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CONODONT BIOSTRATIGRAPHY, MIDWAY PROPERTY, NORTHERN BRITISH COLUMBIA* (104O/16)

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INTRODUCTION

This is a preliminary report on the conodont faunas which have been collected from the area of the Midway silver-lead-zinc manto deposit in Jennings River map area (104O/16), 80 kilometres west of Watson Lake, Yukon and 10 kilometres south of the British Columbia – Yukon border. Approximately 40 conodont collections have been recovered in the area since 1982, as part of property and regional mapping projects. During the summer of 1987, 78 samples were collected for conodont processing by S. Irwin. These samples form part of a broader study of the Devonian-Mississippian conodont faunas and biostratigraphy of the metalliferous Earn Group within miogeoclinal areas of northern British Columbia.

GEOLOGY

Previous work around the Midway deposit area includes 1:250 000-scale reconnaissance mapping by Gabrielse (1969) and 1:25 000 reconnaissance mapping by Nelson and Bradford (1987). Additional property mapping has been carried out by Cordilleran Engineering Ltd.

McDAME GROUP

The Middle Devonian McDame Group is composed of shallow, warm-marine carbonates that were deposited onto a subsiding shelf or platform (Gabrielse, 1963). In this study area the McDame is made up of a lower, dark grey, tan-weathering, massive to laminated, fetid dolostone and an upper, dark grey, fossiliferous platy limestone. Devonian macrofauna accumulations suggest an abundant but low diversity fauna, indicative of intertidal to subtidal environments. The McDame has undergone extensive karsting, at least some of it related to processes that predate Earn Group deposition. In the Midway area, the McDame Group is conformably (?) underlain by Lower Devonian Tapioca sandstone (Nelson and Bradford, 1987).

EARN GROUP

The Devono-Mississippian Earn Group comprises a turbiditic sequence that was originally included in the Lower Sylvester Group (Gabrielse, 1969). It has been reassigned to the Earn Group as named by Gordey *et al.* (1982a). The group consists of black slate, thin-bedded (occassionally) calcareous siltstone, thin to thick-bedded sandstone and chert-pebble conglomerate. There are economically significant baritic, siliceous and sulphide-rich exhalites within this unit (Nelson and Bradford, 1986). Two generally coarsening-upward sequences have been identified in the Earn around Midway by Cordilleran Engineering Ltd. The basal black shales of the Earn were deposited unconformably over the McDame carbonates. The upper contact is the basal thrust of the Sylvester allochthon (Nelson and Bradford, 1987).

SYLVESTER GROUP

The Sylvester Group (used here in a restricted sense to exclude autochthonous strata) consists of an allochthon of Upper Paleozoic to Triassic chert, limestone, greenstone, clastic and ultramafic rocks thrust over autochthonous or parautochthonous strata along the continental margin of North America in Middle Jurassic to Early Cretaceous time (Gordey *et al.*, 1982b). It was originally mapped as autochthonous Sylvester Group by Gabrielse (1963). Nelson and Bradford (this volume) have subdivided the allochthon into three lithotectonic units, the lowest of which contains all the conodont faunas reported here. The tectonic signature was developed during two or more independant tectonic episodes (Harms, 1986; Nelson and Bradford, 1987).

CONODONT FAUNAS

At present, conodont faunas are known from the McDame Group, Earn Group and Sylvester allochthon. This has provided broad constraints on the age of these units. Within the area shown in Figure 1-23-1, the conodonts range in age from Middle Devonian through Late Carboniferous. Six conodont faunas are identified and discussed below:

I. Frasnian *Palmatolepis*.
II. Famennian *Palmatolepis*.
III. *Siphonodella*.
IV. *'Hindeodella' segaformis*.
V. *Gnathodus bilineatus*.
VI. *Idiognathoides*.

