the absence of fusulinid control normally present in the Ely Limestone, actual delineation of thickness to the separate epochs was done on the basis of physical resemblance to other areas displaying well-dated typical Morrowan and Derryan age rocks.

Thickness of individual members is as follows: member 1, approximately 500 feet; member 2, approximately 50 feet; member 3, approximately 527 feet; member 4, approximately 215 feet; and member 5, approximately 218 feet.

A regional epeirogenic uplift apparently acted in eastern Great Basin during mid-Pennsylvanian time, inasmuch as normally rocks of Desmoinesian, Missourian, and Virgilian age are not represented. Dott (1955, p. 2255) refers to this unconformity in the Elko-Eureka-Carlin area as the sub-Strathearn unconformity. As a result of the regional unconformity, upper limit of the Ely Limestone is not everywhere the same age in eastern Nevada and western Utah; normally, however, Late Derryan age strata are overlain disconformably by marine rocks of Early Wolfcampian age. The regional unconformity is present in central Pequop Mountains although it occurs between Late Desmoinesian and Late Wolfcampian age rocks. Hence, the area under investigation contains one of the few exposures of Desmoinesian age rocks in the northeastern Great Basin. Also, because these Desmoinesian age rocks are of entirely different lithology than the more typical Ely Limestone stratigraphically below, Ely Limestone in central Pequop Mountains is here described as restricted to Morrowan and Derryan ages, and the Desmoinesian age silty limestone is referred to a new formation.

Chaetetes sp., the well-known and normally widespread "hair coral" considered by Dott (1954) to be a synchronous time-stratigraphic marker of Derryan (Atokan) age, was not found in place in the Ely Limestone in the map area, but fragmentary pieces in float were noted by Bissell (personal communication, 1960).

Hogan Formation (new name)

In slight opposition to Steele's proposal (1960, p. 100) to refer all Pennsylvanian rocks below the regional unconformity to Ely Limestone, the Desmoinesian age rocks in central Pequop Mountains are here referred to a new formation, the Hogan Formation. Type section of the formation is located in Section 34, T. 34 N., R. 65 E., Elko County, Nevada, and the section was measured on the west side of the range on the most prominent spur in the area (Text-fig. 3). The name "Hogan" is derived from a Western Pacific railroad siding located approximately one mile south of the type section.

The same sequence is present near Moorman Ranch, White Pine County, Nevada, and is of the same lithology and thickness, and occupies approximately the same stratigraphic position superjacent to the Ely Limestone as in central Pequop Mountains. Lane (1960, p. 114-116) recognized these strata to be different from the Ely Limestone, and referred to them as an "unnamed sequence."

Lithology.—Detailed description of the measured section of the type Hogan

Formation is found under "Measured section." General lithology of the Hogan Formation consists primarily of thin to medium-bedded, silty to quartzitic platy limestone, calcareous siltstone, calcareous shale, and argillaceous limestone. Interbedded with the sequence are a few siliceous, cherty limestone and fine-crystalline limestone to medium-crystalline and coarse-textured bioclastic limestone beds. A notable feature of the sequence is the high percentage of silt content and the absence of chert as found in the underlying Ely Limestone. This observance is also recorded by Lane in Moorman Ranch area (1960, p. 116). Occasional thicker bedded limestone beds interrupt the pronounced slope forming sequence, one of which near the top contains rare to moderately abundant fusulinids. Other fossils present in the strata are crinoid stem fragments and brachiopods, corals, gastropods, and bryozoans, all of which are rare in occurrence.

Thickness, age, and correlation.—Thickness of the Hogan Formation in central Pequop Mountains is approximately 750 feet thick. The only age delineation which can be presented for the formation is that given by the fusulinids occurring approximately 620 feet above the base. These fusulinids are identified as follows: *Fusulina weintzi* Verville, Thompson, & Lokke, and *Wedekindellina* cf. *W. euthysepta* (Henbest). Thus, the age of the strata containing these fusulinids is Medial to Late Desmoinesian. It is admitted that the contact of Derryan-Desmoinian age strata could occur within the formation, but the formation was mapped solely on lithology. Derryan fusulinids, however, do occur a few tens of feet below the formational contact in the underlying Ely Limestone, a fact which lends strength to this conclusion.

