



British Columbia Geological Survey Geological Fieldwork 1979

NORTHEAST BRITISH COLUMBIA

DRIFTPILE CREEK – AKIE RIVER PROJECT

(94 F, K, L)

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INTRODUCTION

A regional mapping project was initiated in the Driftpile Creek–Akie River area of northeastern British Columbia in response to increased levels of base metal exploration in this area during 1978. The main purpose of the initial phase of this project was to obtain additional information on the stratigraphic and structural setting of recently discovered shale-hosted barite-lead-zinc-silver occurrences. These occurrences are Devonian in age and are comparable to those of the Selwyn Basin in the Yukon.

The 1979 program involved a two-man helicopter-supported field crew operating out of exploration camps at Driftpile Creek and Pretzel Lake (21 kilometres southeast of Ware). Mapping was done at a scale of 1:125 000 and was restricted to that part of the belt containing Devonian black clastics with known mineral occurrences. This included the area from Gataga Lakes north to Through Creek (Driftpile Creek district) and the area from the Warneford River south to the Ospika River (Akie River district), a total area of approximately 1 350 square kilometres. Samples for future petrographic, paleontological, and geochemical studies were collected at 413 geologic stations. A 1:250 000 geological compilation map is currently in preparation. More detailed mapping, concentrating on delineation of sedimentary facies within the Devonian succession, is planned for the 1980 field season.

EXPLORATION HISTORY

Geologic mapping and stratigraphic studies have been done in the Ware (94F), Tuchodi Lakes (94K), and Kechika (94L) map-areas by Gabrielse (1962, 1977), Taylor and Stott (1973), Taylor (1979), Taylor, *et al.* (1979), and Cecile and Norford (1979), all of the Geological Survey of Canada. In addition, the Gataga Joint Venture has carried out detailed mapping in the Driftpile Creek area (for example, Carne, 1978) and the Cyprus Anvil/Hudson's Bay Oil and Gas joint venture has mapped the Akie River district (W. Roberts, D. Kilby, personal communication).

The first major regional exploration program in the Gataga Lakes area was done by Geophoto Consultants in 1970 on behalf of a syndicate. Follow-up work was done in 1973 by Placer Development Limited (through Canex Placer Limited) on behalf of their joint venture partners, Pembina Pipe Line Ltd., Sur Oil Company Limited, and General Crude Oil Company, Northern Ltd. Subsequent work resulted in the discovery of several shale-hosted barite-sulphide occurrences including Driftpile Creek. In 1976, Castlemaine Explorations Ltd. conducted a regional geochemical program in the Driftpile Creek area and in 1977, Aquitaine Company of Canada Ltd., Chevron Canada Limited, Getty Mining Pacific, Limited, and Welcome North Mines Ltd. formed the Gataga Joint Venture to do follow-up work in geochemically anomalous areas. This work, contracted to Archer, Cathro and Associates, Limited resulted in the staking of