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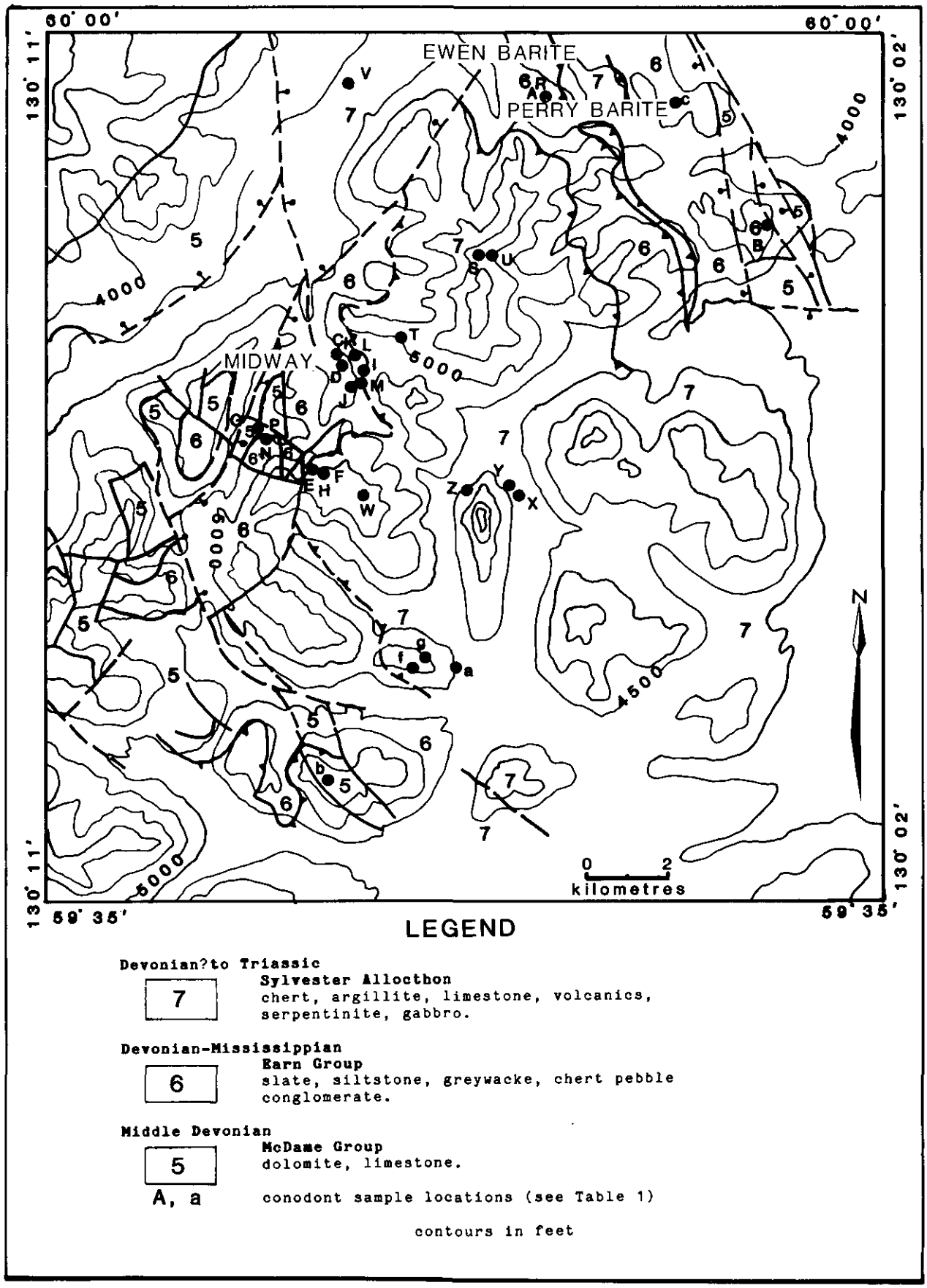

Figure 1-23-1. The collection sites of conodont-bearing samples (A to g), and simplified geology of the Midway area (after Nelson and Bradford, 1987).

FAUNA I

This fauna was recovered from dolomitic siltstone occupying hollows at the top of the McDame limestone at one locality. It comprises poorly preserved specimens of *Icriodus*, *Palmatolepis* and *Polygnathus*. Although these have not been determined to species level, they compare closely with early Late Devonian, Frasnian forms. Additional material should provide a more precise age for this faunule, which is important because it provides the first clear evidence for Late Devonian sedimentation prior to that of the Earn Group. It should also provide information on the nature and magnitude of the hiatus between the two groups.

A representative suite of lithotypes from core material of the McDame limestone (provided by D. Mundy, Cordilleran Engineering Ltd.) was analysed for conodonts, but few were recovered; they can only be broadly dated as Devonian. This probably results from a generally inhospitable environment, but large samples taken selectively might produce diagnostic collections.

Elsewhere within the Cordilleran miogeocline, Frasnian conodont collections are commonly found in Earn Group strata. Many collections of this age are associated with barite deposits in the Selwyn Basin, Yukon Territory (Dawson and Orchard, 1982).

FAUNA II

This fauna is known from the basal 1AC unit of the Lower Earn Group in two drill cores from the Midway property (Table 1-23-1). The fauna is characterized by abundant conodonts: the frequency is suggestive of either very slow rates of sedimentation and concentration as conodont lag deposits, or an extremely productive environment that has experienced a kill.