The upper contact with Permian Wolfcampian marine sediments also was mapped solely on the basis of lithology, inasmuch as fusulinid control is also absent for approximately three-fourths of the section of Wolfcampian age.

There are few exposures of Desmoinesian strata in eastern Great Basin due to the regional unconformity, and past workers have not differentiated Desmoinian strata as being a separate formation; therefore, correlation is restricted to: 1) the sequence described by Lane (1960) as mentioned above; 2) comparable sequences mentioned by Dr. H. J. Bissell (1961, personal communication) in Gold Hill, Butte Mountains, and Cherry Creek Mountains, and Mr. K. A. Hodgkinson (1961, personal communication) in Gold Hill and A-1 Canyon in the Leppy Range.

Permian System

Ferguson Mountain Formation

Berge (1960, p. 18-19) proposed the name Ferguson Mountain Formation for a thick carbonate sequence overlying Ely Limestone, or possibly Strathearn-equivalent strata, at Ferguson Mountain in sections 21 and 22, T. 30 N., R. 69 E., Elko County, Nevada. Steele (1960, p. 101) proposed the name Ferguson Springs Formation for the same sequence of strata, but his publication postdates that of Berge by five months.

Berge mapped the formation according to standard practice as a physical entity, which in this case is time transgressive. Slade (1961, p. 10) working in the same area, however, would make the physical boundaries coincide with time boundaries on the basis of certain lithic elements plus fusulinid occurrence. The writer follows Berge in this matter, since physical boundaries were the basis on which the formations were mapped in Pequop Mountains.

Lithology.—Several varieties of cherty limestone characterize Ferguson Mountain Formation in the map area. Predominantly, it consists of thick-bedded, ledge- and cliff-forming crystalline to bioclastic limestone, some of which is sandy and silty, but most of which is fine- to medium-crystalline in texture. Subordinate interbeds of thin-bedded, siliceous and cherty limestone and siliceous siltstone to shale form slopes between the ledges. A ledge-forming unit, 20 feet thick, consisting of thick-bedded, chert-limestone fragment-quartzite pebble conglomerate appears near the top of the sequence. Chert and case-hard limestone nodules make up 20 percent of some beds, and fossils consist of bryozoans and crinoid stems, and rarely of brachiopods and corals. Abundant diagnostic Late Wolfcampian age fusulinids occur in the upper beds of the sequence.

Lower boundary for the formation is taken where the platy and thin-bedded silty limestone of the Hogan Formation below the regional unconformity changes upward into thicker bedded crystalline to bioclastic limestone of the Ferguson Mountain Formation. The upper boundary is mappable on the presence of a distinctive limestone containing the regionally occurring coral biostrome *Corwenia*? sp., which marks approximately the break in lithology from the thick-bedded crystalline limestone of the Ferguson Mountain Formation to sandy and thin limestone beds of the Pequop Formation.

Thickness, age and correlation.—Total thickness of the Ferguson Mountain Formation in central Pequop Mountains is 250 feet thick. Location of the measured section is approximately in Section 34, T. 34 N., R. 65 E., and on the same spur and directly above the type section of the Hogan Formation.

Fusulinids were collected from the highest unit of the sequence, the only fusulinid bed of the formation in the map area. Among this limited species fauna were several specimens of *Schwagerina dispansa* Ross which have previously been described as occurring in the Upper Wolfcampian Lennox Hills Formation of the Glass Mountains, Texas (Ross, 1959, p. 304-305). In Pequop Mountains this species ranges into the lower beds of the overlying Pequop Formation where it is associated with *Pseudoschwagerina gerontica* Dunbar & Skinner, also a Late Wolfcampian fusulinid. Hence, the age of the Ferguson Mountain Formation in the area under discussion is essentially Late Wolfcampian.

Steele (1960, p. 101) has correlated his "Ferguson Springs Formation" over an areal extent of approximately 5,300 square miles. For excellent discussions of the correlation of this formation, the interested reader is referred to Steele (1960), Berge (1960), Bissell (1960), and Hodgkinson (1961).