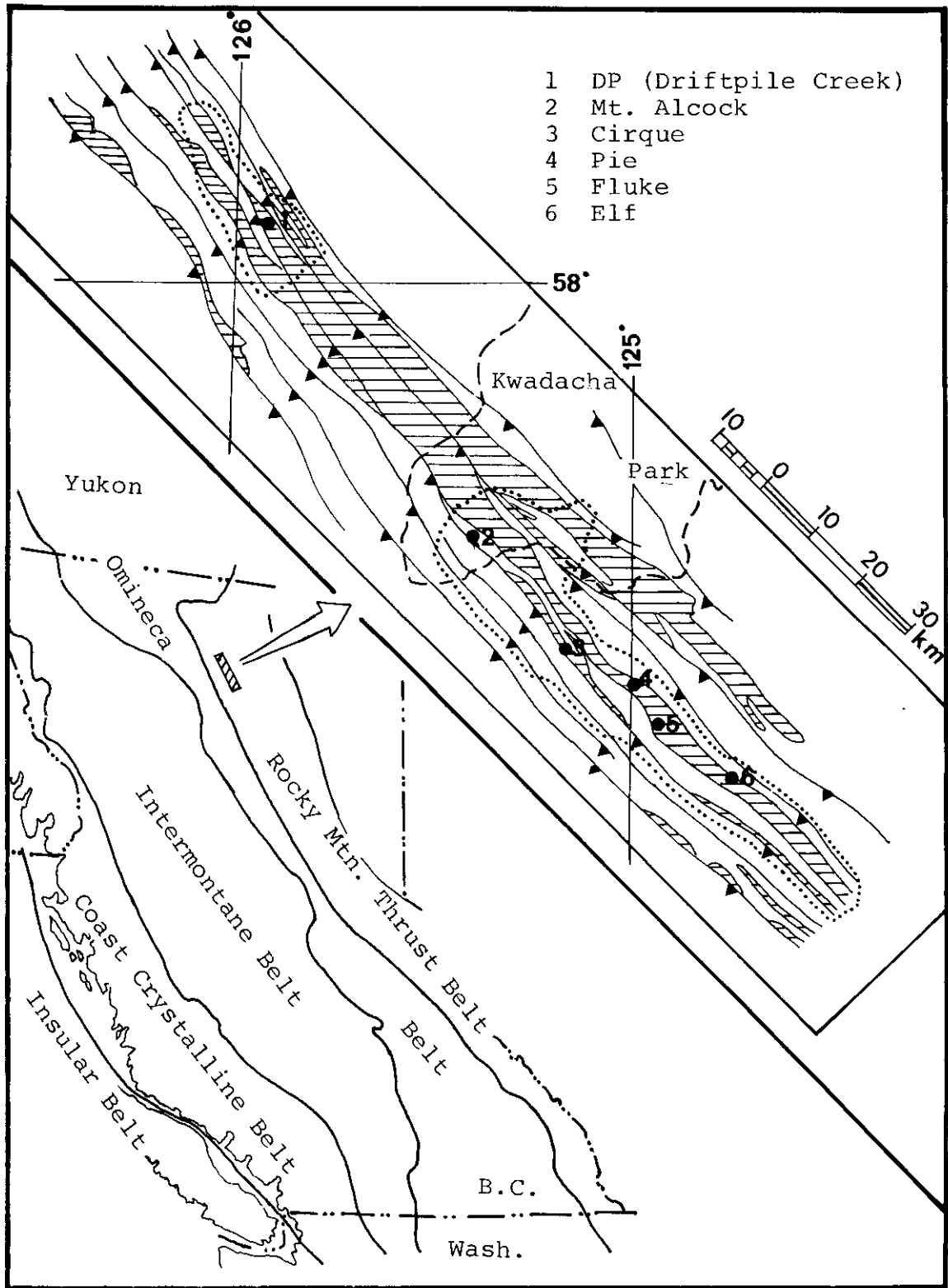


Figure 15. Location and tectonic setting of the 1979 Driftpile Creek-Akie River project area. Inset shows limit of mapping (dotted line), major thrust faults, distribution of Devonian black clastics (lined), and location of major shale-hosted Ba-Pb-Zn occurrences.

several new claim blocks northwest and southeast of Driftpile Creek. Other companies active in the area at that time were Texasgulf Inc., Granby Mining Corporation, S.E.R.E.M. Ltd., Cominco Ltd., and United Mineral Services Ltd. Further south, Cyprus Anvil Mining Corporation and Hudson's Bay Oil and Gas Company Limited were involved in a joint regional exploration program in the Akie River district which resulted in the discovery of three new showings – the Cirque, Elf, and Fluke. In the following year Rio Tinto Canadian Exploration Limited (Riocanex) staked the area between the new showings. During 1978 and 1979 diamond-drilling programs were conducted on the DP (Driftpile) claims, currently under option to the Gataga Joint Venture, and on the Cirque and Elf claims.

PHYSIOGRAPHY

The physiography of the map-area is characterized by northwest-trending ridges, locally rising to 2 200 metres elevation, truncated by broad northeast-trending drainage corridors. The most prominent ridges are generally capped by resistant strata, whereas valleys and low ridges are usually underlain by recessive formations. Alpine glaciation has carved numerous cirque valleys into the most resistant ridges thus producing excellent exposures of the stratigraphic succession, particularly on the steeper northeast-facing slopes. By contrast, valleys are filled with fluvio-glacial and lacustrine deposits and, with the exception of downcutting creeks, contain very little outcrop.

TECTONIC SETTING

The project area (Fig. 15) is located within the Rocky Mountain (Foreland) thrust and fold belt of the Columbian Orogen and is centred approximately 35 kilometres east of the Rocky Mountain Trench. This part of the thrust belt is underlain by Early Paleozoic miogeoclinal strata. These rocks are part of the northwest-trending Kechika Trough which may represent a southeasterly extension of the larger Selwyn Basin. The trough is bounded by platformal carbonates and uplifted Proterozoic rocks to the east forming the Muskwa anticlinorium (Taylor, *et al.*, 1979) and is truncated to the west by transcurrent faults of the Rocky Mountain Trench system.

GEOLOGY

The project area is underlain by sedimentary strata ranging in age from Proterozoic to Early Triassic. The various formations are arranged in narrow discontinuous belts bounded by northwest-trending thrust faults. Mapping was done by traversing ridges and creeks oriented perpendicular to the structural trend and interpolating between traverses. The results of this work are summarized on Figures 16, 17, and 18. Idealized stratigraphic sections are shown on Figure 19.

PROTEROZOIC–CAMBRIAN (UNIT PC)

The oldest rocks exposed in the project area are Hadrynian to Early Cambrian in age. This part of the stratigraphic succession is comprised of a structurally complex assemblage of metasedimentary rocks which are well exposed in the Gataga River valley and ranges to the east (Taylor, *et al.*, 1979). No work was done on these rocks in 1979.