Fauna II is dominated by representatives of *Palmatolepis* ex gr. *glabra* Ulrich and Bassler, accompanied by *P. minuta* Branson and Mehl, *P. subperlobata* Branson and Mehl, *P.* cf. *P. regularis* Cooper, *P. quadrantinodosalobata* Sannemann, and *P. triangularis* Sannemann. Collectively, these conodonts represent the early to middle Famennian conodont zones of Upper *P. crepida* or *P. rhomboidea*. The fauna belongs to the offshore-basinal biofacies of *Palmatolepis* and lacks all indicators of shallow water deposition.

This fauna is widespread in the epicratonic region of western Canada. It is a typical Earn Group association (for example, Gordey *et al.*, 1982a, Fauna VI) in Yukon and the Kechika trough. South of Midway, in the Driftpile-Gataga area, approximately coeval faunas bracket mineralized horizons within the Earn Group (McClay and Insley, 1985; McClay *et al.*, 1986).

FAUNA III

This fauna characterizes the 2AC unit of the Earn Group in two drill cores on the Midway property (Figure 1-23-1, K, M), and has also been recovered from two localities within the outcrop of the Ewen and Perry barites. Fauna III is recognized by the occurrence of *Siphonodella*, the range of

TABLE 1-23-1. DETAILS OF THE CONODONT DATABASE DISCUSSED IN THIS PAPER

Loc. No. (Fig.1-23-1)	GSC Locality Number; Sample Number	Collector, Year	Stratigraphic Unit, Collector Assignment	Fauna No.	C.A.I.	Age
A	C-087737; 82MJO-BVH2	B. Hall, 1982	Earn Group, Ewen Barite	III–IV	6	Early Carboniferous
B	C-087738; 82MJO-BVH3	B. Hall, 1982	Earn Group, 2a	–	5	Middle Devonian–Early Carboniferous
C	C-102870; 82MW-82024	D. MacIntyre, 1982	Earn Group	–	5	Indeterminate
D	C-102871; 82MW-820031	D. MacIntyre, 1982	Earn Group	?III–IV+	5	Late Devonian–Early Carboniferous
E	C-116407; 84GAH-235F	T.A. Harms, 1984	Sylvester Group	IV	5	Early Carboniferous
F	C-116408; 84GAH-238F	T.A. Harms, 1984	Sylvester Group	VI?	5	Late Carboniferous–Early Permian
G	C-118251; 84MJO-SVMTN	W. Jakubowski, 1984	McDame Group	?III–IV+	5	Late Devonian–Early Carboniferous
H	C-118252; 84MJO-WJ84-1	W. Jakubowski, 1984	Sylvester Group	VI	5	Early Carboniferous
I	C-118253; 84MJO-83-34	W. Jakubowski, 1984	Earn Group (1AC)	II	5	Late Devonian
J	C-118254; 84MJO-83-27	W. Jakubowski, 1984	Earn Group (2AC)	–	5	Indeterminate
K	C-118255; 84MJO-83-28.2AC	W. Jakubowski, 1984	Earn Group (2AC)	III	6	Early Carboniferous
L	C-118256; 84MJO-83-28.1AC	W. Jakubowski, 1984	Earn Group (1AC)	II	5	Late Devonian
M	C-118258; 84MJO-82-13	W. Jakubowski, 1984	Earn Group (2AC)	III	5?	Early Carboniferous
N	C-118266; 84MJO-MD-2	D. Mundy, 1984	McDame Group	–	5	Devonian
P	C-118272; 84MJO-MD-8	D. Mundy, 1984	McDame Group	–	5	Middle–Late Devonian
R	C-118275; 84MJO-EWEN	W. Jakubowski, 1984	Earn Group, Ewen Barite	III	6	Early Carboniferous
S	C-143630; 86JB34-01-01	J. Bradford, 1986	Sylvester Group	V	5	Early Carboniferous
T	C-143629; 86JB17-18-01	J. Bradford, 1986	Sylvester Group	?III–IV+	5	Early Carboniferous
U	C-143625; 86JB15-01-01	J. Bradford, 1986	Sylvester Group	IV	5	Early Carboniferous
V	C-143632; 86JB13-07-01	J. Bradford, 1986	Sylvester Group	IV	5	Early Carboniferous
W	C-117623; 86TH02-08-01	T.A. Harms, 1986	Sylvester Group	III–IV+	5	Late Devonian–Early Carboniferous
X	C-143636; 86KG21-01-01	K. Green, 1986	Sylvester Group	–	5	Indeterminate
Y	C-143637; 86KG21-02-01	K. Green, 1986	Sylvester Group	IV	5	Early Carboniferous
Z	C-123645; 86JN30-07-01	J. Nelson, 1986	Sylvester Group	–	5	Carboniferous
a	C-117561; 86JN22-19-01	J. Nelson, 1986	Sylvester Group	IV	5	Early Carboniferous
b	C-143101; 86JN03-06A	J. Nelson, 1986	'McDame Group'	I	5	Late Devonian
c	C-143102; 86JN-05-08	J. Nelson, 1986	Earn Group, Perry Barite	III	5	Early Carboniferous
f	C-143106; 86JN-22-04	J. Nelson, 1986	Sylvester Group	III	5	Early Carboniferous
g	C-143107; 86JN-22-01	J. Nelson, 1986	Sylvester Group	–	5	Indeterminate