Pequop Formation

Steele (1960, p. 106) named the Pequop Formation for a thick sequence of thin-bedded, fusulinid-bearing limestone which was measured one and one-half miles north of the Jasper Railroad Tunnel in central Pequop Mountains, Section 3, T. 33 N., R. 65 E., Elko County, Nevada. It is here pointed out with reference to the Elko NK11-12 topographic sheet, printed by the Army Map Service, that in designating the type section location two errors were unintentionally committed: 1) a distance of one and one-half miles north of the Jasper tunnel would locate the type section in section 11 or 12, and not in Section 3. Sections 11 and 12 both include an area of complex folding, faulting, and possibly contain rocks older than Leonardian; 2) if Section 3 was intended, the location would contain approximately Ely Limestone, Hogan Formation, Fer-

guson Mountain Formation, and lower beds of the Pequop Formation. In addition, the area would occupy the south slope of the prominent east-west trending spur which definitely exposes the best Pequop Formation on its crest. This spur was obviously intended to be the one containing the type Pequop Formation, but was improperly located according to sections. Therefore, according to recommendations of the American Commission on Stratigraphic Nomenclature concerning the designation of reference localities to supplement a type locality, the writer hereby proposes a reference locality to the Pequop Formation in central Pequop Mountains in sections 34 and 35, T. 34 N., R. 65 E., Elko County, Nevada. The measured section is found on the first large prominent west-trending spur north of the Jasper tunnel, and directly above the measured sections of Ely Limestone, Hogan Formation, and Ferguson Mountain Formation (Text-fig. 3).

Lithology.—In the reference locality, Pequop Formation consists of thin-bedded and platy, fine- to medium-crystalline, silty to fine-sandy limestone which is interbedded with medium- to thick-bedded, pure aphanic to fine-crystalline limestone. Repetitious exposures of the two lithologies display alternation of ledges and slopes throughout the entire Pequop sequence. Predominant colors in the formation are purplish-gray, maroon to tan, medium to dark brown-gray and gray-brown. Chert and quartzitic case-hard-limestone is not abundant through the section, although it occurs in nodular form locally in abundance of two to ten percent.

The prolific occurrence of fusulinids in the Pequop Formation at its type locality probably is the most spectacular feature of the formation. Although they are abundant in most parts of the section and occur in both lithologies, the platy, silty limestone contains greatest abundance.

Other fossils in the Pequop Formation are crinoid stems, brachiopods, bryozoans, corals, gastropods, and algae. The colonial coral *Corwenia ?* sp. occurs in the basal bed of the Pequop Formation, and is present throughout the entire map area; it deserves special comment. Steele (1960, p. 106) makes reference to this coral as being present in the basal beds of the formation at numerous localities in the northeastern Great Basin, including Ferguson Mountain, East-Humboldt Range, Carbon Ridge, and Pequop Mountains. *Corwenia ?* sp. not only has wide areal distribution, but also *approximately* marks the Wolfcampian-Leonardian time boundary. In some localities, for example at Ferguson Mountain, several biostromes of *Corwenia ?* sp. can be found above the unit of its initial occurrence. In many other places, however, only one bed containing this coral has been noted, and normally that is essentially the basal unit of the Pequop Formation, and often the lowest zone of rocks of Leonardian age. Commonly, abundant forms of Early Leonardian *Parafusulina* spp. are present in the same bed which contains *Corwenia ?* sp. This is not true in central Pequop Mountains, however, as valid Late Wolfcampian age fusulinids occur several hundred feet above the biostrome. Thus, the *Corwenia ?* sp. bed, because of distinctive lithic characteristics, forms the lower mappable unit of the Pequop Formation in Pequop Mountains, but the mappable boundary does not precisely coincide with the Wolfcampian-Leonardian time boundary. As a result, the Pequop Formation in this area is not a time rock unit, as 245 feet of the Lower Pequop Formation are of Late Wolfcampian age.

The upper boundary of the formation is mapped on the change in lithology from cliff-forming, thick-bedded crystalline limestone of the Upper Pequop

Formation to the thin and platy, slope-forming, cherty, calcareous siltstone-silty limestone of the Loray Formation.

Thickness, age, and correlation.—A total thickness of 3,087 feet of Pequop Formation was measured in its reference locality in central Pequop Mountains. This thickness is at variance with the thickness of 1,570 feet designated by Steele (1960, p. 106) for the formation in the same area. Perhaps, Steele suspected repetition of the formation by at least one of two faults, which occur 1,692 feet and 2,318 feet respectively within the section, and therefore restricted the thickness in the original designation. However, the present study proves stratigraphic continuity, because distinctive beds are not duplicated or omitted, and detailed study of fusulinids indicates no important gaps. The reader is referred to the fusulinid range chart (Text-fig. 2) to note the continuance of the species above and below the faults, and the first occurrence of younger species above the faults. Therefore, any faulting in the measured section is here reported as having negligible displacement.

