FALCONBRIDGE LIMITED
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1988 FINAL REPORT ON THE SURFACE GEOLOGY CHEMAINUS JOINT VENTURE

NTS 92B/13, 92C/16

by

Dr. M.G. Morrice

February 1989 Vancouver, B.C.

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SUMMARY

The 1988 surface geological program on the Chemainus Joint Venture (JV) involved 1:5000 scale property-wide mapping, more detailed 1:1000 mapping around specific showings and a trenching program which accompanied diamond drilling. Results of the trenching program are in Vande Guchte (1988). Objectives of the surface program were to provide a geological base map of the property, to document the stratigraphy of the McLaughlin Ridge Formation, to characterize and delimit alteration zones, to provide a structural synthesis and to attempt to constrain the more favourable areas of base metal deposition.

The lithologic package of exploration interest is the Devonian McLaughlin Ridge Formation, a heterolithic assemblage of mafic, intermediate and felsic volcanic rocks and subordinate sedimentary rocks. The McLaughlin Ridge Formation occurs in the core of an open anticline that is shallowly and apparently doubly plunging. The McLaughlin Ridge volcanics are flanked along both their northern and southern margins by sedimentary rocks of the overlying Mississippian Cameron Formation. Both the McLaughlin Ridge and Cameron River Formations have been intruded extensively by gabbros of the Triassic Karmutsen Formation. All lithologies are unconformably overlain by clastic sediments of the Cretaceous Nanaimo Group.

The McLaughlin Ridge Formation is dominated by quartz +/- plagioclase-phyric felsic pyroclastics in the central part of the claim group. Their thick-bedded nature and the presence of fiamme indicate that most of these felsic volcanics erupted as pyroclastic flows. Minor felsic flows or sills occur in the Anderson Creek and Watson Creek areas and associated with Minova/Laramide's Coronation deposit. The felsic volcanics become subordinate to clinopyroxene-phyric mafic and intermediate flows and pyroclastics both across the belt to the north and south and along the belt to the east and west. Many of these mafic volcanics are highly vesicular monolithic lapilli tuffs and tuff breccias, consistent with subaerial or shallow water eruption and near-vent accumulation.

All lithologies within the McLaughlin Ridge have undergone several periods of deformation. An early period of ductile deformation produced a well-developed west-northwest trending, steeply dipping schistosity in all lithologies. A shallowly plunging mineral and stretch lineation accompanied the development of this schistosity. This early schistosity has been displaced by a later, east-west trending and steeply dipping sinistral crenulation cleavage. Late brittle features abound on the property. These include kink bands, conjugate shear fractures, and faults of various attitudes. The most prominent fault is the Fulford fault,

which is most likely a series of splays, marked by gouge zones, which parallel the early schistosity. Neither sense nor amount of displacement on the Fulford fault is known. These structural features are consistent with an early period of south- southwest directed compression followed by a period of relaxation to produce the brittle features. Renewed south- southwest directed compression resulted in a period of north-dipping listric faulting, of which the Fulford is an example.

Alteration of all McLaughlin Ridge volcanics is widespread. In terms of base metal exploration, the most important alteration types are sericite +/- pyrite (Na_2O, CaO depletion) alteration of felsic volcanics and chlorite +/- pyrite +/- sericite alteration (MgO enrichment) of mafic volcanics. Sericitized felsic volcanics occur throughout the property, while chloritized mafic volcanics have been identified only in the vicinity of the Sharon showing on Brent 1. No new base metal occurrences were discovered as the result of the 1988 surface geological program.

The geological mapping program of 1988 has provided a framework for future exploration on the Chemainus JV. However, the general dearth of outcrops means that many of the interpretations are based on scant data. This map should be thought of as a preliminary map that will, undoubtedly, require modification as new information is accessed.

RECOMMENDATIONS

Based on surface mapping in 1988, I recommend that the following two avenues of exploration on the Chemainus JV be pursued in the near future:

A. Future work designed to increase our understanding of the geology of the property.

(1) Geological Mapping. (i) 1:5000 scale geological mapping of the property should be completed in the spring of 1989. Areas that were not mapped in 1988 include the extreme eastern and western ends and northern and southern margins of the property and some of the newly established grid lines, especially those on Chip 1-4.

(ii) If warranted, 1:1000 scale mapping of specific areas of interest can be implemented in 1989. This phase of the 1988 program was aborted in favour of expanding the 1:5000 mapping. The usefulness of 1:1000 mapping hinges on whether or not it will enable geological interpretations, not possible at 1:5000, that will aid exploration efforts. It was felt that in 1988, too little of the geology of the property was understood at 1:5000 to warrant 1:1000 mapping.

(2) Geophysics. I recommend that a detailed gradient magnetometer survey be conducted over those parts of the property

where it may benefit the geological interpretation. This survey would be of use in tracing magnetic mafic volcanic units which interupt an otherwise monotonous sequence of felsic volcanics, as on Holyoak 2 and 3 and Chip 1-3. Several of these magnetic units have been detected in the existing magnetic survey, however, because many are less than 20 m thick, that is, less than the existing survey station separation, they are not always detected on adjoining lines. This makes correlation difficult. The most critical area identified to date is the region between Powerline and Watson Creeks. The geological interpretation in this area is based chiefly on the correlation of widely separated outcrops. While magnetic mafic volcanics do occur, they are thin (<20 m thick), resulting in a disjointed magnetic picture. Consequently, detailed correlation is ambiguous in places. It is very important to make this interpretation less ambiguous in order determine the fate of the Anita mineralized zone west of line 20E. I recommend that a gradient magnetic survey be conducted between line 3W and 28E, from stations 5N to 5S, with stations spaced at 5 m intervals. If the results from this survey prove useful, similar detailed magnetic surveys should be conducted elsewhere on the property.

(3) Drilling and Trenching. Additional geological information, as accessed by drilling and trenching, is required in areas of particularly poor exposure. In the next phase of exploration, I recommend the drilling of sections to fill in existing information and provide well-constrained geological sections at approximately 1 km intervals. To accomplish this, I recommend drilling of sections along, or near, lines 14W (Brent 1), 40E (Chip 1), 12E (Chip 2), 10W (Chip 3), 21W (Chip 3), and 33W (Chip 4). Where feasible, trenching should accompany drilling, to provide additional information. This drilling should sample all major felsic volcanic units within a particular section. In addition, I recommend that existing drill sections be extended to encompass felsic units not sampled. In particular section 2E (Chip 2) should be extended to the south, and sections 50'W (Holyoak 3) and 1+50W (Brent 1) should be extended to the north.

B. Future work designed to test for mineralization.

(1) Drilling. The marked similarities between the geological setting of Westmin's Lynx Mine (Walker, 1985) and the Anita mineralized zone indicates that exploration on the Chemainus JV should continue to test the contacts between mafic and felsic volcanics. As to the prioritization of the many mafic-felsic contacts that exist on the property, I feel that the best contact to explore is the contact between the stratigraphically highest felsic volcanic unit with the overlying mafic volcanic. This assumes that mafic units within the felsic volcanic package represent only brief cessations in volcanic activity; cessations too brief to allow accumulations of sizeable massive sulphide deposits. The thick felsic volcanic unit between Watson Creek and Anderson Creek may be the uppermost felsic volcanic in this area;

its margins should be explored aggressively. Initial exploration should focus near the western end of this unit where a quartz-phyric flow or subvolcanic intrusion has been identified. The importance of this quartz-phyric felsic volcanic is that it represents a local volcanic centre; that is, a heat source capable of initiating and sustaining hydrothermal convective circulation and ultimately leading to base and precious metal deposition.

Additional drilling should test shallow and deep I.P. chargeability anomalies that are associated with felsic volcanics. For example, on the Chip Claims, such anomalies are located at 3E to 6E/0+50N, 13E to 15E/1N, 14W to 17W/5N, 21W to 26W/4N to 5N, 30W to 35W/1N to 3N, and 32W to 39W/3S to 4S. On the Brent-Holyoak Claim Group felsic volcanic-associated chargeability anomalies that have not been drilled are located at 38W to 49W/Baseline to south claim boundary and 8W to 2E/11S to 15+50S.

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INTRODUCTION

Location, Access and Physiography

The Chemainus Joint Venture project area is located on southeast Vancouver Island with the centre of the property approximately 16 km west of the town of Chemainus, British Columbia (Figure 1).

Access to the property is along seldom-used logging roads and abandoned railway grades which can be reached from MacMillan Bloedel Ltd.'s "Copper Canyon Mainline" haulage road along the Chemainus River (Figure 2).

With the exceptions of deeply incised stream valleys and steep hillsides in the north part of Chip 1 and 2 and the west part of Brent 1, the topography of the claims is gentle. Elevations range from between 500 and 1100 metres, with higher elevations encountered along the northern margin of the property.

The Chemainus JV comprises two separate claim groups. The western group, referred to as the Chip claims, occupies a total of 2602 hectares in claims Chip 1 to 18. The eastern claim group, referred to as the Brent-Holyoak claims, is composed of Brent 1 and Holyoak 1 to 3 claims, with a total area of 1085 hectares (Figure 2). These two claim groups, which occupy an aggregate of 15 km of strike length of the Sicker Group, are separated by 2.5 km strike length of Sicker Group which is presently held by a Minnova Inc./Laramide Resources joint venture. This latter claim group hosts the Coronation deposits (Bailes et al, 1987). The west end of the Chemainus JV is bordered by claims held by Trek Resources and an independent prospector; the east end of the JV is bounded by Minnova Inc.'s Mt. Sicker property and Cominco's Nugget claims.