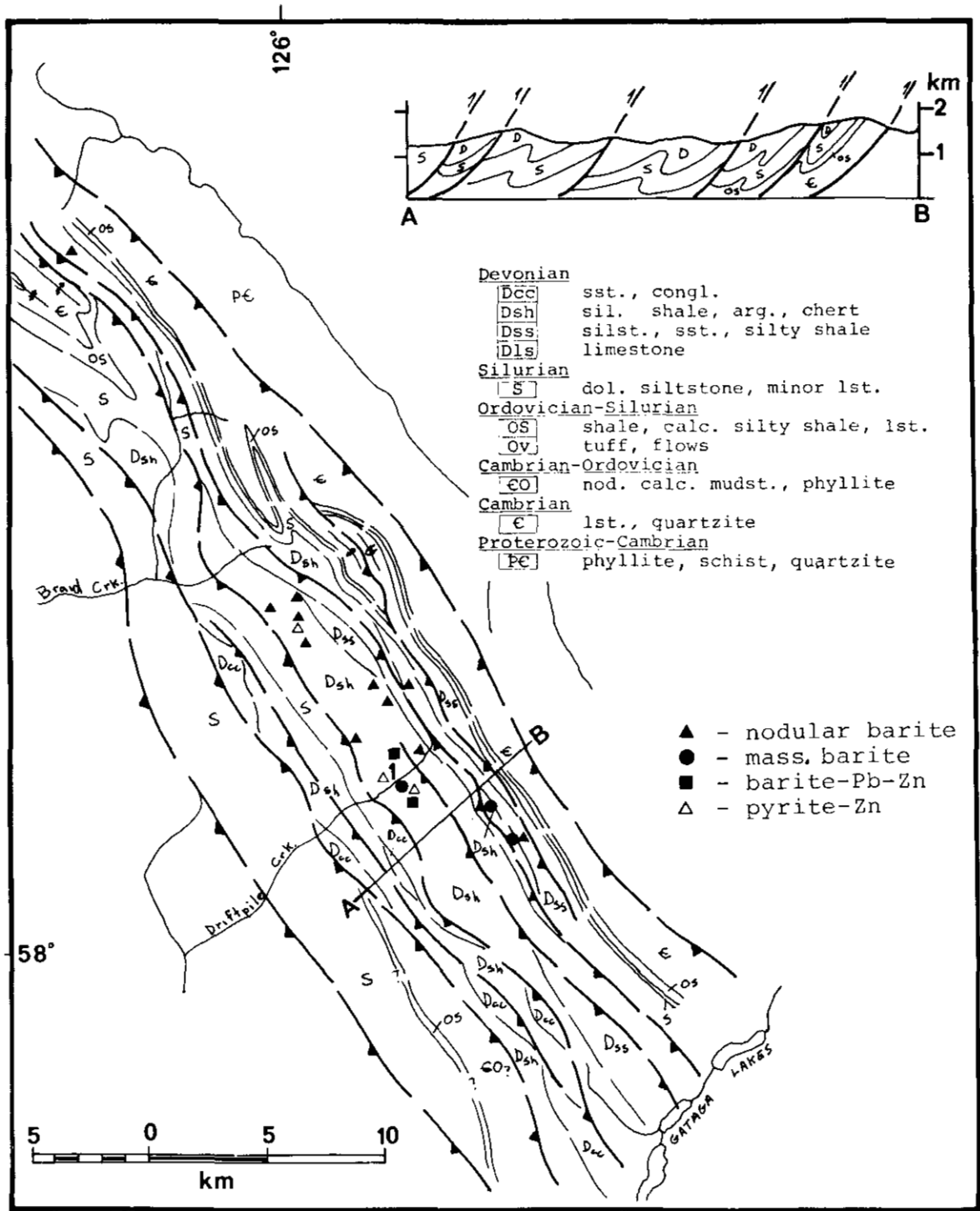


Figure 16. Geology of the Driftpile Creek district. [1 = Driftpile Creek occurrence.]

LOWER TO MIDDLE CAMBRIAN (UNIT €)

Hadrynian to earliest Cambrian rocks are unconformably overlain by quartzite and massive limestone believed to be correlative with the Lower to Middle Cambrian Atan Group. These rocks are very resistant and form prominent cliffs, particularly where they have been thrust over younger, less resistant strata. The upper limestone unit is well exposed in the Driftpile Creek district (Fig. 16) where it consists of massive grey micritic limestone, possibly representing archeocyathid 'patch reefs' and biostromes (Carne, 1978). Rusty weathering, dolomitized channel or reef front breccia deposits and interbedded quartzite and quartzite pebble conglomerate locally occur at the top of the limestone unit and may represent a pre-Ordovician erosion surface. Taylor, *et al.* (1979) have described several periods of block faulting, uplift, dyke emplacement, and erosion in Cambrian and older rocks exposed east of the Driftpile Creek area.

CAMBRIAN TO ORDOVICIAN (UNIT €O)

In the Akie River district (Fig. 17) the Atan limestone is apparently unconformably overlain by up to 1 500 metres of cream to light grey-weathering, wavy banded, nodular calcareous mudstone or phyllite, believed to be part of the Kechika Group. These rocks are well exposed in the core of several large overturned anticlinal structures. Lithologically similar rocks are absent in the Driftpile Creek area, where Atan limestone is apparently overlain by Ordovician to Silurian age rocks. Several thin tuff horizons were noted in the upper part of the Kechika Group suggesting periodic Late Cambrian to Early Ordovician volcanism. The stratigraphy of the Kechika Group has recently been described in detail by Cecile and Norford (1979).

ORDOVICIAN TO SILURIAN (UNIT OS)

In the Akie River district, Kechika rocks are unconformably overlain by a succession of calcareous siltstone, shale, limestone, and volcanic rocks which have been assigned to the Middle Ordovician to Upper Silurian Road River Formation (Taylor, *et al.*, 1979). These rocks reflect the establishment of an abrupt, well-defined basin-platform transition zone along the eastern margin of the project area that persisted from Early Ordovician to Late Devonian time. Three major cycles of platformal or near-platformal deposition followed by marine transgression and progressively more distal basinal deposition are recognized in the stratigraphic record, roughly corresponding to the Ordovician, Silurian, and Devonian periods.

The stratigraphy of the Road River Formation in the Ware map-area has been described by Cecile and Norford (1979). Within the project area this formation includes a lower unit of cream, beige, and reddish brown-weathering, laminated calcareous siltstone and shale with limestone turbidite interbeds. The latter are probably related to the Skoki shale-out as described by Cecile and Norford (1979). A much thinner succession of lithologically similar rocks overlies the Atan limestone in the Driftpile Creek area and are also tentatively assigned to the Road River Formation. In both areas these rocks are conformably overlain by black carbonaceous basinal shales containing Middle Ordovician to Upper Silurian graptolite assemblages. Black chert horizons are locally interbedded with the shales. This part of the stratigraphic succession is very incompetent relative to underlying and overlying strata and consequently the shales are intensely sheared and folded and have a well-developed axial plane cleavage. Upon weathering these rocks decompose to a black carbonaceous mud.