Steele (1960, p. 106) divided the Pequop Formation into three members in the Moorman Ranch section in White Pine County, Nevada on the basis of presence of an evaporitic sequence within the Pequop Formation. He assigned 1,750 feet to the Lower Moorman Ranch Member, which is separated unconformably from 1,050 feet of Upper Moorman Ranch Member by a few feet of "thin, yellow gypsiferous-looking siltstone." He postulates the missing interval between the lower and upper members is represented in the Butte Mountains, White Pine County, Nevada by an evaporitic sequence called the Summit Springs Evaporite Member of the Pequop Formation. This same sequence was measured in the Butte Mountains in the summer of 1960, and it is agreed that Steele's designation of the three members is valid. The present study does not justify extension of these members of the Pequop Formation northward to central Pequop Mountains because the physical subdivision listed above does not appear to exist this far north. The present study has resulted in the division of the formation in the Pequop Mountains into parts having respectively Early, Medial, and Late Leonardian ages on the basis of diagnostic fusulinids. These divisions did not prove to be mappable in this study, and hence, are not intended to be interpreted as members. Thickness designations are as follows: Pequop Formation rocks of Early Leonardian age, 1,105 feet; Medial, 522 feet; and Late, 1,460 feet.

The sequence in this study containing association of *Schwagerina hessensis* Dunbar & Skinner, *Parafusulina schucherti* Dunbar & Skinner, *P. bakeri* Dunbar & Skinner, and *P. allisonensis* Ross is designated as Early Leonardian age. Association of *P.* aff. *P. visseri lata* Reichel and *P. spissisepta* Ross in conjunction with occurrence of upper and lower limits of other distinctive species delineates Medial Leonardian age rocks. Late Leonardian age rocks are so designated in this study on the basis of association of *P. bösei* Dunbar & Skinner, *P. fountaini* Dunbar and Skinner, *P. vidriensis* Ross, *P. rothi* Dunbar & Skinner, and *P. sellardsi* Dunbar & Skinner (Text-fig. 2).

Steele (1960, p. 106) recognized that areal distribution of the Pequop Formation occupies over 18,000 square miles in northeastern Nevada and northwestern Utah. Interested readers are referred to discussions by Steele (1960), Bissell (1960), and Hodgkinson (1961).

Loray Formation

Loray Formation was proposed by Steele (1960, p. 106-107) for a sequence

of yellow-tan, gypsiferous siltstone and thin bioclastic limestone exposed at the head of Loray Wash on the southwest side of Montello Valley, Elko County, Nevada. The formation has a characteristic evaporitic type of lithology in most areas of occurrence. The writer has recognized the formation in central Pequop Mountains and, although it is rather thin, it compares favorably in lithology with outcrops reported from the type locality.

Lithology.—Loray Formation in the Pequop Mountains consists of interbedded calcareous siltstone and fine-grained orthoquartzite, silty and fine-sandy limestone, medium-textured bioclastic limestone, and medium-crystalline matrix limestone. Thin- to medium-bedding predominates in the sequence. Most of the section contains fine sand and silt and is chert free, although the middle beds contain less than five percent chert in one inch nodules to two foot thick beds. Contained fossils are crinoid stem fragments, bryozoans, and brachiopods. Gypsiferous material, reportedly present in the type locality, is absent in the area under current investigation. The nature of the lithology contained in the formation, however, suggests that the sequence in the Pequop Mountains represents a less restricted evaporite suite than that of the type locality.

The formation rests with apparent conformity on upper beds of the Pequop Formation, and is distinguished on the basis of lithology difference. The upper beds of the Pequop Formation are 100% carbonates that are medium- to thick-bedded, have shades of gray as distinctive color, are practically silt and sand free, and weather into prominent ledge-cliff and slope topography. The Loray Formation is thin-bedded, contains a predominance of silt and sand, is tan to maroon and yellow-brown in color, and weathers into prominent receding slopes. The upper boundary is chosen at approximately the base of a 20 foot thick limestone unit of what may be Kaibab Limestone, or its equivalent. Identification of this unit as basal Kaibab Limestone is on the basis that it is overlain by a sequence of siltstone and phosphatic, cherty shale, which was previously identified in Indian Canyon approximately ten miles south. At this locality the phosphatic beds overlie an excellent stratigraphic section of Kiabab Limestone.