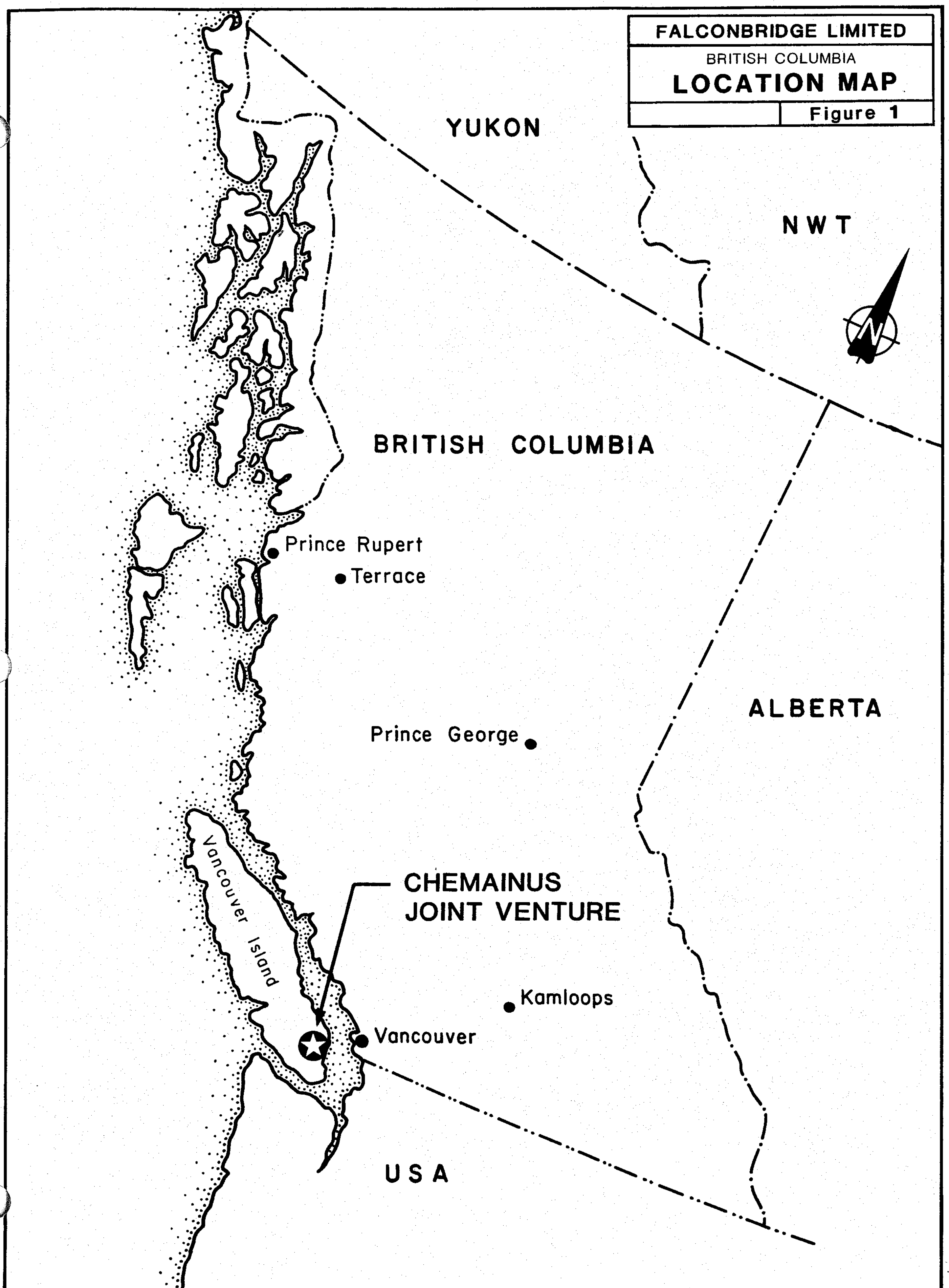
Previous Geological Work

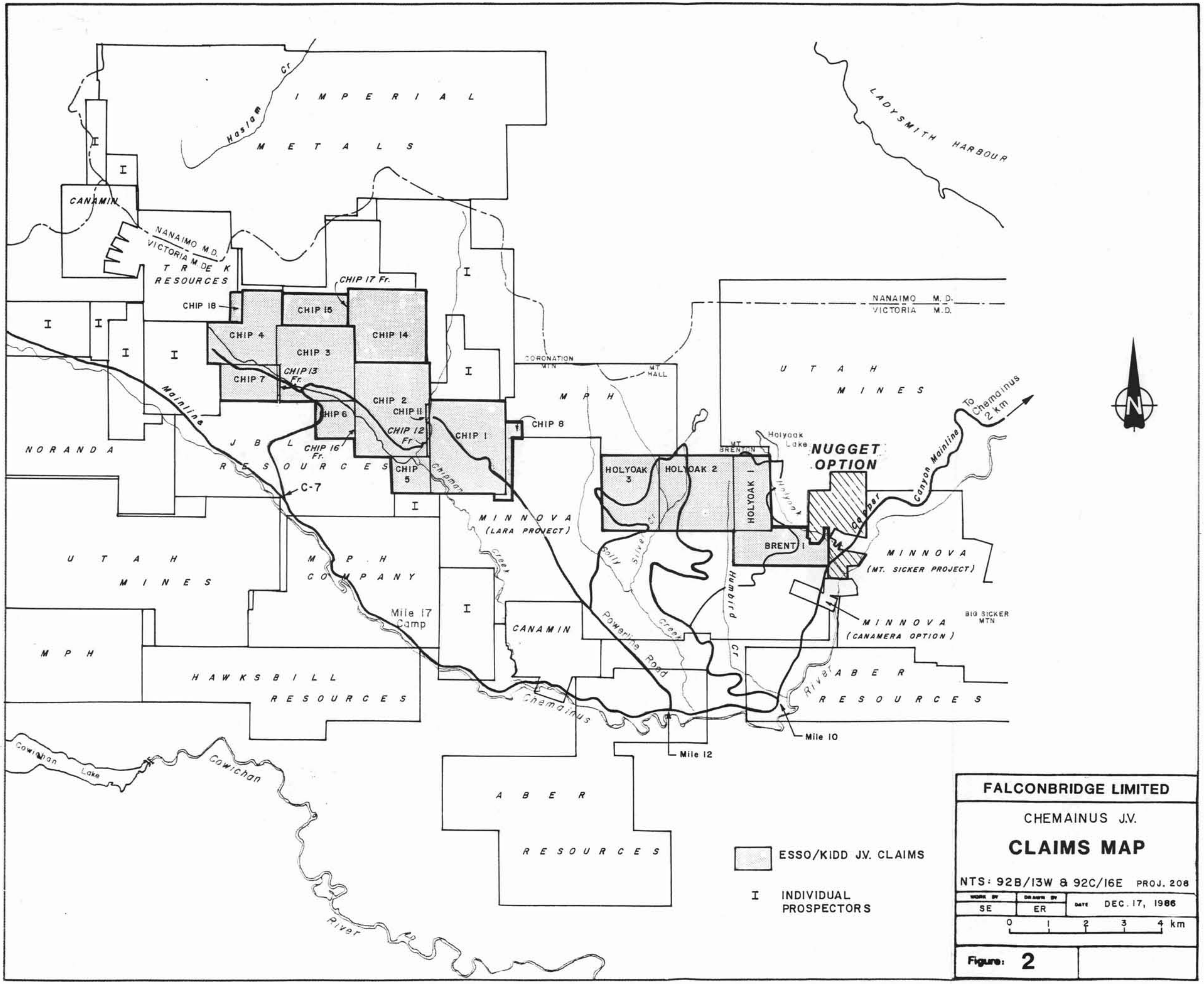
On a regional scale, the area underlain by the Chemainus JV is included in Muller (1980), Massey and Friday (1988) and Massey et al (1988).

Previous property-scale geological mapping of the Chemainus claim group was by Britten (1984), Everett and Cooper (1984), Enns and Hendrickson (1986) and Mallalieu et al (1987). These surveys focussed on specific regions of the property; none encompassed the entire claim group.

Present Geological Survey

The present geological survey was conducted from April 19 to July 26 and August 29 to November 10, 1988. The mid- summer break in


FALCONBRIDGE LIMITED
BRITISH COLUMBIA
LOCATION MAP
Figure 1
YUKON
NWT
N
BRITISH COLUMBIA
Prince Rupert
Terrace
Prince George
ALBERTA
Vancouver Island
CHEMAINUS
JOINT VENTURE
Kamloops
Vancouver
USA


IMPERIAL METALS
Haslam Cr
LADYSMITH HARBOUR
CANAMIN
NANAIMO M.D.
VICTORIA M.D.
TREK RESOURCES
CHIP 17 Fr.
CHIP 18
CHIP 15
CHIP 14
CHIP 4
CHIP 3
CHIP 13 Fr.
CHIP 7
CHIP 2
CHIP 11
CHIP 6
CHIP 12 Fr.
CHIP 1
CHIP 8
CHIP 16 Fr.
CHIP 5
Chipman
Mainline
C-7
NORANDA
JBL RESOURCES
CORONATION MTN
MT HALL
MPH
UTAH MINES
NANAIMO M.D.
VICTORIA M.D.
To Chemainus 2 km
Holyoak Lake
MT BRENTON
NUGGET OPTION
HOLYOAK 3
HOLYOAK 2
HOLYOAK 1
Holyoak
BRENT 1
Copper
Canyon Mainline
MINNOVA (LARA PROJECT)
MINNOVA (MT. SICKER PROJECT)
MINNOVA (CANAMERA OPTION)
BIG SICKER MTN
Solly
Silver Cr
Humbird Cr
Creek
UTAH MINES
MPH COMPANY
Mile 17 Camp
CANAMIN
Powerline Road
MPH
HAWKSBILL RESOURCES
ABER RESOURCES
River
Chemainus
Mile 10
Mile 12
Cowichan Lake
Cowichan River
ABER RESOURCES
ESSO/KIDD JV. CLAIMS
I INDIVIDUAL PROSPECTORS
FALCONBRIDGE LIMITED
CHEMAINUS J.V.
CLAIMS MAP
NTS: 92B/13W & 92C/16E PROJ. 208
SE
ER
DEC. 17, 1986
0 1 2 3 4 km
Figure: 2

field work was due to closure of the bush due to extreme fire hazard.

The objectives of the present survey were to provide a bedrock geological map at 1:5000 over much of the claims, to provide more detailed (1:1000) geological maps of specific areas of interest, and, through a trenching program, to access additional outcrop in critical areas. Results from the trenching program, including trench maps at 1:500, are presented in Vande Guchte (1988).

Geological mapping was done along roads, streams and grid lines. Information was plotted in the field on transparent overlays on 1:5000 orthophotos, and was subsequently transferred to 1:5000 base maps, made from the orthophotos. An effort was made to visit all critical outcrops in the claim group, most of which had been noted by Mallalieu et al (1987). In particularly critical areas, the author mapped the geology along newly established grid lines which were not present during the previous geological mapping. Trenching and drill hole information were incorporated into the final geological maps. Geological maps are presented at 1:5000 (Figure 3) and 1:10000 (Figure 4). Both sets of maps provide the same information, however those at 1:10000 allow the reader to get a better overall picture of the property geology as a whole.

The 1:1000 mapping failed to provide any additional insight into the geology of selected areas due to poor exposure and the discontinuous nature of lithologic units in detail. Therefore, this phase of the mapping was curtailed in favour gaining a better understanding of the overall geology of the belt by expanding the 1:5000 mapping to the eastern and western extremities of the claim group.

Acknowledgements

The author was capably assisted in the field, at different times, by M. Vande Guchte, R. Barrick, T. Cowans and D. Money.

GENERAL GEOLOGY

Introduction

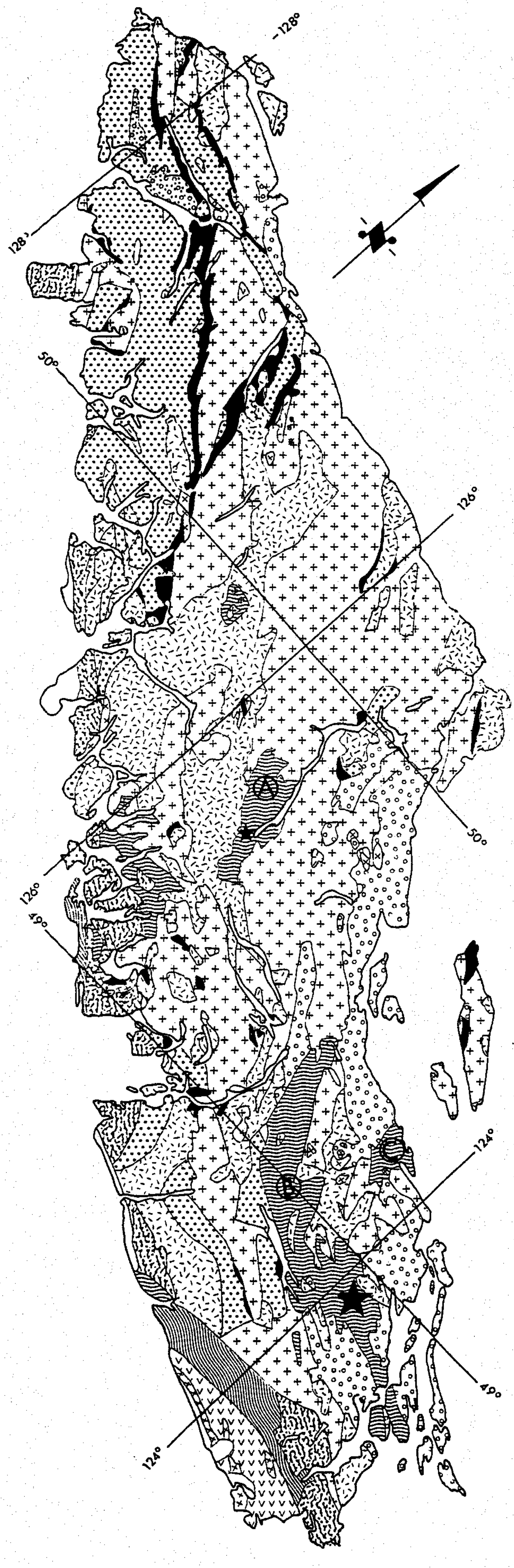
Vancouver Island is underlain by a diverse assemblage of lithologies, which, with the exception of the extreme southern tip of the island, belong to Wrangellia, an allochthonous terrain which was accreted to the continental margin of North America during the Cretaceous (eg. Muller, 1977; Jones et al, 1977). The oldest rocks within Wrangellia are Paleozoic volcanics and sediments of the Sicker Group which is exposed on Vancouver Island in several structural culminations, the largest of which are the Cowichan-Horne Lake, Buttle Lake, Tofino and Nanoose uplifts (Figure 5). The Chemainus Joint Venture occupies a portion of the southeast part of the Cowichan-Horne Lake uplift (Figure 5).

Most of our understanding of the Sicker Group derives from recent geological studies within the Buttle Lake (Juras, 1987) and Cowichan-Horne Lake (Massey and Friday, 1987, 1988; Sutherland Brown et al, 1986; Muller, 1980) uplifts. While there are striking similarities in the geology of the Cowichan-Horne Lake and Buttle Lake uplifts there has been no concentrated effort on correlating units between the two uplifts; each uplift has its own set of formational names. Nevertheless, a tentative correlation of lithologies between the two uplifts is presented in 1. Of prime importance in this correlation is the presence of volcanic-hosted massive and semi-massive sulphide deposits within the McLaughlin Ridge Formation in the Cowichan Lake Formation (Twin J, Coronation, Anita) and the Myra Formation of the Buttle Lake uplift (Lynx, Myra, Price, H-W). However, the reader should view this correlation with due caution due to the abrupt facies changes which characterize volcanic deposits, the great distances over which these correlations are made, and the rather poor age constraints on lithologies of the two uplifts.

Cowichan-Horne Lake Uplift

Within the Cowichan-Horne Lake uplift the Sicker Group has been subdivided into five formations (1). From oldest to youngest these are the Duck Lake, Nitinat, McLaughlin Ridge, Cameron River and Mount Mark Formations.