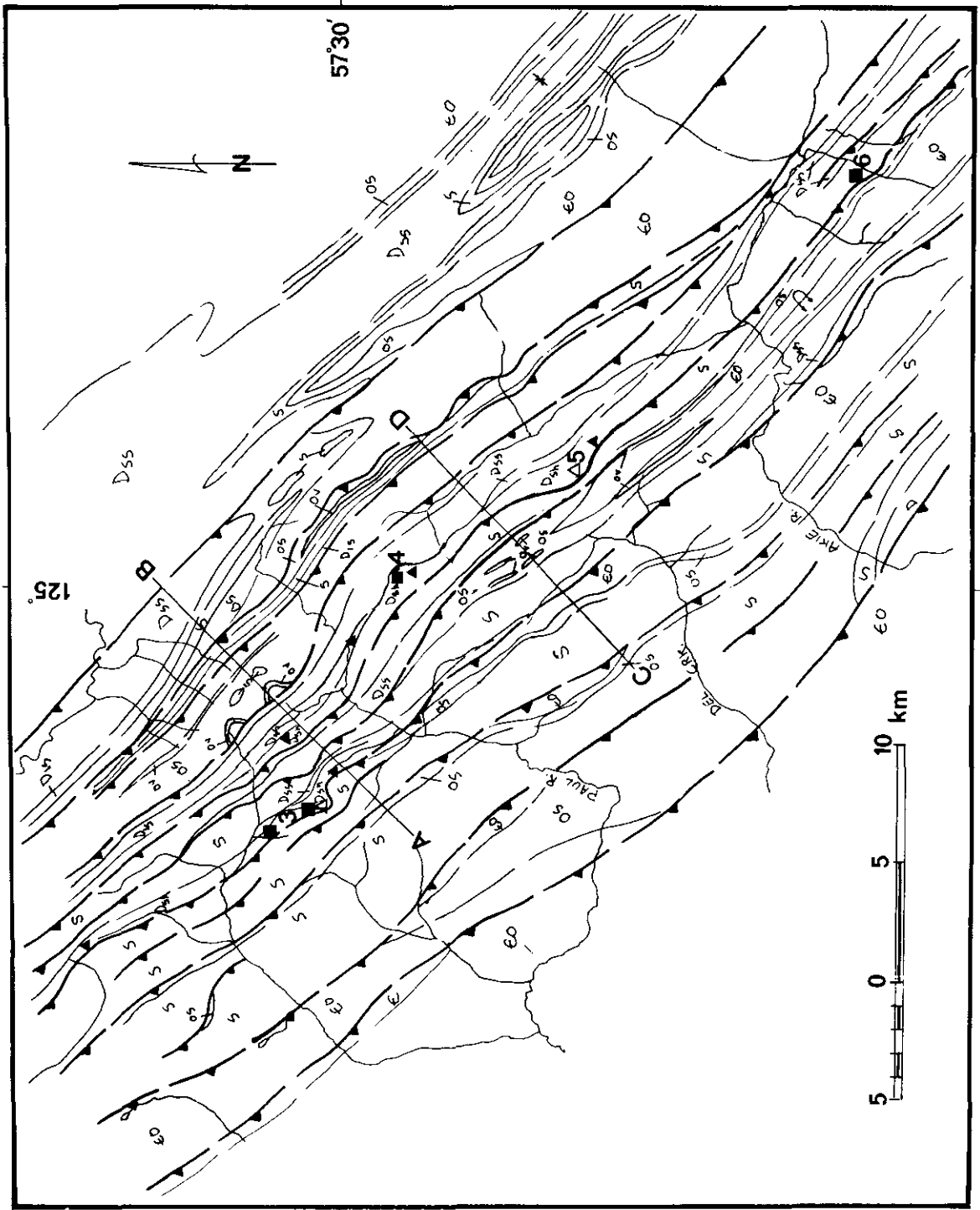


Figure 17. Geology of the Akie River district (see Figure 16 for legend and explanation of symbols; 3 = Cirque, 4 = Pie, 5 = Fluke, 6 = Elf.)

In the Akie River district discontinuous volcanic horizons occur near the base of the black shale unit. The best exposures of these rocks occur east of the Pie claims (Fig. 17) where a greenish grey-weathering massive micro-dioritic flow, up to 50 metres thick, overlies graptolitic black shale and chert and in turn is overlain by interbedded shale and orange to brown-weathering vitric crystal and lapilli-tuff with high carbonate content. These rocks are probably related to periodic volcanic activity along a deep-seated rift zone.

SILURIAN (UNIT S)

Road River shales are unconformably overlain by up to 800 metres of orange to brown-weathering siltstone and minor limestone of apparent Silurian age. This unit is relatively competent and resistant and is found capping peaks and ridges throughout the project area, particularly where it has been thrust over younger rocks.

In the Driftpile Creek area the Silurian section is less than 200 metres thick, but becomes progressively thicker to the west. The main lithologies are interbedded platy, thin laminar-bedded and blocky thick flaser-bedded dolomitic siltstone with minor orange-weathering limestone interbeds. Overall, the succession is strongly bioturbated and contains spiral feeding trails, siliceous sponge spicules, and poorly preserved graptolites. Similar rocks constitute a much thicker Silurian section in the Akie River district. However, in this area the base of the section is marked by a 10 to 20-metre-thick unit of grey, blocky weathering, massive limestone or dolostone, overlain by 5 to 10 metres of interbedded black chert, laminated silty shale, and limestone turbidites [SL unit of Cecile and Norford (1979) ?]. The stratigraphic succession suggests an eastward migration of the basin-platform transition zone during Middle Silurian time. Limited paleocurrent data and the composition of the dolomitic siltstone turbidites suggest these rocks are derived from the carbonate platform. As such, they may be basal equivalents of the Nonda Formation.