Thickness and age.—The measured section was obtained on a prominent spur immediately north of that containing the type Pequop Formation. It is approximately located in sections 35 and 26, T. 34 N., R. 65 E. Total measured thickness is 245 feet.

Steele (1960, p. 106-107) gives an Early Guadalupian age to the Loray Formation. However, the Permian Subcommittee of the National Research Council's Committee on Stratigraphy (1960, Dunbar, *et al.*) has listed the entire Kaibab Limestone sequence as Late Leonardian. The writer chooses to follow the latter interpretation, although it as admitted the Leonardian-Guadalupean boundary may occur within the Kaibab Limestone. Therefore, the Loray Formation is accepted in this study as of Late Leonardian age.

Tertiary System

Volcanics

Several small outcrops of volcanic rocks are found in the map area but were not mapped nor studied. They are acidic in composition, possibly rhyolite or quartz-latite, and possibly are Tertiary in age.

Quaternary and Recent Systems

Unconsolidated sediments are found in the map area in the form of fans, gravels, and Recent colluvium and alluvium. Alluvial fans, although well developed on both sides of the range, are best exposed on the western side. On this

Snelson, 1955

GENERALIZED STRATIGRAPHY OF THE SOUTHERN PEQUOPS

AGE	NAME	COLUMNAR SECTION	THICKNESS IN FEET	CHARACTER AND DESCRIPTION
TERT.-QUAT.	Undifferentiated		850+	Stream, pediment, and playa dep. Minor basalt remnants Conglomerates, siltstones, s.s. Silver to whitish-grey tuffs
	Unconformity			
LOWER TRIASSIC	Thaynes(?) "B" fm.		450±	Arg. limestones, siltstone, shale
	Thaynes(?) "A" fm.		2450±	Interbedded olive-drab to greenish-grey shales and fine to medium crystalline, grey limestones Basal ridge-forming grey lms. Some fossils (Terebratula thaynesiana)?
	Dinwoody(?) fm.		400±	Olive-drab to greenish-grey sh. with Meekoceras lms. near base
(covered)	Unconformity ?			
PERMIAN	Phosphoria(?) fm. Upper Productid Limestone		400±	Dictyoclostus multistriatus, Spiriferina pulchra, Spiriferina pseudocameratus, Composita subtilita, bryozoa, crinoids Grey chert-layered lms. with productids, spiriferoids, etc. Composita bands & nodules of chert & siliceous lst. forms lt. band.
	Middle Member		900±	Buff to grey limestones, Chert pebble sharpstone congl. near base
	Lw. Chert-Phos.		175	Chert, mud stone, oolitic phosph.
	Kaibab(?) fm.		150-200	Grey lms., thin chert layers
	? Unconformity ?			
	Pre-Kaibab(?) Pequop fm (?)		9000+	Primarily grey limestones, some argillaceous and arenaceous, and weather rusty-orange; some limestone with black and brown chert layers, stringers, and nodules. Sandstones, and mudstones generally covered. Some chert pebble conglomerate. Fusilines present. Parafusulina, Schwagerina, Triticites, Schubertella, Paraschwagerina, Pseudoschwagerina, Waeringella (Lower Wolfamp to Upper Leonard)

Olive-drab to greenish-gy sh. w/ intbdd Meekoceras-bearing reddish f. chocolate-brn., Fe-impregnated lsts. nr. t/ base.