The Duck Lake Formation is exposed in the northwest part of the Cowichan-Horne Lake uplift, near Port Alberni. This formation comprises a monotonous sequence of variolitic pillowed and massive basalts of probable MORB-like geochemistry (N. Massey, geologist, B.C. Dept.Energy & Mines, personal communication, 1988). The Duck Lake Formation is overlain by the Nitinat Formation, a fairly homogeneous sequence of mafic clinopyroxene +/- plagioclase-phyric flows and pyroclastics of calcalkalic to alkalic (shoshonitic) affinity. Flows and individual clasts are typically highly Figure



Geological sketch map of Vancouver Island.

LEGEND

CARMANAH GROUP		MIDDLE TERTIARY
CATFACE INTRUSIONS		EARLY TO MIDDLE TERTIARY
METCHOSIN VOLCANICS		EARLY TERTIARY
NANAIMO GROUP		LATE CRETACEOUS
QUEEN CHARLOTTE GROUP / KYUQUOT GROUP	}	LATE JURASSIC TO EARLY CRETACEOUS
LEECH RIVER FORMATION / PACIFIC RIM COMPLEX	}	
ISLAND INTRUSIONS		EARLY AND (?) MIDDLE JURASSIC
BONANZA GROUP		EARLY JURASSIC
VANCOUVER GROUP	}	LATE AND (?) MIDDLE TRIASSIC
PARSON BAY FORMATION / QUATSINO FORMATION	}	
KARMUTSEN FORMATION	}	
SICKER GROUP		PALEOZOIC
METAMORPHIC COMPLEXES		JURASSIC AND OLDER

★ CHEMAINUS JOINT VENTURE

★ BUTTLE LAKE, WESTIN RESOURCES LTD.

(A) BUTTLE LAKE UPLIFT

(B) COWICHAN - HORNE LAKE UPLIFT

(C) NANOOSE UPLIFT

FALCONBRIDGE LIMITED

REGIONAL GEOLOGY

(After Muller, 1981)

WORK BY	DRAWN BY	DATE:
	VJG	Dec 1988

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Figure: 5

Table 1. Comparison of stratigraphy in the Cowichan-Horne Lake and Buttle Lake uplifts. Formation names from Sutherland Brown and Yorath (1985) and Juras (1987), except Duck L., from N.Massey, geologist, B.C Dept Energy & Mines, personal communication, 1988.

AGE (1)	LITHOLOGY (2)	COWICHAN HORNE L. UPLIFT	BUTTLE L. UPLIFT
E.Per-Penn	Limestone	Mount Mark	Buttle L.
Penn or Miss	Ves.MV		Flower R.
E.Miss?	V,S,G		Thelwood
E.Miss	S,G	Cameron River	
L.Dev.	M,I,FV,MS	McLaughlin Ridge	Myra
L.Dev.	MV	Nitinat	Price
Dev.?	MV	Duck L.	

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1 Ages from: Brandon, et al, 1986;
Juras, 1987.
Abbreviations: E.-Early, L.-Late, Per-Permian, Penn-Pennsylvanian, Miss-Mississippi, Dev-Devonian.

2 Abbreviations: Ves-vesicular, V-volcanic, S-sediment, G-gabbro, M-mafic, I-intermediate, F-felsic, MS-massive sulphides.

vesicular. The Nitinat Formation is overlain by the McLaughlin Ridge Formation, a heterolithic sequence of calcalkalic to alkalic (shoshonitic) felsic, intermediate and mafic volcanics, and derived sediments. Felsic volcanics are quartz +/- plagioclase-phyric pyroclastics, flows and subvolcanic intrusions. The Saltspring Intrusion, centred in southern Saltspring Island, may represent an intrusive phase (volcanic centre?) related to McLaughlin Ridge felsic volcanism. Intermediate and mafic volcanics are aphyric to clinopyroxene +/- plagioclase - phyric pyroclastics, flows and subvolcanic intrusions, texturally and geochemically similar to lithologies within the Nitinat Formation. The McLaughlin Ridge Formation is overlain, apparently conformably, by the Cameron River Formation, a dominately epiclastic and chemical sedimentary package comprised of thinly bedded cherts, argillites, siltstones and wackes. The uppermost formation within the Sicker Group of the Cowichan-Horne Lake uplift is the Mount Mark Formation. This formation, not exposed in the Chemainus JV, is composed of massive and laminated crinoidal calcarenites and argillites (Massey and Friday, 1987).

The Sicker Group has been intruded by gabbro and diorite sills and dykes which fed Karmutsen Formation volcanics of the overlying Vancouver Group, in reponse to Late Triassic crustal dilation (Massey and Friday, 1988). In the Chemainus JV area, the Sicker Group and Karmutsen intrusions are overlain unconformably by clastic sediments of the Late Cretaceous Nanaimo Group.

Available age constraints on various formations within the Sicker Group are summarized in Brandon et al (1986) and Juras (1987). The best estimate for the age of the Saltspring Intrusion is a U-Pb zircon date of 393(+25,-10)Ma (Early Devonian). A U-Pb zircon age of 370(+18,-6)Ma (pre- Late Devonian) is the best estimate for the age of the Myra Formation at Buttle Lake. Faunal data indicate that the Cameron River Formation is Early to early Late Mississippian. The Mount Mark (Cowichan-Horne Lake uplift) and Buttle Lake (Buttle Lake uplift) Formations contain early Middle Pennsylvanian through Early Permian conodonts.

PROPERTY GEOLOGY

Introduction

The current geological interpretation of the Chip Claims and the Holyoak-Brent Claims is shown on 1:10,000 maps (Appendix A). The Chemainus JV is underlain by approximately 57% McLaughlin Ridge Formation (units 2,3 and 4), 23% Cameron River Formation (unit 5), 17% Karmutsen gabbro and diorite (units 7 and 8), and 3% Nanaimo Group (unit 11). Nitinat Formation lithologies are not exposed within the confines of the Chemainus JV but outcrop immediately east of the property. A discussion of this formation is warranted given its similarity to mafic units within the overlying McLaughlin Ridge Formation on the property and its similarity to the Price Formation in the Buttle Lake uplift, which is the footwall to the H-W deposit.

Lithologies within the Chemainus JV trend west-northwest. Bedding attitudes are difficult to discern in most of the property. Those that were observed have dips which vary from 20 degrees to vertical. Virtually all lithologies are characterized by a steeply dipping, variably intense schistosity. Mineral and stretch lineations are shallow plunging within the plane of schistosity.

Devonian

Nitinat Formation

The following discussion is based on observations of Nitinat lithologies east and south of the property (Massey et al, 1987).

Lithologies within the Nitinat Formation are mafic flows, pyroclastics and subvolcanic intrusions, characterized by the presence of up to 50% large (0.25-1.5 cm) calcic clinopyroxene phenocrysts. Lesser (0-15%) plagioclase phenocrysts are present locally. Flows are massive or pillowed; pillow breccia is present on Panorama Ridge, 2 km northwest of Chemainus. Pyroclastics, which dominate the Nitinat Formation, comprise monolithic tuff breccia, lapilli tuff and lesser tuff. Clasts are invariably vesicular, with up to 65% calcite, quartz or chlorite-filled amygdules. The monolithic nature of the pyroclastics and their high vesicularity are consistent with near-vent deposition in a shallow marine to subaerial environment, perhaps in tuff or cinder cones.

McLaughlin Ridge Formation

(i) Introduction

The McLaughlin Ridge Formation is the lithologic package of exploration interest, hosting massive and semi-massive sulpide deposits in the Cowichan-Horne Lake uplift and being remarkably similar to the massive sulphide-hosting Myra Formation in the Buttle Lake uplift. The McLaughlin Ridge Formation occurs, uninterrupted, along the entire length of the claim group with an average exposed width of 2 km. The McLaughlin Ridge Formation is composed of varying proportions of felsic, intermediate and mafic volcanics and subvolcanic intrusions and lesser clastic and chemical sediments. Felsic volcanics dominate the central part of the claims, decreasing in abundance, at the expense of mafic and intermediate volcanics, to the northwest and southeast.

Classification in the field is based on colour index (CI) (% mafic minerals); mafic volcanics have CI>35, intermediate volcanics 15-35 and felsic volcanics <15. The quartz-phyric nature of felsic volcanics distinguishes them from the more felsic intermediate volcanics. These colour indices correspond approximately with SiO_2 contents of 53%, 53-70% and >70%, respectively.

(ii) Ultramafic, Mafic Volcanics (Units 1,2)

Mafic, and lesser ultramafic volcanics are the main lithologies in the western, eastern and northern parts of the property. The distinction between mafic and ultramafic volcanics is not readily made in the field, but is based on geochemical criteria with ultramafic volcanics containing <53% SiO_2 and >10% MgO. Thus defined, only a small proportion of ultramafic compositions and no mappable units of ultramafic volcanics occur on the property. In the central part of the property, mafic volcanics occur as thin, continuous units interbedded with felsic volcanics.

Weathered surfaces are medium to dark green, fresh surfaces are dark green. Mafic volcanics are invariably highly schistose chlorite schists. In thin section mafic volcanics are composed of a mineral assemblage of chlorite + actinolite + plagioclase +/- epidote +/- calcite +/- magnetite. Many are weakly to strongly magnetic, with up to 10%, <1 mm diameter, disseminated magnetite. Many of the mafic chlorite schist units contain up to 15% 0.5-1.5 cm long dark green-black chlorite wisps, interpreted to represent flattened clinopyroxene phenocrysts (see below). Calcite is a common constituent of chlorite schist units; some units encountered in drill core contain up to 50% calcite.

Where less deformed, as at the edges of the property, primary volcanic fabrics are preserved in mafic units. Many are characterized by the presence of up to 25%, 0.5-2 cm diameter, equant calcic clinopyroxene phenocrysts, which have been pseudomorphed by actinolite which, itself is in varying stages of alteration to chlorite. These phenocrysts have been variably flattened; with extreme deformation only chlorite wisps remain. Plagioclase phenocrysts, up to 2 mm in size and in amounts ranging up to 15%, are variably sericitized and sausseritized. Alteration to coarse epidote occurs locally. An additional characteristic of the mafic volcanics is their highly vesicular nature. Most clasts in pyroclastic deposits are vesicular; some are scoriaceous, containing up to 60%, <1 mm-1 cm diameter, quartz or calcite-filled vesicles.

With the exception of flows on Brent 1, Chip 2, and Chip 4, all mafic volcanics appear to be pyroclastic deposits. On Brent 1, in Trench 1+50W, mafic volcanics are characterized by massive, aphyric units (1-3 m thick) with about 50% .05- .1 mm long plagioclase microlites in a chloritic matrix (after clinopyroxene). Minor quartz-epidote-filled amygdales are 1-3 mm in diameter. Some of these flows contain pillow- like forms. These massive units are separated by <1-2 m thick monolithic clastic units which are variably chloritized. This mafic volcanic sequence is interpreted to represent a series of pillowed and massive mafic flows; the flow contacts are marked by rubbly flow top and bottoms and possible pillow breccias. The clastic nature of the contacts rendered them more amenable to subsequent (chloritic) alteration. On Chip 2, three occurrences of thin (<5 m) clinopyroxene +/- plagioclase-phyric mafic flows or sills have been encountered at 14E/0+60N, 8E/0+50N, and 14W/1+60N. These three mafic units occur at about the same stratigraphic position and may correlate. On Chip 4, a massive clinopyroxene + plagioclase-phyric flow is well exposed in a road cut between lines 28W and 30W at 6N. This flow is capped, to the north, by a flow-top breccia composed of highly vesicular fragments.

Where protoliths are discernable, the majority of mafic volcanics are pyroclastic deposits. Classification follows that of Fisher (1966) and Schmid (1981), whereby tuffs are composed mainly of ash-size fragments (<2 mm), lapilli tuff of lapilli-size clasts (2-64 mm) and tuff breccia of block-size clasts (>64 mm).

Pyroclastic protoliths are best exposed in the north part of Chip 1 and 2. Here, they are dominately lapilli tuffs with lesser tuffs and tuff breccias. Virtually all clasts are essential; most deposits are monolithic and poorly sorted indicating little or no reworking subsequent to deposition. They are interpreted to have been deposited in a subaerial to shallow water environment, perhaps in tuff or cinder cones. Heterolithic mafic pyroclastics in the Anderson Creek area of Chip 4 are variably hematitized. Clasts range in composition from mafic to intermediate. These poorly sorted lapilli tuffs and tuff breccias may represent debris flows. Well bedded mafic tuffs characterize the mafic volcanics in the Anita area of Chip 1 where they are well exposed in Trenches along lines 27E and 28E and have been intersected in drill core. Bedding within these tuffs varies from <1-5 cm thick and is sometimes graded. Clinopyroxene-phyric massive units (sills?) are associated with mafic tuffs in this area. These massive units are characterized by the presence of up to 10%, 0.5-1 cm diameter, spherical, epidote-rich clots.