which approximates the early to middle Tournaisian (Kinderhookian). *Siphonodella*, the offshore successor to Late Devonian *Palmatolepis*, is found alone in some collections, but more commonly, species of *Gnathodus*, *Polygnathus*, *Protognathodus* and *Pseudopolygnathus* are associated, as for example at the Perry Barite property (c). High diversity faunules such as this are certainly conducive to improved zonal resolution, which may become critical to the question of Earn-Sylvester separation.

The occurrence of Fauna III also in strata assigned to the Sylvester Group (f) underlines this problem. This sample contains each of the genera listed as occurring in the Perry Barite collection, but in addition includes *Bispathodus* ex gr. *stabilis*, a relatively long-ranging taxon that occurs more commonly, possibly exclusively, in samples referred to the Sylvester Group (*see* below).

Elsewhere, *Siphonodella* is known to occur both in the Antler Formation of east-central British Columbia (Struik and Orchard, 1986), which belongs in the same tectonostratigraphic terrane as the Sylvester Group, and in the Earn Group of the Selwyn basin.

FAUNA IV

This fauna, known from four localities referred to the Sylvester Group, is typified by *'Hindeodella' segaformis*. In each of these collections (E, U, V, Y), *Bispathodus* ex gr. *stabilis* also occurs, as do fewer *Polygnathus* and *Pseudopolygnathus*. The last two genera also occur in Fauna III, but *B.* ex gr. *stabilis* is not known to occur for certain below Fauna IV. Some Midway samples (D, G, T) contain questionable specimens of *Bispathodus* and are therefore assigned a range of age, including levels younger than Fauna IV (IV + = Early Visean). One additional collection from the Sylvester Group (a) lacks the *segaformis* element, but contains *Eotaphrus*; both these taxa are of Early Carboniferous, Late Tournaisian (lower Osagean) age and are therefore combined in Fauna IV.

The *segaformis* element is widespread in areas marginal to the craton, and has been reported from stratiform barite deposits in Yukon Territory (Dawson and Orchard, 1982).

FAUNA V

In the study area, Fauna V is known from a single locality within the Sylvester Group. It consists of *Gnathodus bilineatus*, *G. girtyi*, *Lochriea commutata* and *Idioprioniodus*, an association indicative of the Late Visean to Early Namurian (Late Mississippian). Elsewhere in the Cordillera, this fauna is one of the most widespread (Orchard, 1987); it occurs in both the Antler and Fennell formations of the allochthonous Slide Mountain terrane, and in limestone-quartzite units of autochthonous Yukon strata (for example, Gordey *et al.*, 1982, Nos. 1-4, 7).

FAUNA VI

This fauna is known from one or two localities within the Sylvester Group. It is characterized by *Idiognathoides*, which indicates a Late Namurian to Bashkirian (Early to early Middle Pennsylvanian) age. As in other collections from the Slide Mountain terrane (Orchard, 1986), one faunule (H) also includes primitive *Neogondolella*. A second collection (F) contains *Idiognathodus*, a genus that is commonly found with *Idiognathoides*, although the former ranges through the Upper Carboniferous and lowermost Permian.

CONCLUSIONS

Within the study area, the following conodont-based biostratigraphic conclusions are reached:

(1) Dolomitic siltstone occupying hollows at the top of the McDame Group are Late Devonian in age, but significantly older than basal Earn Group.

(2) The hiatus between the McDame and the Earn groups is equivalent to an undetermined part of the Frasnian plus about five conodont zones within the Famennian.

(3) Informal Unit 1AC, which occurs at or near the base of the Earn Group in the Midway area, is referred to the Upper *Palmatolepis crepida* Zone or *P. rhomboidea* Zone of the early to middle Famennian.