DEVONIAN

Within the project area the Silurian siltstone unit is conformably to disconformably overlain by shale, siltstone, and limestone of Devonian age. With the exception of limestone and the more siliceous shale facies, these rocks are very recessive and are usually poorly exposed. In many areas the Devonian succession has been completely removed by erosion. The most complete Devonian stratigraphic sections occur in overturned synclinoria which have been overridden by thrust plates containing older, more resistant strata. Unfortunately, under such a stress regime the Devonian rocks, because of their incompetence, tend to coalesce into tight isoclinal folds and develop a pervasive axial plane cleavage. These features make definition of original stratigraphic thicknesses and recognition of lateral and vertical facies changes extremely difficult. In spite of the structural complexity of the Devonian section, an attempt has been made to divide the succession into different units. These units are largely based on gross lithological characteristics. Four major subdivisions have been used in the current mapping project.

- (1) D_{ls} – limestone, minor chert, shale (Dunedin Formation equivalent);
- (2) D_{ss} – silty shale, siltstone, minor sandstone, limestone (Besa River Formation equivalent);
- (3) D_{sh} – Siliceous shale, argillite, chert (Gunsteel shale);
- (4) D_{cc} – sandstone, siltstone, conglomerate (Warneford coarse clastics).

These unit names conform to those currently being used informally by workers in the area, for example, Carne (1978), Roberts (1977), and Gabrielse (1977).

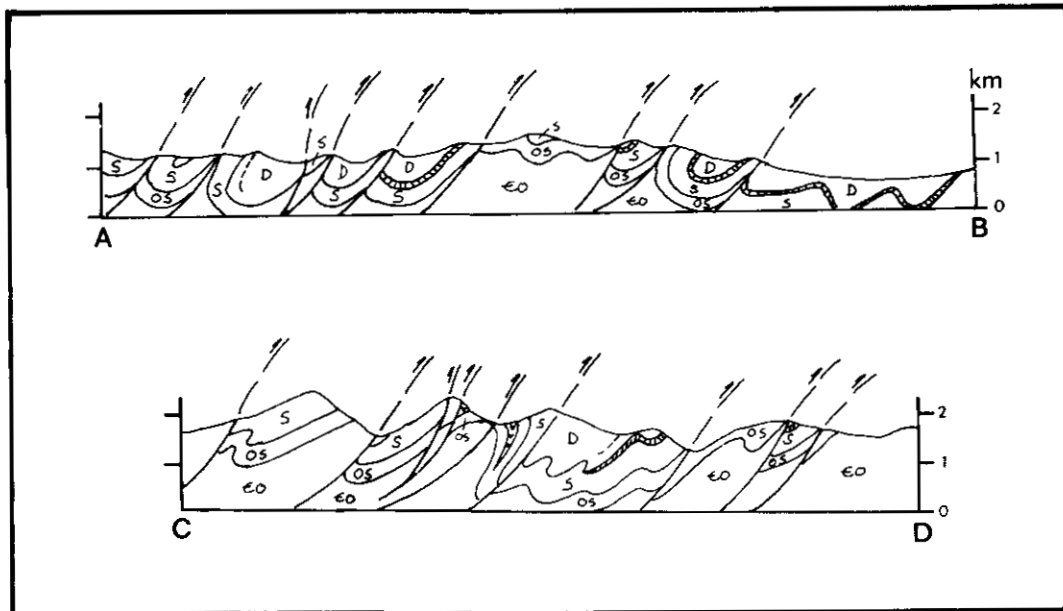


Figure 18. Structural sections, Akie River district (see Figure 17 for location of section).

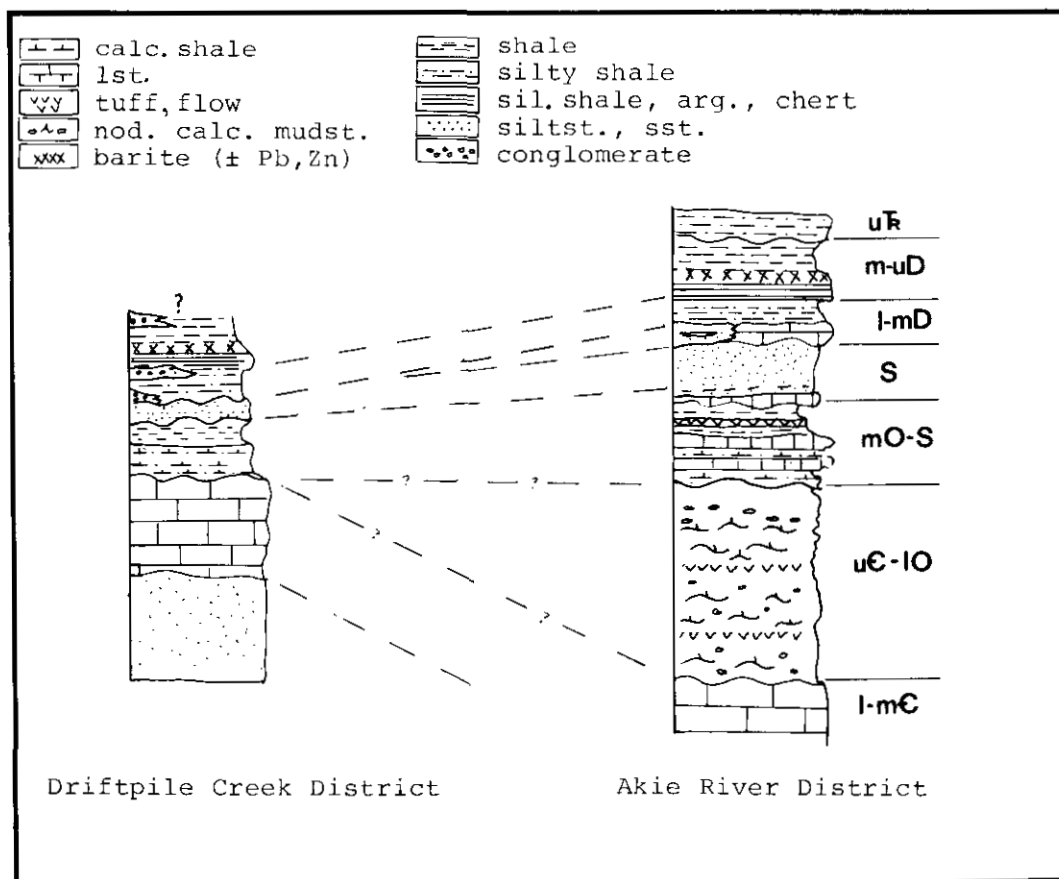


Figure 19. Idealized stratigraphic section, Akie River and Driftpile Creek districts.