(iii) Intermediate Volcanics (Unit 3)

Intermediate volcanics occur throughout the property intimately associated with mafic volcanics. They attain their greatest abundance towards the east end of the property on Holyoak 2 and Brent 1. In addition, a distinct suite of intermediate volcanics are sandwiched between the mafic volcanics of the McLaughlin Ridge Formation and Cameron River cherts along the northern part of the property, from Chip 1 to Chip 4.

Weathered surfaces are light to medium green, fresh surfaces are light to dark green. Most intermediate volcanics are highly schistose units composed of a mineral assemblage similar to the mafic volcanics. Where deformation is weak and protoliths can be ascertained, all intermediate volcanics are pyroclastic deposits. Most of the pyroclastic deposits are tuffs. However, outcrops of well-preserved tuff breccia and lapilli tuff are exposed in trenches 1+50W and 3W on Brent 1. Here, heterolithic, and poorly sorted pyroclastics are matrix to clast supported. Clasts, cigar-shaped due to deformation, range up to 1 m long. Most clasts are intermediate in composition and plagioclase-phyric. Minor felsic, quartz-phyric and mafic volcanic and rare chert clasts are also present. These pyroclastics are interpreted to have been deposited as debris flows.

The intermediate volcanics which occur between mafic volcanics of the McLaughlin Ridge Formation and the sediments of the Cameron River Formation are well-exposed at the hairpin turn along the W-8 road in the northeast part of Chip 3. Here little-deformed, well-bedded (0.1-5 cm thick beds) plagioclase-phyric tuffs occur in the core of a west-northwest plunging structural culmination. Graded bedding and flame structures are developed locally. Some ash and lapilli-size clasts contain concentric rims. These rims may have been added to the clasts, in a manner similar to the growth of hailstones. Such accretionary, or armoured lapilli accumulate only on land or in shallow water usually within a few kilometres of the eruptive vent. Most are products of phreatomagmatic eruptions (Williams and McBirney, 1979).

(iv) Felsic Volcanics (Unit 4)

Felsic volcanics are the dominant lithology of the McLaughlin Ridge Formation on the Chemainus JV. They are the main lithology in the central part of the claims, decreasing in abundance both east and west at the expense of mafic and intermediate volcanics.

Weathered and fresh surfaces vary from pale green to pale buff. The colour appears to be related to intensity of alteration; pale green felsic volcanics are least altered, pale buff felsic volcanics have been intensely sericitized (see below). Intensity of deformation is variable. In thin section felsic volcanics are composed of quartz + plagioclase + sericite +/- chlorite. The green colour of the relatively unaltered felsic volcanics is due to the presence of pale green sericite +/- chlorite.

In most cases, the distinction between pyroclastics and flows or sills can be determined in thin section. Pyroclastics are characterized by a wide range in crystal size from obvious phenocrysts to crystal fragments which make up the matrix. Crystals are angular and broken. Flows and sills contain a more restricted range of crystal size with a marked size difference between phenocrysts and groundmass. Groundmass is composed of a very fine grained homogeneous granoblastic intergrowth of quartz and plagioclase with or without tiny (<.1 mm long) plagioclase microlites. Phenocrysts are euhedral and seldom are angular or broken. Quartz phenocrysts are invariably embayed in both pyroclastics and flows.

Most of the felsic volcanics are pyroclastics; possible flows and/or subvolcanic intrusions occur on Chip 4, Chip 2, and in the footwall of the Minnova/Laramide Coronation Zone. In the Coronation footwall, the groundmass of the felsic volcanics is a fine to medium grained, equigranular mosaic of plagioclase laths, consistent with a slow rate of crystallization, perhaps as a subvolcanic intrusion. A possible quartz-plagioclase-phyric felsic flow crops out on Chip 2 near 2E/3N. On Chip 4, at Anderson Creek (32W-34W/-1N- 3N), a felsic flow or sill is characterized by the presence of up to 10% large (0.5-0.8 cm) euhedral quartz phenocrysts. Similar large quartz phenocrysts are associated with the felsic footwall units to the Coronation deposit, felsic pyroclastics near the Sharon showing on Brent 1 and Saltspring intrusions exposed along Highway 1 between Chemainus and Duncan, B.C. Their significance is not known, however their presence allows the subdivision of the otherwise monotonous felsic volcanic package.

While most felsic volcanics are pyroclastic, bedding and clasts are only rarely observed. Most of the felsic volcanics appear to be coarsely bedded tuffs; light green clasts with ragged terminations are interpreted to represent flattened pumice fragments (fiamme). The majority of these felsic volcanics are interpreted to be metamorphosed pyroclastic flows, on the basis of their clastic, coarse- bedded nature, the presence of fiamme, and their apparent thickness (several 100's of metres). Thin bedded felsic tuffs occur locally. On Chip 2, at 10E/4+60N, possible accretionary lapilli in felsic tuffs indicate subaerial accumulation.

The felsic pyroclastics form a monotonous sequence in the middle part of the claim group. A distinct quartz + plagioclase-phyric, coarsely bedded felsic tuff unit occurs between lines 2W and 31E near the south limit of the McLaughlin Ridge Formation. This unit is not altered and is characterized by the presence up to 20 %, 0.5-1.5 cm, equant, plagioclase phenocrysts, lesser quartz phenocrysts and rare chert clasts.

(v) Sedimentary Rocks (Unit 5)

Within the McLaughlin Ridge Formation, sediments are a minor component, occurring as thin (<10 m thick) units of argillite, siliceous argillite, and chert. The best exposed occurences are black siliceous argillites in the north part of Holyoak 3, light green siltstone, argillite and chert in the Anita area and black argillite at Watson Creek. Argillite and siliceous argillite are invariably black; green argillites occur at the Anita area and associated with black siliceous argillites on Holyoak 3. Cherts are buff to green. Where discernable, bedding is 1-20 mm thick. In thin section cherts are a very fine grained quartzofeldspathic mosaic with occasional detrital quartz and plagioclase grains and, in some cases, possible radiolaria.

(vi) Stratigraphy

The intense deformation which has affected all lithologies within the McLaughlin Ridge Formation has greatly hindered attempts at documenting the stratigraphy of this formation. Limited bedding and facing direction determinations are restricted to the margins of the formation and suggest an overall antiformal structure. However, the lack of information within the central part of the formation restricts the discussion of stratigraphy to general terms.

The general stratigraphic picture that has emerged is of a basal member dominated by felsic volcanics which is overlain by a mafic and intermediate volcanic-dominated sequence which is subsequently overlain, apparently conformably, by sediments of the Cameron River Formation. The mafic Nitinat Formation is not exposed on the claim group but is inferred to underlie the McLaughlin Ridge Formation. The basal felsic volcanic member is estimated to be a maximum of 600 metres thick based on the maximum exposed width, in the central part of the belt, assuming a simple anticline with axial fold trace bisecting the belt. This member is composed dominately of felsic pyroclastic flows which are variably quartz +/- plagioclase-phyric. Alteration within the felsic member, manifest as sericite +/- pyrite mineral assemblages, occurs throughout the member, but appears to be especially prominent near its upper contact with the mafic member. Thin interbeds of mafic volcanics interrupt the otherwise monotonous felsic succession. These mafic units may represent "background" volcanism which accummulated during lulls in the outpouring of the felsic pyroclastic flows. Alternatively these thin mafic units may be infolded or infaulted portions of the upper mafic member. The mafic volcanic-dominated member that overlies the felsic member is estimated to be <400 metres thick. These upper mafic volcanics are texturally and compositionally similar to the thin mafic interbeds in the felsic member and to the mafic units in the Nitinat Formation. Alteration, in the form of hematitization, is prevalent near the top of the mafic member. Thin jasper units are associated with these hematitically altered mafic volcanics. The mafic member is overlain directly by Cameron River Formation sediments on most of the property. However, along the north margin of the McLaughlin Ridge Formation, in the Chip claims, a unit of plagioclase-phyric intermediate volcanics occurs between hematitized mafic volcanics and Cameron River sediments.

Mississippian

Cameron River Formation

(i) Sedimentary Rocks (Unit 5)

The Cameron River Formation is defined by the presence of thick accumulations of sedimentary rocks which bound the McLaughlin Ridge Formation along its northern and southern margins. On the

Chemainus JV the Cameron River Formation is composed mainly of cherts with lesser, but significant, siltstones and wackes. Bedding is well developed, ranging in thickness from 0.1-5 cm. Grading is locally present.

Triassic

Karmutsen Formation

(i) Mafic Intrusive Rocks (Unit 7)

Mafic intrusive rocks, related to Late Triassic Karmutsen volcanism, are ubiquitous throughout the property. Individual intrusions vary from several cm to 400 m wide and have been traced along strike for up to 6.5 km. In a gross sense most mafic intrusions are sill-like, appearing to have intruded along lithologic contacts in many instances. Cross- cutting relationships are present locally. Attitudes range from vertical to near-horizontal. Weathered surfaces are medium to dark green; fresh surfaces are dark green. Colour indices average 40-60, however ultramafic phases with CI>90 have been identified in drill core. Both porphyritic and equigranular varieties are present. Porphyritic gabbros contain 1-15%, 0.2-0.6 mm plagioclase phenocrysts in a fine grained equigranular groundmass. Equigranular varieties are medium to coarse grained and invariably contain up to 10%, large (0.2-0.6 mm), skeletal ilmenite crystals, now variably pseudomorphed by leucoxene. Porphyritic varieties with fine grained groundmass are most common in narrow sills or near the margins of larger intrusions. Medium and coarse-grained equigranular varieties are most common in the interior of larger intrusions. Mafic intrusions range from massive, non- foliated to mylonitic; fabric parallels that of surrounding volcanics. A feature of many of these mafic intrusions is their abrupt terminations. This may be related to primary controls or to subsequent deformation.

(ii) Intermediate Intrusive Rocks (Unit 8)

Intermediate intrusive rocks are restricted to one sill- like diorite exposed at the east end of the property. This very magnetic diorite is medium-grained equigranular with a CI of 20-30.

Post-Triassic

(i) Late Intrusive Rocks (Unit 10)

Late, post-metamorphic and post-deformational intrusive rocks are a very minor component of the Chemainus claim group. All clearly crosscut prexisting schistosity and are themselves nonfoliated. All are thin (<2 m wide) equigranular intermediate dykes. Colour indices average about 35-40. Late dykes were observed along the powerline, about 800 m east of Chip 1 and on Chip 4, near 29W/7N.

Cretaceous

Comox, Haslam Formations (Nanaimo Group)

(i) Sedimentary Rocks (Unit 11)

Clastic sediments of the Nanaimo Group unconformably overlie or are in fault contact with older volcanic, sedimentary and intrusive rocks. In the Chemainus JV area the fining upward sequence comprises basal conglomerates and sandstones of the Comox Formation overlain by rusty weathering argillite and siltstone of the Haslam Formation (Muller and Jeletzky, 1970). Conglomerates include non-transported lithified regolith, little transported lithified talus and well transported boulder and cobble conglomerates. Clast types exhibit reasonably close correlation to underlying lithologies. Conglomerate matrix and overlying sandstone units are dominately composed of immature wacke.

Nanaimo Group sediments unconformably overlie older lithologies along the south margin of the property. A sliver of Nanaimo sediments, encountered in drill core in the Anita area, is in fault contact to the north with McLaughlin Ridge volcanics. Its southern contact, again with McLaughlin Ridge volcanics, is unconformable in places and a fault in places (Money et al., 1988).

Metamorphism

With the exception of Late Intrusive rocks (Unit 10) and Nanaimo sediments (Unit 11), all lithologies have been metamorphosed. The presence of abundant calcite, actinolitic amphibole and chlorite in mafic volcanics indicate that peak metamorphic conditions reached greenschist facies. The presence of hornblende in mafic volcanics in the Watson Creek area indicates slighter higher metamorphic conditions have developed locally.

Correlation of Geology with Geophysics

With the exception of an area with a thick cover of clay-rich glacial till on Brent 1, ground geophysics has proven to be a useful tool in correlating geological units across poorly exposed portions of the property. The following discussion relies heavily on Hendrickson (1988).

Magnetics has proven especially useful in correlating units across poorly exposed areas. The first order distinction in magnetics is between felsic and mafic volcanics. In general, mafic volcanics are 150-450 nanoteslas (56150-56600 vs 55950-56100 nanoteslas) above the surrounding felsic volcanics. This has greatly facilitated the correlation of the thin mafic units that are interbedded with the felsic volcanics. The diorite intrusion at the east end of the property is similarly responsive to magnetics. A maximum value of 59328 nanoteslas was recorded over this intrusion; most values were several hundred nanoteslas above the surrounding felsic volcanics. A pronounced dipole effect, evident along the northern and to a lesser degree along the southern margin of this intrusion, suggests that this intrusion has a shallow dip.