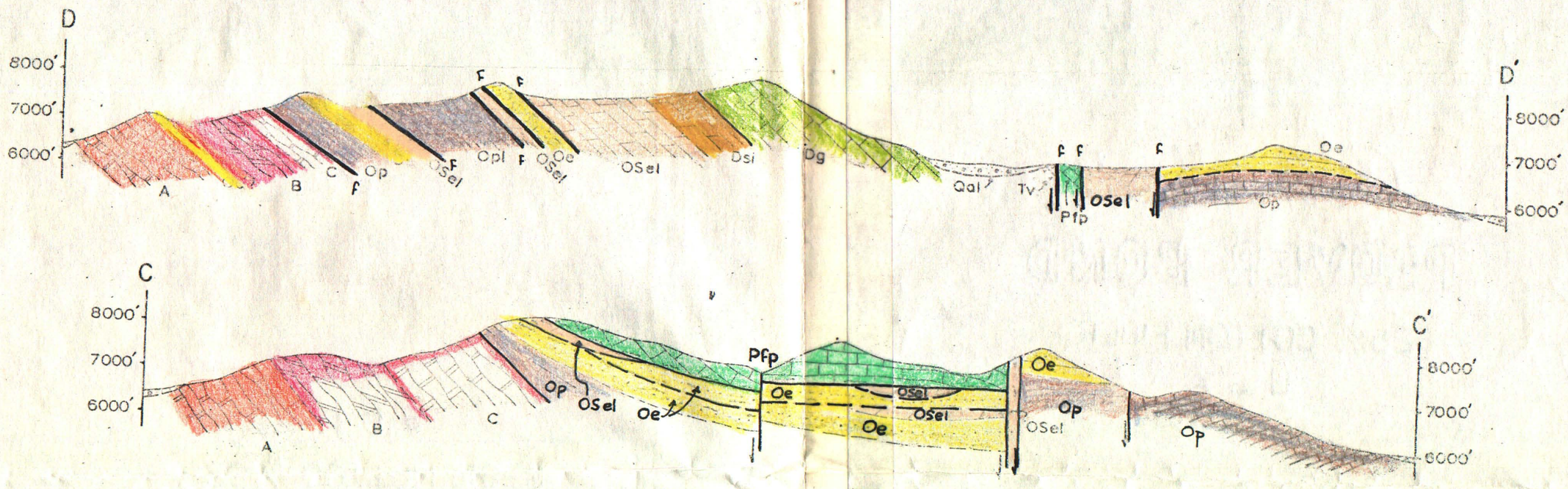
Top 90' - gy.; buff & brn., f. to m. grn. lst (often argill.) some chert pebbles (1 buff-white, porous, chert-pebble lst.) orange-brn. to buff chert pebble sharpstone cgl. w/ calc. matrix.

50' - f. to m. xline gy. lst.

dark bands

blk. & brn. chert, blk. mudst. & some bluish blk. oolitic phosphatic rk.

GEOLOGIC CROSS SECTIONS OF THE PEQUOP MOUNTAINS



Limestone
Dolomite
Siltstone
Quartzite
Calcite marble
Dolomite marble
Schist
Brecciated rocks

Thorman, 1962
Plate C

THORMAN

indurated whitish-gy. vitric tuff (glass shards)
poorly-indurated lt. tan tuff. sts.
orange to dk.gy. weathered, augite- ± lamprobolite-bearing hypersthene basalt

fault contact?

dips 5-8°S

③ alternating tuffaceous? ± calc. sts., ss. & cg.

② lt. tan cg.- angular to subangular frags. of lst + some chat.

① 45- lt. silver-gy., f.grn., t/b friable vitric tuff (~~diff~~ lacks cohesiveness & shard development of vitric tuff to N.)

P2. lst.

note: angular discordance at pre-Kaibab(?) — Kaibab(?) contact. Fault? a unconformity?

↖ Snelson now regards this as a "high-angle thrust" re. Harlow, SG

GEOLOGIC MAP of So. Pequop Mts. Nevada

Geology by S. Snelson 1955

Control by USGS and aerial photographs

Scale 0 1 2 Miles

EXPLANATION

Tert.-Quaternary
- Stream, pediment and playa deposits
- Vitric tuffs, siltstones, s.s., and congl; minor basalt

Triassic
- "B" MEMBER - THAYNES(?) FM.
- "A" MEMBER - THAYNES(?) FM.
- DINWOODY(?) FM.

Permian
- undifferentiated
- PHOSPHORIA(?) FM.: UPPER PRODUCTID LMS.; MIDDLE MEMBER; LOWER CHERT and PHOSPHATE
- KAIBAB(?) FM.
- PRE-KAIBAB(?)

Contacts: located; approx. position; indefinite

Faults: known; approx. position; thrust (high angle); inferred thrust

Anticline showing plunge
Overturned anticline
Syncline showing plunge
Overturned syncline

Attitudes: Normal; Overturned

Fossil locality

Coyote; Indian Creek; Spring Creek Fault; Abbott Fault; Correct Ridge; Isolation Ridge; Dolly Varden; Northern