(4) Both the informal Unit 2AC of the Earn Group, and strata associated with the Ewen and Perry barites, are Early to Middle Tournaisian in age. This is also the age range assigned to the oldest conodonts identified within Sylvester Group.

(5) In the study area, the Sylvester Group, as presently conceived, includes limestone of four different ages: Early to Middle Tournaisian (Fauna III), Late Tournaisian (Fauna IV), Early Namurian (Fauna V), and Late Namurian to Bashkirian (Fauna VI).

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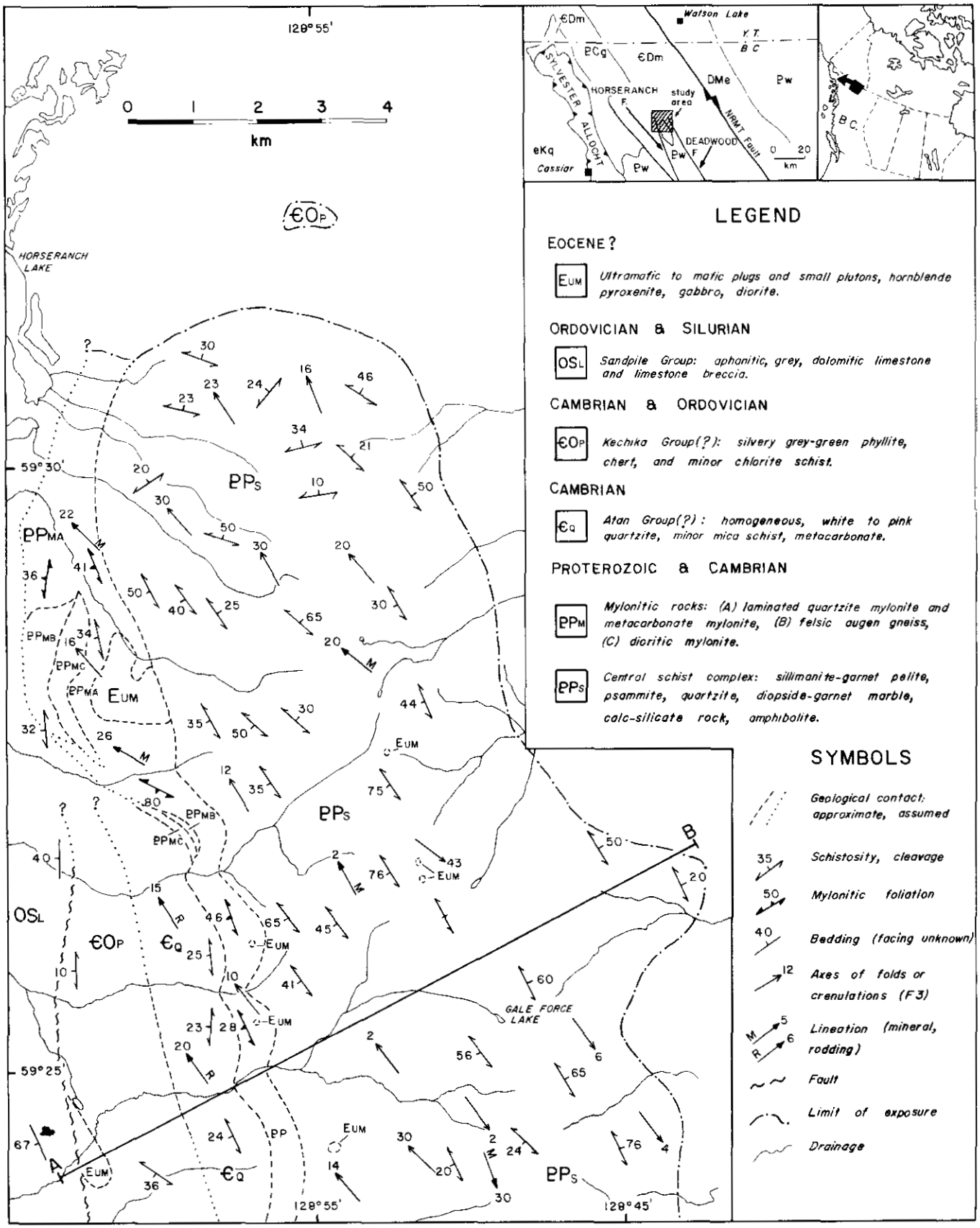

Figure 1-24-1. Geology of the northern Horseranch Range. Inset shows index map and regional geology. Line A-B is the location of the cross-section in Figure 1-24-2.