Most VLF responses on the property appear to be due to conductive fault and shear zones. However, several formational conductors and conductive lithologic contacts also exhibit VLF responses. The major fault on the property, the westnorthwest trending Fulford Fault is a persistent moderate to weak VLF conductor along much of its length. The VLF suggests that the Fulford Fault bifurcates west of line 18E on Chip 2. North of the Fulford, near the baseline from 9E to 1W a strong VLF conductor corresponds to pyritic and graphitic argillite. Pyritic cherts of the Cameron River Formation exhibit excellent VLF response on Chip 1 (line 28E to 49E) and Chip 3 (line 7W to 16W).

Both deep (gradient) and shallow (Schlumberger) I.P. surveys have delineated several linear chargeability anomalies. Many of these are coincident. Most of the anomalies (+/- 20 msec) are due to disseminated sulphides in felsic volcanics. Within gabbroic bodies, moderate to strong chargeability anomalies (up to 50 msec) are due to the presence of disseminated ilmenite (Money et al, 1988). Mafic volcanics tend not to have anomalous I.P. responses.

Resistivity is a useful tool in mapping major lithologic units. The Karmutsen gabbros, Cameron River cherts and little deformed northern mafic volcanics have particularly high resistivities (>2000 mhos), mafic, intermediate and deformed mafic volcanics are characterized by resistivities of 1000-2000 mhos and areas of thick overburden cover have resistivities less than 1000 mhos.

GEOCHEMISTRY

Introduction

A total of 3564 rocks from the Chemainus JV have been analysed for major and selected trace elements. 2865 of these were sampled during the 1988 field season, the remaining 699 were sampled in the period from 1984-1987. Two types of samples are included in this database. All samples taken prior to 1988 and 658 of those taken in 1988 are whole rock samples, taken from a particular spot on the outcrop to provide information on the geochemistry of a particular lithology. In contrast 554 alteration samples, all taken in 1988, were rock chips of a particular lithology, taken from various places on an outcrop or series of outcrops to provide information on the overall alteration of a particular unit or area.

Nitinat Formation

Nine samples of Nitinat Formation lithologies were analysed for major and trace elements. Most of these samples were collected from Shaw Creek (north shore of Lake Cowichan) and Panorama Ridge, along Highway 1 between Chemainus and Ladysmith.

Of the nine analyses, all are basaltic (<53% SiO_2) in composition except for VA07131, which is andesitic (58% SiO_2) (2). Variable CaO (5-19%), MgO (5.5-11.5%) and Ni (25-130 ppm) at constant SiO_2 (45-50%) indicate clinopyroxene and olivine control. For example, the correlation of high CaO contents with high modal clinopyroxene can be explained by clinopyroxene accummulation. Alkali contents are variable but tend to be high (eg.K_2O=.1-2.9%, Sr=260-790, Ba=55-1940); such high values being characteristic of calcalkalic to alkalic volcanics. This calcalkalic to alkalic nature is further confirmed by light-enriched rare earth element (REE) patterns ($(La/Yb)_N$=5-10) which display moderate, negative, even slopes throughout the range from light to heavy REE's (Figure 6). La ranges from 25 to 70x chondrites; Yb from 7 to 10x chondrites. There are no significant Eu anomalies. The high K_2O/Na_2O ratios (.5-1.0) and low contents of high field strength elements (HFSE) (TiO_2<1.0%, Zr<40 ppm) serve to further characterize the alkalic volcanics as belonging to the shoshonitic rock series, the characteristic alkalic series at convergent plate boundaries (Joplin, 1968).

McLaughlin Ridge Formation

1088 rocks from the McLaughlin Ridge Formation were analysed for major and trace elements. Of these, 121 were analysed for REE's. Lithologies range in composition from basalt to rhyolite. In an attempt to monitor geochemical variability, the McLaughlin Ridge Formation has been sudivided into 22 members (Mafic Member A-K, Intermediate Member A-C, Felsic Member A-H) (Figure 7). Each member is a mappable entity that, although dominated by one composition, contains a range of magma compositions. For example, Felsic Member A is dominated by felsic volcanics but also contains significant mafic and intermediate volcanics.

Rare Earth Elements

(i)Mafic Members

Mafic Members A and E (MMA, MME) are characterized by moderate, even slopes with La levels of 40-100x chondrites and Yb levels of 4 to 15x chondrites (Figures 8a-d, 10). These patterns are similar to those for Nitinat volcanics (Figure 6). Intensely carbonatized phyllites from Silver Creek have distinctly different patterns, at lower absolute REE contents, presumably due to alteration (Figure

8b). Mafic Member B, on the other hand, is characterized by flatter slopes at generally lower levels of REE's (Figures 9a-d). La varies from 5 to 50x chondrites; Yb from 1.5 to 15x chondrites. Low REE contents and flat patterns characterize high MgO-basalts (VA07067-11% MgO, VA07095-10.5% MgO) (Figure 9a). The high TiO2 basalt from MMG has a flat REE pattern from La to Sm at 20x chondrites and a shallow, negative slope from Eu to Yb (Figure 11). The relatively high TiO2 and low CaO basalts from MMH are characterized by fairly flat to even light REE-depleted patterns (Figure 12).

(ii)Intermediate Members

Intermediate volcanics of IMA and C exhibit moderately inclined patterns with even slopes (Figures 13, 14). La values range from 30 to 80x chondrites, Yb from 5 to 8x chondrites. Weak to moderate positive and negative Eu anomalies are evident. The slope of the REE pattern is steeper for IMC than IMA.

(iii)Felsic Members

Most unaltered felsic volcanics have moderately to steeply inclined REE patterns that exhibit flattening in the heavy REE's (Gd-Yb) (Figures 15-17). Sample VA07190, a hornfelsed fesic volcanic from Chip 2, has a markedly different pattern, at higher REE contents than all other felsic volcanics (Figure 15c). This sample is characterized by moderate slopes from La to Sm, a very pronounced negative REE pattern and flat slope from Gd to Yb.

High-SiO2 felsic volcanics (VA07059, 07062, 07235, 11056: 76-91% SiO2) (Figures 15a,c;17) are characterized by lower REE contents and flatter slopes than unaltered felsic volcanics.

(iv)Sedimentary Rocks

REE's from jasper within MMA, on Chip 3 exhibit a moderate even slope at low REE levels (La=10x, Yb=2x chondrites) (Figure 18). Ba-rich sediments from the Anita area are characterized by steeply inclined REE patterns (Figure 19), similar to patterns of felsic volcanics.

Harker Variation Diagrams

(i)Mafic Members

Na2O contents range between 0 and 6% in mafic volcanics of mafic members (Figures 22a-e). MMA, F, and H contain a significant proportion of samples which exhibit varying degrees of Na2O-depletion (Figures 22a,d,e). This contrasts with those members which exhibit little or no Na2O-depletion (eg. MMB; Figure 22b).

The two intensely carbonatized analyses from MMF exhibit severe SiO_2- and Na_2O-depletion (Figure 22d).

K_2O contents are variable among the Mafic Members with most samples containing 0-3% K_2O (Figures 23a-e). MMH has a bimodal population with most samples containing 0-1% K_2O, but about 25% of analyses forming a distinct population at 3-5% K_2O (Figure 23e). A further distinction between MMA and B is evident in the K_2O-SiO_2 variation diagrams (Figures 23a,b). MMA exhibits a range of K_2O from 0-6%; most samples contain <3% K_2O. However, all mafic volcanics in MMB contain <3% K_2O. The relatively high K_2O contents exhibited by many of these volcanics is consistent with their having an alkalic affinity.

CaO contents vary from 0 to 12.5% with a trend of decreasing CaO with increasing SiO_2 (Figures 24a-e). The CaO- SiO_2 relationship again serves to underscore geochemical differences betweem MMA and MMB. MMB contains very few mafic compositions with low CaO contents, while a significant proportion of mafic compositions in MMA are low in CaO (Figures 24a,b).

Al_2O_3 contents exhibit considerable scatter in the Mafic Members (Figures 25a-e). Most Al_2O_3 contents vary between 15 and 20%, however MMB contains a significant proportion of samples with relatively low (<15%) Al_2O_3 (Figure 25b). Al_2O_3 decreases with increasing SiO_2.

Fe_2O_3 contents range up to 15% in all Mafic Members except MME (Figures 26a-e). Fe_2O_3 decreases with increasing SiO_2, with no evidence for an early iron enrichment (tholeiitic) trend.

MgO exhibits a marked decrease with increasing SiO_2 in all Mafic Members, consistent with fractionation of olivine and clinopyroxene. MgO contents of mafic volcanics range from 1-12.5%; values >8% occur in MMA, B, and H (Figures 27a-e).

TiO_2 contents in mafic compostions of the Mafic Members range from 0.5-2.5%; most are <1% (Figures 28a-e). Mafic Members A, B, G, and H contain samples with >1% TiO_2 (Figures 28a,b,d,e). Analyses define linear trends of decreasing TiO_2 with increasing SiO_2. The slopes of these trends becomes more shallow below 1% TiO_2.

P_2O_5 contents range from 0.05-0.7% (Figures 29a-e); most samples contain <0.5% P_2O_5.

(ii) Intermediate Members

Harker variation diagrams for Intermediate Members are shown in Figures 30-37. The most noteworthy features of these diagrams are:

(a)IMC exhibits two populations based on Na_2O contents. Most samples contain >2.3% Na_2O, however several samples contain <2% Na_2O (Figure 30b). These low-Na_2O samples are most likely altered.

(b)Most samples contain <2% CaO (Figures 32a,b). This may be indicative of CaO-depletion through alteration.

(c)TiO_2 exhibits an excellent negative correlation with SiO_2 (Figures 36a,b).

(iii)Felsic Members

Harker variation diagrams of Felsic Members are presented in Figures 38-45. The most noteworthy features of these diagrams are:

(a)The Na_2O contents of Felsic Members B, C, and E are predominately >2%, indicating few of the samples of these members have been altered through Na_2O-depletion (Figures 38b,c,e). On the other hand, Member H is dominated by samples with <2% Na_2O, consistent with extensive Na_2O depletion (Figure 38g). Felsic Members A, D, F, G have a wide range of Na_2O contents (0-6.8%); a significant proportion of these members contain <2% Na_2O and most likely have been altered (Figure 38a,d,f).

(b)With the exception of FMH (2.7-4.2% K_2O), Felsic Members contain a wide range of K_2O (0.2-6%) (Figure 39a-g).

(c)The extreme CaO depletion of FMH contrasts markedly with variable CaO contents of other Felsic Members (Figures 40a-g). Note also that FMA contains a large proportion of samples with low CaO contents (Figure 40a).

(d)Al_2O_3, Fe_2O_3 and MgO decrease with increasing SiO_2 in all Felsic Members (Figures 41a-g, 42a-g, 43a-g). The decrease in Al_2O_3 is consistent with plagioclase fractionation, the decrease in Fe_2O_3 with magnetite fractionation, and the decrease in MgO with fractionation of pyroxene.

(e)All Felsic Members exhibit decreasing TiO_2 with increasing SiO_2. However the slope of these trends is variable among the members with Felsic Members E, G, and H having flatter slopes than Felsic Members A, B, C, I, and F (Figures 44a-g).

(f)Analogous to TiO_2 behaviour, P_2O_5 trends are flatter for Felsic Members E, H, and G, than for Felsic Members B, C, F, and I (Figures 45a-g).

(iv)Sedimentary Rocks

Harker variation diagrams for McLaughlin Ridge sediments are presented in Figures 54-61. The most noteworthy features of these diagrams are:

(a)The decrease in Al_2O_3, Fe_2O_3, MgO, and TiO_2 with increasing SiO_2 suggests that these sediments contain a significant component derived from McLaughlin Ridge volcanics.

(b)The sediments are composed of a wide range of compositions. This is evident in SiO_2 contents which range from <50% to 96%. The high SiO_2 contents are associated with cherts, SiO_2 contents between 50 and 70% characterize wackes and pelites derived from mafic to intermediate McLaughlin Ridge volcanics.

Miscellaneous Variation Diagrams

Ba vs. Na_2O and Ba vs. CaO variation diagrams are presented in Figures 62-67. The most noteworthy features of these diagrams are:

(a) The highest Ba contents of Mafic Members are in samples which have low Na_2O contents (Figures 62a-e); with only a few exceptions Ba contents >2000 ppm are associated with Na_2O contents <1%. However, samples with low Na_2O contents do not necessarily contain elevated Ba values. Mafic Member E is the only member that is consistent in having high Ba at low Na_2O (Figure 62d). Similarly, Ba contents, while highest in those samples with <1.5% CaO, may also be quite low in low CaO samples (Figures 63a-e).

(b)Ba contents of Intermediate Members exceed 2000 ppm only in IMC (Figures 64, 65). All Ba contents >2000 ppm are also low in Na_2O and CaO (Figures 64b, 65b).