UNIT D_{ls}

East of the Cirque claims (Fig. 17) Silurian siltstone is unconformably to disconformably overlain by up to 100 metres of grey fossiliferous limestone believed to be correlative with platformal carbonates of the Dunedin Formation (Morrow, 1978). Here the limestone is thick bedded and massive with alternating fossil-rich and fossil-poor beds. Elsewhere in the area the limestone is thin and discontinuous and shales-out into the basinal Besa River Formation. Limestone turbidites and coarse debris flows with interbedded quartz siltstone, siliceous argillite, calcareous siltstone, and black graptolitic shale are characteristic of this shale-out. The shale-out appears to be very abrupt, suggesting a relatively sharp well-defined platform margin with a steep basinward slope.

The Dunedin Formation or its equivalent is apparently absent in the Driftpile Creek area although it occurs to the east in the Tuchodi Lakes map-area (Taylor and Stott, 1973).

UNIT D_{ss}

Unit D_{ss} is interpreted to be the basinal equivalent of the Dunedin limestone and is tentatively correlated with the Besa River Formation (Kidd, 1963; Pelzer, 1966). Immediately east of the Fluke and Elf showings up to 200 metres of brownish grey-weathering, poorly sorted, slightly calcareous siltstone and minor sandstone with interbedded siliceous argillite appears to overlie Silurian siltstone and interfinger with Devonian limestone. Further to the west these rocks grade into laminated silty shale with occasional thin siltstone and sandstone interbeds. These interbeds carry white calcareous detritus which may be shell fragments. At the Cirque property laminated silty shales overlie Silurian siltstone but here this unit is less than 50 metres thick. It is suggested that unit D_{ss} represents a clastic wedge thinning and fining westward away from the platform margin.

UNIT D_{sh}

Unit D_{sh} includes bluish grey-weathering, siliceous black laminated silty shale, blocky thick-bedded siliceous argillite or chert, and rusty weathering pyritic carbonaceous black shale. These rocks have been given the informal name Gunsteel Formation. Although stratigraphic relationships are not well defined it appears that Gunsteel rocks unconformably overlie both the Besa River and Dunedin Formations and may in places lie directly on Silurian siltstone. The Gunsteel Formation appears to thicken locally, suggesting development of small isolated basins or troughs within the larger basin of deposition. Gunsteel rocks apparently represent a major marine transgression which marks the change from a well-defined basin-platform regime to a more flyschoid-type deposition during Late Devonian time. This event is roughly coincident with the Antler orogeny recognized elsewhere in the Cordillera.

UNIT D_{cc}

Unit D_{cc} is restricted to the western half of the Driftpile Creek map-area and to the area between Mount Alcock and Gataga Lakes. This unit includes grey-weathering, poorly sorted sandstone and siltstone, poly-mictic pebble conglomerate, and minor shale and has been given the informal name Warneford Formation

(Roberts, 1977). Well-defined, proximal to distal turbidite sequences are characteristic of the Warneford Formation and define a series of westerly derived submarine fans (Carne, 1978) that are interfingered with and in places overlie Gunsteel shales. This type of flysch deposition probably reflects rapid uplift to the west during latest Devonian to earliest Mississippian time.

TRIASSIC

Gunsteel shale is disconformably overlain by dolomitic siltstone which has been preserved within an overturned synclinal structure east of Mount Luke. Although these rocks are lithologically similar to the Silurian siltstone unit, they are easily distinguished by containing shelly fauna of Early Triassic age (Gabrielse, 1977).

MINERAL OCCURRENCES

Cecile and Norford (1979) have described stratiform barite occurrences in Kechika, Road River, and Silurian siltstone units in the Ware map-area. Within the current project area the most significant concentration of barium is associated with siliceous argillite and shale of the Devonian Gunsteel Formation. Six major shale-hosted barite-lead-zinc occurrences with or without associated laminar banded pyrite-zinc mineralization are known. These are Driftpile Creek, Mount Alcock, Cirque, Pie, Fluke, and Elf. Location of these occurrences is shown on Figures 15, 16, and 17. In addition, numerous occurrences of stratiform blebby or nodular barite and locally massive white crystalline barite are known in Gunsteel shale of the Driftpile Creek and Akie River districts. This suggests the barite-bearing horizons are present on a regional scale and locally thicken to form significant deposits of potential economic value.

Prospecting in the Driftpile Creek and Akie River districts has been enhanced by the fact that the baritic horizons often produce prominent kill zones. In addition, extensive orange to red ferricrete deposits occur where groundwater emanates from faults cutting pyritic shale horizons.

DP (DRIFTPILE CREEK) (94K/4)

The Driftpile Creek occurrence was discovered by Canex Placer in 1973 while following up anomalous stream sediment data. The paucity of outcrop and presence of deep surface oxidation necessitated extensive geochemical and geophysical surveys (Wise, 1974; Kowalchuk and Rivera, 1976) during the early stages of exploration. The property was subsequently optioned to the Gataga Joint Venture and in 1978 nine drill holes totalling 1 016 metres were drilled. An additional 21 drill holes totalling 2 417 metres were drilled in 1979. This work has defined several southwest-dipping, finely laminated pyrite and bedded barite horizons within siliceous shales of the Gunsteel Formation. The Devonian section is extensively folded and faulted in this area and some of the mineralized horizons may represent fault repeats.