(c)Within Felsic Members, Ba contents are highest in those samples with low Na_2O (Figures 66a-g). Ba contents exceed 2000 ppm in Felsic Members A, B, E, F, G, and H. Only in MMB do high Ba contents occur in rocks with >2% Na_2O (Figure 66b). Ba contents are highest in rocks with low CaO contents (Figures 66a-g).

Cameron River Formation

One sample of chert from the Cameron River Fm was analysed for REE's. This sample has a moderately steep pattern from La to Gd and a flat pattern from Gd to Yb (Figure 20). Harker variation diagrams for the Cameron River sediments are shown in Figures 46-53.

Karmutsen Formation

Karmutsen gabbros have slightly light REE-enriched patterns with La=20-120x and Yb=10-30x chondrites (Figures 21a,b). One sample (VA00565) has a negative Eu anomaly (Figure 21a).

Harker variation diagrams for Karmutsen intrusive rocks are presented in Figures 68-75. While most samples contain <55% SiO_2, several are intermediate in composition, containing 55-65% SiO_2. Na_2O and CaO contents are variable (0-5% Na_2O, 1-14% CaO). Of particular note is the tholeiitic (iron enrichment) trend exhibited by Fe_2O_3 and TiO_2. These elements initially increase with decreasing SiO_2, pass through maximum values of 20% and 3%, respectively, and thereafter decline with increasing SiO_2 (Figures 72, 74). The change from increasing to decreasing Fe_2O_3 and TiO_2 with SiO_2 marks the appearance of titanomagnetite as a fractionating mineral (eg.Gill, 1981).

Lara, Mt. Sicker, Buttle Lake

Several samples of volcanics associated with sulphide occurrences in the Cowichan Lake-Horne Lake (Lara, Mt.Sicker) and Buttle Lake Uplifts were analysed for REE's. In addition, one sample from the Saltspring Intrusion is included in this data (Figures 76-79). The most noteworthy features of these diagrams are:

(a)The REE pattern of the Saltspring intrusion is identical to that of one surface footwall sample from the Lara deposit (Figures 76, 78b). Both patterns are characterized by a marked negative Eu anomaly and a flattening of slope in the heavy REE's.

(b)Chloritic mafic volcanics from Mt.Sicker have similar REE patterns to chloritized mafic volcanics in MMH at the Sharon Showing (Figures 12, 77b).

(c)Samples from the footwall alteration zone beneath the H-W orebody at Buttle Lake have distinctive REE patterns that are characterized by flat slopes in the light REE's, steep slopes in the middle REE's (Sm-Dy) and flat slopes in the heavy REE's (Figure 79b).

(d)Hangingwall ultramafic volcanics at the Lynx deposit ("G-flow" of Juras, 1987) have moderate slopes with variable negative to positive Eu anomalies (Figure 79f).

(e)The REE pattern for Price Formation volcanics is indistinguishable from REE patterns of basalts from the Nitinat Formation and some of the McLaughlin Ridge Mafic Members (Figure 79e : VA07148, Figures 6, 8).

(f)REE patterns for felsic volcanics at Buttle Lake, Lara, Mt. Sicker and the Chemainus JV exhibit marked similarities.

Summary

Several features of the geochemistry of the McLaughlin Ridge Formation on the Chemainus JV should be noted.

(a)The marked similarity of REE patterns of mafic volcanics of the Price, Nitinat and McLaughlin Ridge Formations suggests a genetic link among the three.

(b)Some of the mafic members of the McLaughlin Ridge Formation are geochemically distinct. MMH basalts have high TiO_2, low CaO and flat REE patterns. MMB and D contain very few samples with $Na_2O<2\%$, suggesting that these members may have escaped widespread hydrothermal alteration. Ultramafic compositions ($MgO>10\%$) occur in MMA, B and H.

(c)FMB and E contain very few Na_2O-depleted samples, that is, these members appears to have escaped widespread Na_2O- depletion. On the other hand FMA and H contain a high proportion of low-Na_2O samples, indicating that these members have experienced widespread Na_2O-depletion. Both MMA and H are also characterized by low CaO contents. Note that MME and, to a lesser extent MMB also contain low-CaO samples, indicating alteration of these members by CaO-depletion only.

(d)Ba contents, in mafic members, are generally <2000 ppm with a few samples from MMA, B, E, and H containing >2000 ppm Ba. Several samples from IMC contain >2000 ppm Ba. Within Felsic Members, Ba exceeds 2000 ppm in FMA, B, E, F, G, and H. Virtually all samples with >2000 ppm Ba are depleted in Na_2O.

STRUCTURAL GEOLOGY

Bedding

Bedding attitudes are not known with any certainty over most of the Chemainus JV. This has imposed severe constraints on the interpretation of structure and volcanic stratigraphy on the property. Where observed, most bedding trends westnorthwest with moderate to steep dips (Figures 80, 81). However there are numerous locations where shallowly dipping bedding was observed or inferred. While most of the observations are from the edges of the belt, there is no reason not to expect similar attitudes to be present within the core of the belt. One interpretation of these variable attitudes would involve the overall structure of the belt being controlled by a low amplitude open anticline (hence shallow bedding) with the steeper bedding attitudes caused by higher frequency, tight (parasitic?) folding (Figure 82).

Bedding attitudes are sparse; those that were noted aregenerally confined to the margins of the property. Reliable facing direction determinations are even scarcer. Along the south margin of the McLaughlin Ridge Formation, mafic tuffs immediately south of the Anita mineralized zone dip steeply and face south. North of Chip 1, mafic and intermediate volcanics of the McLaughlin Ridge Formation face north; the overlying intermediate volcanics dip shallowly to the north. On Chip 3, well-exposed Cameron River cherts exhibit well developed open to tight folding at the outcrop scale. Similar scale and style of folding occurs in Cameron River cherts in small quarries along the north margin of the McLaughlin Ridge Formation, in the northeast corner of Chip 4. Shallowly dipping bedding was observed in intermediate volcanics at the hairpin turn at the northeast corner of Chip 3. Facing directions at this location indicate an upright succession that is exposed in the core of an open syncline, the axis of which plunges shallowly to the westnorthwest. Shallowly dipping Cameron River cherts are well exposed at Mt. Brenton, north of the Holyoak-Brentclaims. Shallowly dipping bedding was also encountered in drill core near the Sharon Showing on Brent 1, where steeply dipping schistosity is at near right angles to bedding in mafic tuffs. Other indirect indications that bedding is, at least in part, shallowly dipping include outcrop patterns in the Holyoak-Brent claims, the dispersal of linear geophysical trends in the Silver Creek area, and interpretations of geology between drill holes at Silver Creek. Stereonets of bedding attitudes are presented in Figures 80 and 81. The shallow dipping attitudes from the Brent claims are from Cameron River sediments in the vicinity of Mt. Brenton.

Foliations

Virtually all lithologies of the McLaughlin Ridge Formation have a well developed planar penetrative fabric. The intensity of fabric development is less in Cameron River sediments than in neighbouring McLaughlin Ridge lithologies. This may be due to one or both of a shorter deformational history for the younger Cameron River Formation, or different response to stress due to different rock competencies. For example, strain within the Cameron River cherts appears to be chiefly brittle, which contrasts markedly with the ductile deformation of McLaughlin Ridge volcanics. Strain within the Karmutsen gabbros and diorites is manifest as discrete zones of shearing and/or mylonitization. These high strain zones are generally <1 metre wide and are oriented parallel to the schistosity in the neighbouring volcanics. Many of these shear zones contain discontinuous quartz +/- calcite +/- pyrite +/- chalcopyrite veins. Deformation within the Nanaimo Group sediments is restricted to local shear zones associated with the Fulford Fault and its splays.

The dominant west-northwest trending, steeply dipping foliation (Figures 83, 84) is variably developed and defined by the planar alignment of platey minerals, principally sheet silicates (muscovite, sericite, chlorite). This fabric is the earliest preserved foliation in the McLaughlin Ridge Formation. Fabric development is particularly intense within sericitized felsic volcanics and carbonatized mafic volcanics. Hematitized mafic volcanics also tend to be schistose, while less altered mafic volcanics along the northern part of the property from Chip 1 to Chip 2 and intermediate volcanics in the northeast part of Chip 3 are only weakly foliated.

A later, locally well developed, spaced crenulation cleavage is present throughout the property. This is a steeply dipping rock cleavage that trends at about 080 degrees and has a sinistral sense of movement (Figures 85, 86). Cleavage spacing is 0.5-1 cm.

Lineations

Three types of lineations have been noted on the property. Intersection lineations are those lineations formed as the result of the intersection of two planar features. The most common are steeply plunging intersections of the two well developed foliations. Where bedding is observed bedding/cleavage intersections parallel fold axes, if cleavage is axial planar to folding. Shallowly plunging intersection lineations were observed in mafic volcanics in the Sharon area and in intermediate volcanics at the hairpin curve on Chip 3. A second type of linear feature are fold axes associated with small scale folds. Most of these are kink bands with steeply plunging fold axes. The third and most common type of lineation are due to the preferred orientation of elongate phenocrysts (quartz, uralitized clinopyroxene) or stretched clasts. These lineations represent the direction of tectonic transport. All lineations of this type have shallow plunges (<20 degrees); mainly to the west in the west part of the property and to the east in the east part of the property (Figures 87, 88). This pattern of stretch lineation trends, combined with stratagraphic relationships, indicates that the Cowichan-Horne Lake uplift has been folded into a broad, doubly plunging anticline. This broad folding event has folded the stretch lineationsand therefore postdates their formation.

Shear Zones and Faults

High strain zones have been documented in virtually all lithologic units on the property. The sole exception appears to be the Cameron River sediments. This may reflect the difference in behaviour to induced stress or a contracted deformational history for the Cameron River Formation. High strain zones in volcanics occur as 1-50 metre wide, west-northwest trending, steeply dipping, zones of intense schistosity, most common in sericitized felsic volcanics and carbonatized mafic volcanics. Some of these ductile shear zones have coincident VLF anomalies. Fault gouge has been encountered in several locations in drill core and newly excavated trenches. Zones of gouge are 10-100 cm wide and composed of light grey clay with varying angular lithologic clasts. The Fulford Fault, as encountered in drill core, has a well developed associated gouge zone.

Late brittle faults abound. These have variable attitudes with trends ranging from parallel to perpendicular to F1 foliation. Dips are likewise variable from shallow to vertical. Brittle faults, parallel to F1 foliation have caused abrupt thinning and thickening of argillites on Holyoak 3. Such faults may be responsible for considerable thinning or thickening of stratigraphy. Unfortunately, they are hard to document, particularly with the generally poor exposures which prevail over most of the property. Cross cutting late brittle faults are ubiquitous. However, displacements across these features appear to be generally quite minor.

Small-Scale Brittle Features

Small-scale brittle deformational features are ubiquitous throughout the property. Three types are recognized: brittle faults, kink bands and shear fractures.

Brittle faults occur as hairline fractures of variable orientation and attitude. Offsets across those faults which are at high angles to schistosity are minor. Offsets across those faults that parallel schistosity are unknown, but may be important in causing along strike thinning and thickening of units. This appears to be the case on Holyoak 3 where siliceous argillites thin and thicken along strike between trenches.

Kink bands are locally well developed on the property. They are particularly well developed in a discrete 10-50 metre wide linear zone near the west end of the property from 21W to 31W at about 8N. In many cases conjugate kink bands have developed. These kinks generally have steep plunges. With axial planes trending at about 000 and 050 degrees, the principal stress (sigma one) was directed at about 115 degrees.

Shear fractures are similarly locally well developed on the property. Conjugate shear fractures have steep dips and trend at 000 (dextral) and 050 (sinistral), having developed under a stress field with the maximum compressive stress oriented at 025 degrees. In general where only one shear fracture is present, it tends to be sinistral and oriented at 050 degrees.

Folding

Facing directions along the northern and southern margins of the McLaughlin Ridge Formation and the gross stratigraphic relationship whereby the Cameron River Formation overlies the McLaughlin Ridge Formation, are consistent with the interpretation that the overall structure of the property is dominated by a major west-northwest trending anticline. The identification and interpretation of shallowly dipping bedding suggest that this anticline may be a fairly open structure. Mineral and stretch lineations and cleavage-/bedding intersections indicate a shallowly plunging fold axis. West-plunging stretch lineations in the west part of the property and east-plunging stretch lineations in the east part of the property indicate that this major anticline has been itself folded into a broad doubly plunging structure.

Structural Synthesis

Lithologies within the Chemainus JV have undergone a protracted history of deformation. The earliest deformation, which is not evident on the property, is a Late Devonian (syn-Sicker) deformation (D1) that produced large-scale open folds in the Nitinat and McLaughlin Ridge Formation volcanics (Massey and Friday, 1987). The oldest documented deformation on the property (D2) produced the dominant west-northwest trending, steeply dipping schistosity (S2) which is particularly well developed in McLaughlin Ridge Formation lithologies. This variably developed schistosity is most intense within sericitically altered felsic volcanics and carbonatized mafic volcanics. Numerous linear zones of intense development may represent shear zones. S2 is apparently axial planar to a series of west-northwest-trending, southwest-verging, asymmetric folds which developed post-Lower Permian to pre-Middle Triassic (Massey and Friday, 1987). The ubiquitous, shallowly plunging mineral and stretch lineation (L2) developed on S2 planes during D2. L2 is oriented parallel to the minimum compressive stress direction. Superimposed upon S2 is a spaced sinistral crenulation cleavage (S3) that is oriented at about 080 degrees, with steep dips. The maximun compressive stress responsible for this crenulation cleavage was oriented at about 035 degrees. The small-scale brittle features which are common throughout the property may have developed towards the end of D2 or D3 as the stress field was relaxed and/or strain rates were increased. D4 was characterized, in the Late Triassic by extensive crustal dilation which provided avenues for emplacement of the Karmutsen gabbros and diorites. No small scale structures have been attributed to this deformation. Prior to the deposition of the Nanaimo Group, regional-scale warping of Vancouver Island produced the major geanticlinal uplifts cored by Sicker Group rocks. This deformation (D5) may be responsible for the broad scale variation in the plunges of mineral and stretch lineation on the property. During the Late Cretaceous, large-scale westnorthwest trending thrust faults cut the Cowichan-Horne Lake uplift into several slices. Where exposed in drill core, these thrusts dip vertically to about 65 degrees to the north-northeast and trend parallel to S2. They become listric at mid-crustal depths (Sutherland Brown and Yorath, 1985). The most prominent of these in the Chemainus JV is the Fulford Fault, which is most likely a series of fault splays rather than one discrete fault zone. In drill core the Fulford is marked by a metre wide zone of clayey gouge that juxtiposes McLaughlin Ridge volcanics against and on top of Nanaimo sediments. Displacements along these thrusts are unknown but are estimated to be in the order of 1-10 km (Massey and Friday, 1987). Similarly, direction of movement is unknown. However, the regional map pattern suggests movement directed to the west-southwest; the latest movement was horizontal and westerly directed as indicated by slickensides (Massey and Friday, 1987). The last deformational event which has affected the Sicker Group is manifest as a series of Tertiary(?) north-northeast crossfaults, with subvertical downthrows to the west (Massey and Friday, 1987).

ECONOMIC GEOLOGY

Alteration

Hydrothermal alteration has affected all rock types in the McLaughlin Ridge Formation to varying degrees. Several alteration types are recognized in the field. Mafic and intermediate volcanics may experience carbonate, chlorite +/- pyrite +/- sericite and/or hematite alteration. Alteration of felsic volcanics is most commonly to a quartz + sericite +/- pyrite assemblage; carbonatization of felsic volcanics is less common.

Carbonatized mafic volcanics weather pale brown with carbonate minerals dispersed parallel to foliation. This is the most common alteration to have affected mafic volcanics through most of the property. Carbonatization of mafic volcanics is particularly intense in Holyoak 2, near the northern contact with the Cameron River cherts, and within the discrete mafic horizons which trend across the central regions of Chip 1,2, and 3. Intensely carbonatized mafic volcanics are characterized by low SiO_2 (<40%), low Al_2O_3 (7.5%), low Na_2O (0.12%), high K_2O (2.2%) and high LOI (23.5%). One additional style of carbonate alteration has affected mafic volcanics in the western part of the property. There, bright orange-brown ankerite? emanates outward from 060 degrees trending fractures which crosscut the F1 foliation. This is clearly a late alteration, not related to syngenetic metal deposition, but which may be important for epigenetic precious metal localization. This type of alteration results in decreased SiO_2 (34%) and Na_2O (.7%) and elevated CaO (16%) and LOI (23.5%).

Chlorite +/- pyrite +/- sericite alteration is the dominant alteration that has affected mafic volcanics on Brent 1 in and adjacent to Trenches 1+50W and 3+00W and at the Sharon adits. This style of alteration occurs as chlorite +/- pyrite-rich veins (0.5-2 cm wide) or as pervasive chlorite +/- pyrite +/- sericite alteration which selectively alters the mafic minerals in the rock. Pyrite is the dominant constituent of 0.1-1 cm diameter pyrite + quartz +/- chalcopyrite aggregates. Particularly intense alteration of this type may be related, in part, to porous zones, such as rubbly flow contacts, in the mafic volcanic sequence. Geochemically, mafic volcanics that have been intensely chloritized and sericitized are characterized by high MgO (10-12%), high Al_2O_3 (17-20%), high MnO (.5-.8%) and high LOI (4.5-8%). SiO_2 (43-47%) and CaO (.4-4.8%) tend to be low in abundance.

Hematite alteration of mafic volcanics is particularly well developed along the north sides of Chip 1 to 4, at or near the top of the McLaughlin Ridge Formation. Rocks have a purple colour due to finely disseminated hematite. Hematite alteration may be pervasive, fracture-controlled, or, in coarse clastic rocks, may preferentially alter clasts or matrix. The occurrence of hematite altered mafic volcanics near the top of the mafic sequence suggests that alteration was controlled by paleotopography, with the upper part of the mafic sequence accumulating in a more oxidizing (subaerial?) environment.

Carbonatization has affected most felsic volcanics on the property, however the intensity of alteration is generally weak. This alteration occurs dominately as thin (<1 mm) calcite veins. Carbonatized felsic volcanics contain slighter higher CaO (4-5%) and LOI (4-6%) contents than their unaltered counterparts.

The most common type of alteration to affect felsic volcanics is sericitization +/- pyritization. The mere presence of sericite in these volcanics is not necessarily indicative of alteration; sericite is a common product of the metamorphism of felsic volcanics. Intensely altered (sericitized) felsic volcanics lack plagioclase, being composed of a quartz + sericite +/- pyrite mineral assemblage. This destruction of plagioclase results in the characteristic depletion in Na2O and CaO that characterizes many alteration zones associated with volcanic-hosted massive sulphide deposits. Sericite altered felsic volanics tend to be more schistose than their unaltered counterparts. In the field sericitized felsic volcanics are buff coloured, in contrast with the greenish hue, due to the presence of minor chlorite and/or green sericite, characteristic of unaltered felsic volcanics. Sericite altered felsic volcanics occur in linear zones which are oriented parallel to schistosity and lithologic contacts throughout the property. Therefore, sericitization appears to be conformable to layering. However, the lack of discernible zones of cross-cutting alteration may be due to transposition of cross-cutting features due to the extreme deformation that has affected these rocks.

Felsic volcanics which have been particularly intensely altered occur in the south part of Trench 3+00W on Brent 1, in the north and southwest parts of Holyoak 3, in the Anita area of Chip 1, and in the northernmost felsic member in Chip 1 to 4. In geochemical terms, particularly severe Na2O- and CaO-depletion (<0.5% Na2O, <0.5% CaO) has affected felsic volcanics in the south part of Brent 1 and the north part of Holyoak 2 and 3.

Mineralization

To date, base and precious metal mineralization has been recognized in four locations on the property. From east to west these are the Sharon, Silver Creek, Holyoak and Anita areas (Figure 7).

At the Sharon Showing, disseminated pyrite +/- chalcopyrite mineralization is associated with chloritic +/- sericitic alteration of mafic volcanics. Grab samples contain up to 9050 ppm Cu and 235 ppm Zn. DDH CH85-7 intersected 74.8 m of 0.18 % Cu in altered mafic volcanics. The geometry of this mineralized zone is unknown at present. These mafic volcanics are closely associated with quartz- phyric felsic volcanics that have been intensely sericitized (Na_2O<0.5%, CaO<0.5%).

Mineralization on Holyoak 2 (Silver Creek) has been difficult to trace. Zinc mineralization has been encountered in sericitized felsic volcanics on line 31W; a 1.5 m channel sample in a trench contained 2.4% Zn, 1% Cu and 19.5 g/t Ag, while 7.5 metres of 1% Zn were intersected in drill hole CH85-10. This mineralized zone is terminated by a gabbro dyke at 50 m depth (Money et al, 1988).

In the Holyoak area (Holyoak 3), drilling during 1988 intersected several minor zones of mineralization. The most interesting of these consists of 0.5 m of 2% Zn with a weak polymetallic signature (slightly anomalous Au, Ag, As, Ba) that was intersected in drill hole CH88-60. This appears to be along strike from the Randy North Zone (Bailes et al, 1987). This mineralization is associated with sodium- depleted (<1% Na_2O) felsic volcanics.

The most consistent mineralization encountered to date on the property occurs in the Anita area of Chip 1 where polymetallic mineralization occurs at or near the contact of sercitized felsic volcanics and relatively unaltered mafic volcanics. Mineralization has been traced, in two zones, from line 20E to 31E. The best intersection to date was in drill hole CH88-49 (2.7m of 2.98% Cu, 5.99% Zn, 1% Pb, 117.5 g/t Ag, 2.78 g/t Au). The host sericitized felsic volcanics are variably sodium-depleted; however, alteration is not intense, with Na_2O only rarely below 1%. These felsic volcanics are also characterized by local enrichments of barium (2400-5900 ppm).

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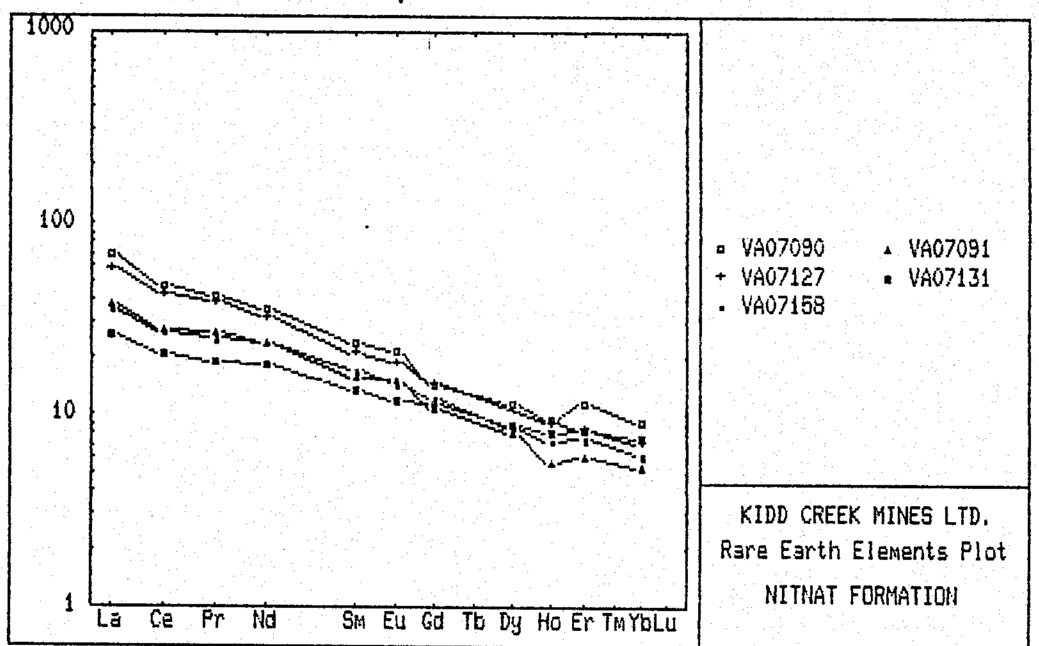

FIGURE 6 : Chondrite-normalized REE diagram; Nitnat Formation

LEGEND
MEMBERS
CR Cameron River
K Karmutsen
N Nanaimo
MMA - K Mafic Members A - K
IMA - C Intermediate Members A - C
FMA - H Felsic Members A - H
Brent - Holyoak Claim Group
Chip Claim Group
Randy North (sph)
Holyoak (sph)
Silver Creek (sph, cpy, gal)
Sharon (cpy)
Anita (sph, cpy)
Coronation (sph, cpy, gal)
FALCONBRIDGE LIMITED
CHEMAINUS JOINT VENTURE
DISTRIBUTION OF MEMBERS: McLAUGHLIN RIDGE FORMATION
WORK BY MGM
DRAWN BY
DATE: April 1989
500 0 500 1000 m
SCALE IN METRES
1 : 20 000
Figure: 7