The main massive sulphide horizons are characterized by very finely laminated pyrite which locally has soft sediment deformation and graded bedding. Bedding is locally disrupted by the diagenetic growth of small calcium carbonate nodules. Barite and sphalerite are present in variable amounts.

The best mineralization exposed on the property is located in trenches 1 400 metres north of Driftpile Creek. Here thin parallel bands composed of discrete irregular grains of galena and sphalerite occur in a dark

grey-bedded barite host. The best drill intersection during the 1978 program was from this horizon and graded 9.05 per cent lead and 3.53 per cent zinc over 8.1 metres. What appears to be the same horizon was intersected in drill holes immediately south of Driftpile Creek but here finely laminated pyrite predominates and galena and barite are present in very minor amounts.

MOUNT ALCOCK (94F/11)

A prominent white barite kill zone occurs on the ridge northeast of Mount Alcock, in Kwadacha Wilderness Park. This showing is contained within a fault-bounded wedge of Gunsteel shale surrounded by Silurian siltstone. The barite horizon is apparently 25 to 30 metres thick and dips from 45 degrees to 75 degrees to the southwest. Within the barite horizon is a 2 to 3-metre-thick zone containing fine diffuse bands of galena and sphalerite. Assays of grab samples collected from this zone follow.

Sample No.	Ag <i>ppm</i>	Ba <i>per cent</i>	Cu <i>per cent</i>	Pb <i>per cent</i>	Zn <i>per cent</i>
AL-1	24	50.5	0.002	13.0	0.11
AL-2	17	49.3	0.002	10.8	1.41
AL-3	15	50.3	0.001	8.4	2.41
AL-4	20	50.8	0.001	10.0	4.81
AL-5	15	51.8	0.002	6.8	1.07

CIRQUE (94F/6, 11)

The most significant barite-lead-zinc deposit in the project area is the Cirque. This deposit is described in detail in the following report.

PIE (94F/6, 7)

The Pie claims were staked by Rio Tinto in 1978 to cover an area of Gunsteel shale southeast of the Cirque claims. An extensive soil sampling and hand trenching program was done in 1979. Several showings of stratiform nodular and massive barite with varying amounts of galena, sphalerite, and minor chalcopyrite occur in Gunsteel shales exposed on the southwest limb of an anticline cored by Devonian limestone. Minor amounts of sphalerite also occur within the limestone.

FLUKE (94F/7)

The Fluke claims were staked by Cyprus Anvil Mining Corporation/Hudson's Bay Oil and Gas in 1978 to cover a panel of Gunsteel shale sandwiched between Silurian siltstone to the west and Besa River rocks to the east. Several thin bands of pyrite with coarse-grained galena and sphalerite have been exposed by trenching. Outcrop is very limited within the area of interest and extent of the mineralized horizon is not known at this time. Blebby barite occurs in siliceous argillite exposed southeast of the main showings.

ELF (94F/7)

The Elf claims were staked by Cyprus Anvil in June 1978 to cover an area of moderately anomalous silt sediment samples and an occurrence of massive barite-lead-zinc float. The claims straddle a northwest-trending belt of Gunsteel shale southwest of the Akie River. Subsequent work on the property resulted in the discovery of a new barite-lead-zinc showing on the heavily timbered southeast-facing slope above one of the anomalous creeks. Hand trenching has exposed a zone of siliceous pyritic argillite and shale containing 10 to 20-centimetre-thick beds of dark grey bedded barite with diffuse bands of galena. Some thin, very fine-grained bands of galena are also present. The mineralized zone is apparently 4 to 5 metres thick at this point, with a moderate dip to the southwest. An extensive soil geochemical anomaly is coincident with the apparent trend of the mineralized horizon. Boulders of white crystalline barite containing medium to coarse-grained galena and sphalerite occur downstream from the main showing, but appear to be derived from a different source. Several occurrences of laminated pyrite and nodular barite were noted upstream from the main showing. These occurrences are apparently contained within wedges of Gunsteel shale trapped beneath overthrust plates of Silurian siltstone. Assay results of four grab samples are listed as follows:

Sample No.	Ag <i>ppm</i>	Ba <i>per cent</i>	Cu <i>ppm</i>	Pb <i>per cent</i>	Zn <i>ppm</i>
ELF-1	15	51.5	35	3.0	37
ELF-2	33	30.1	88	32.0	1 408
ELF-3	43	47.1	70	16.8	687
ELF-4	93	12.1	383	15.0	115

Sample Descriptions

- ELF-1 -- white crystalline barite with interstitial galena float in creek.
- ELF-2, 3 -- dark grey-bedded barite with diffuse galena bands, from trenches.
- ELF-4 -- thin, very fine-grained band of galena and interstitial barite, from trenches.

DISCUSSION

The nature and stratigraphic setting of shale-hosted barite-lead-zinc deposits in the Driftpile Creek and Akie River districts are strikingly similar to those in the MacMillan Pass area of the Yukon (Carne, 1979). In both areas the mineral occurrences, which are clearly syngenetic to early diagenetic, are associated with a siliceous carbonaceous black argillite or shale facies overlying or interfingering with a proximal to distal turbidite assemblage. A synsedimentary graben structure and a stockwork feeder zone have been defined at MacMillan Pass (Carne, 1979) but are still unrecognized in the Driftpile Creek--Akie River project area. However, in this area the platform margin does appear to have been very sharp and tectonically active at the time of mineralization and may have been located along a northwest-trending rift system. The distribution of mineral occurrences and volcanic rocks in the Akie River district is parallel to such a trend, suggesting the inferred rift system was the site of volcanic and hydrothermal activity from Ordovician to Late Devonian time. If these relationships are correct, then the timing of rifting and associated mineralization coincided with the early stages of marine transgression (crustal downwarping?) and was followed by prograding flysch-type sedimentation from an uprising terrane to the west. It is hoped that future work on the Devonian section will provide a more refined model for the genesis of the shale-hosted barite-lead-zinc occurrences in the Akie River and Driftpile Creek districts.

ACKNOWLEDGMENTS

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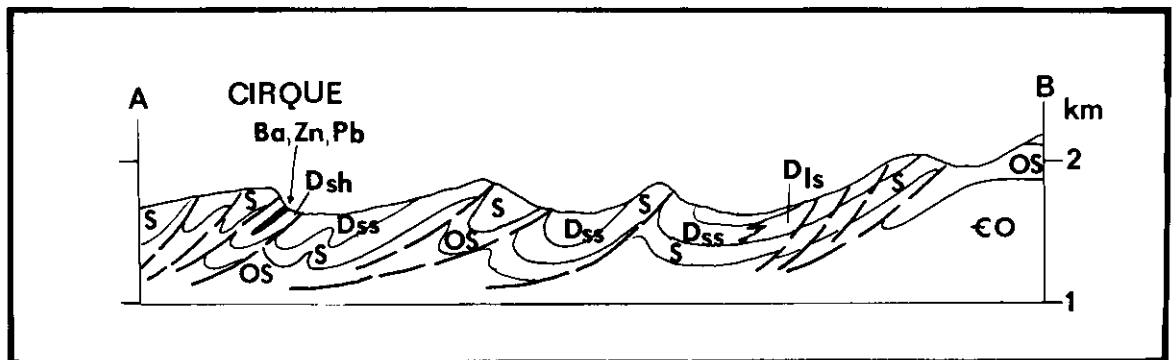
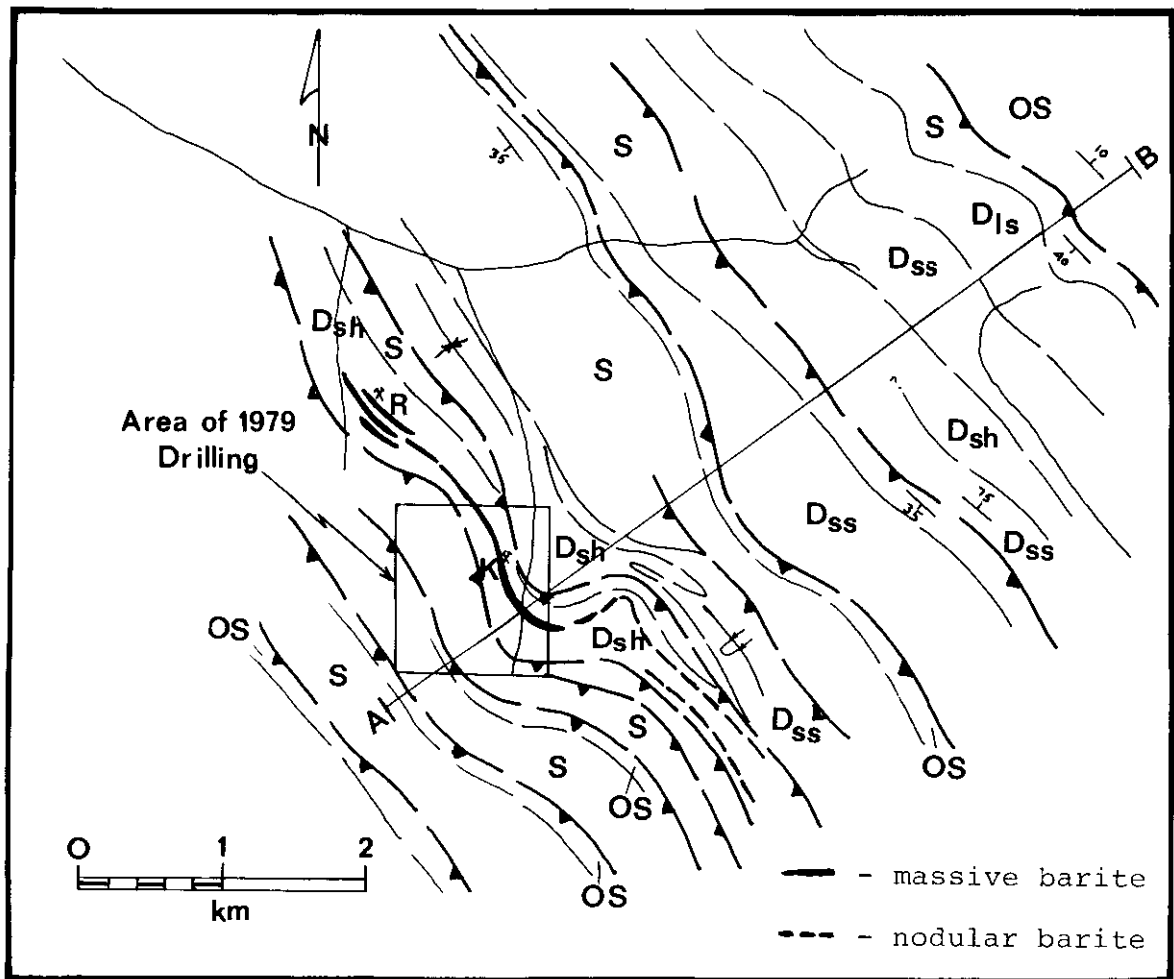


Figure 20. Geology of the Cirque claims (see Figure 16, page 58, for legend).