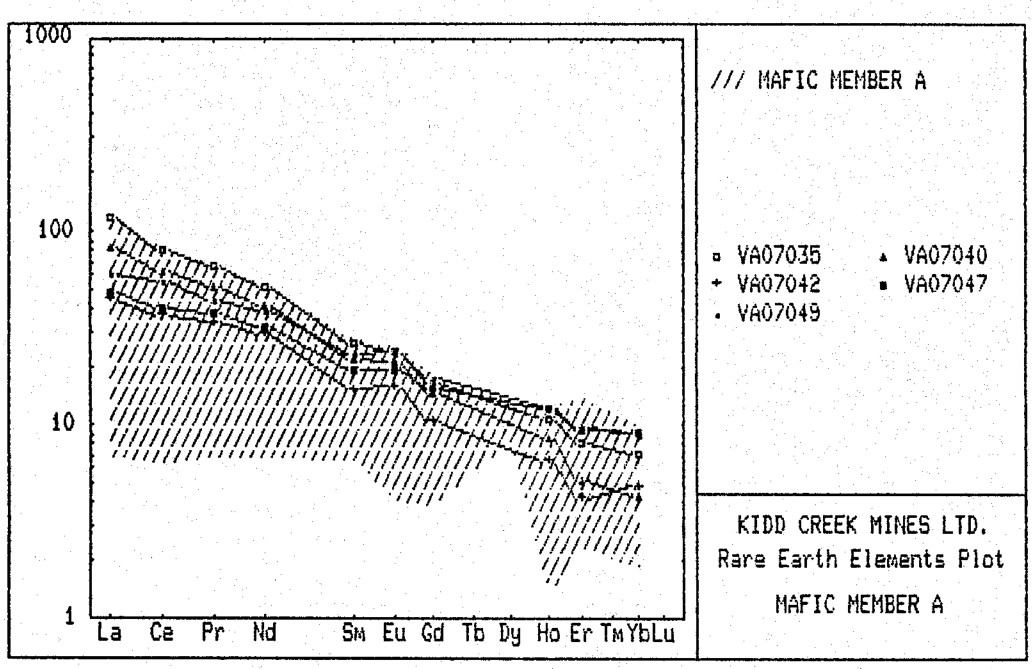

FIGURE 8a : Chondrite-normalized REE diagram; Mafic Member "A"

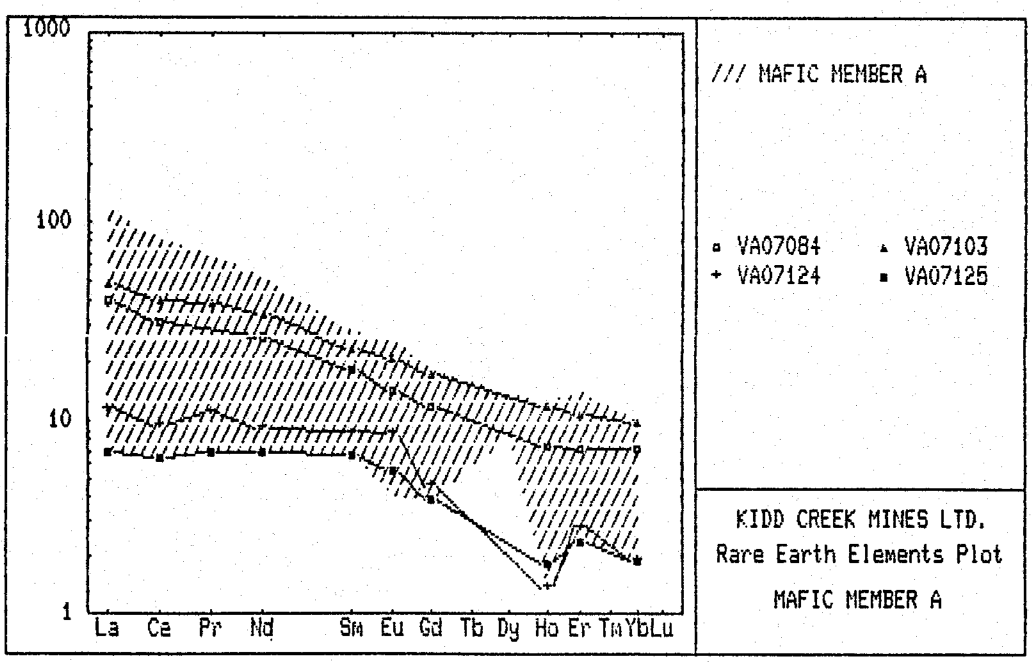

FIGURE 8b : Chondrite-normalized REE diagram; Mafic Member "A"

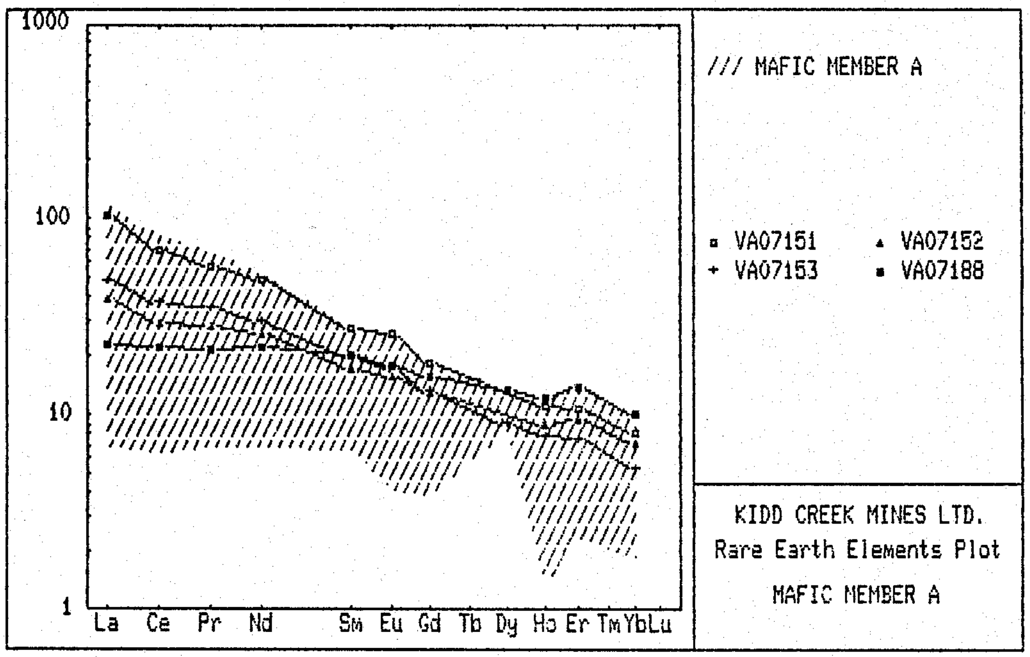

FIGURE 8c : Chondrite-normalized REE diagram; Mafic Member "A"

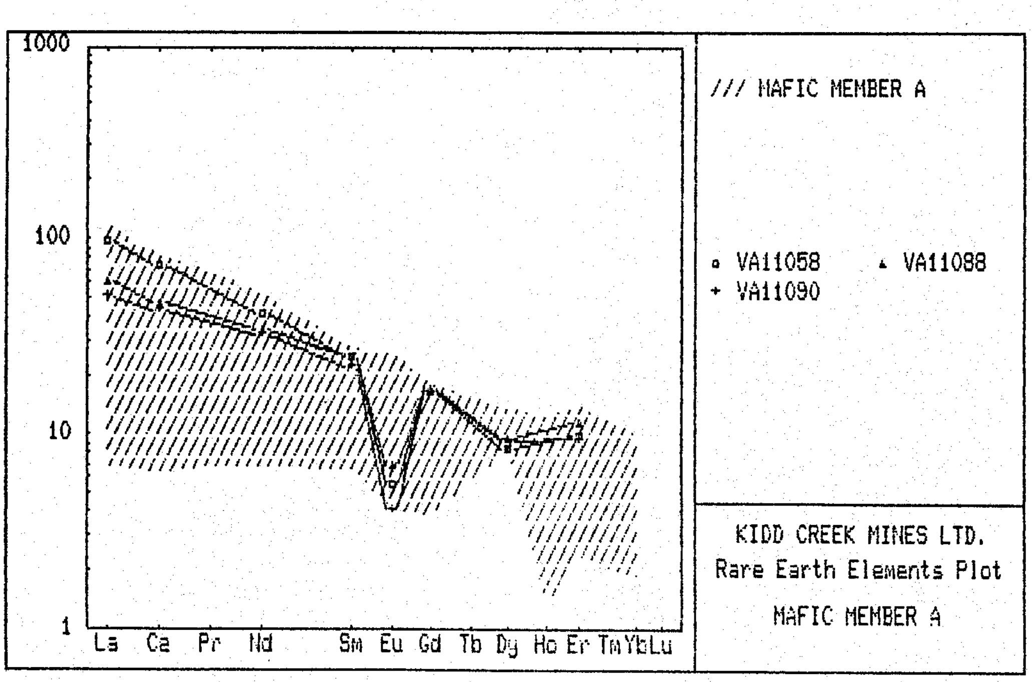

FIGURE 8d : Chondrite-normalized REE diagram; Mafic Member "A"

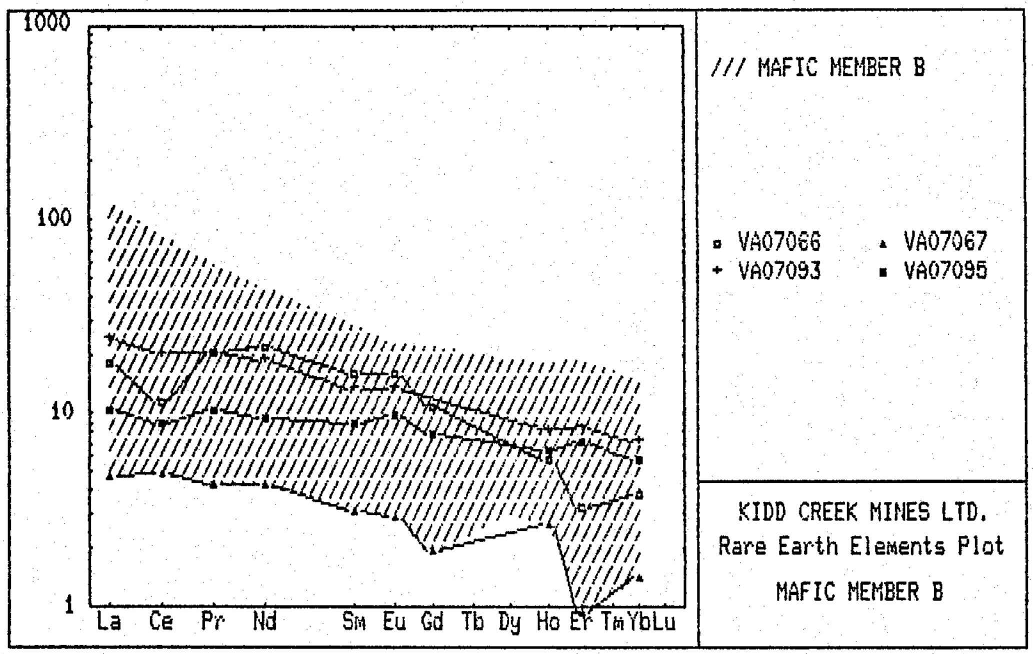

FIGURE 9a : Chondrite-normalized REE diagram; Mafic Member "B"

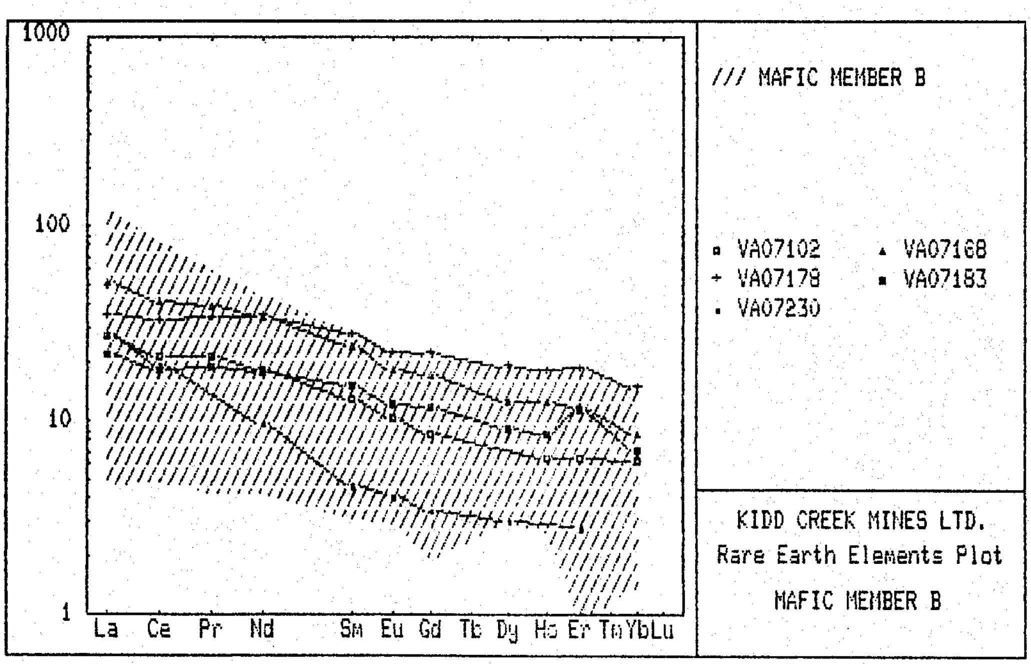

FIGURE 9b : Chondrite-normalized REE diagram; Mafic Member "B"

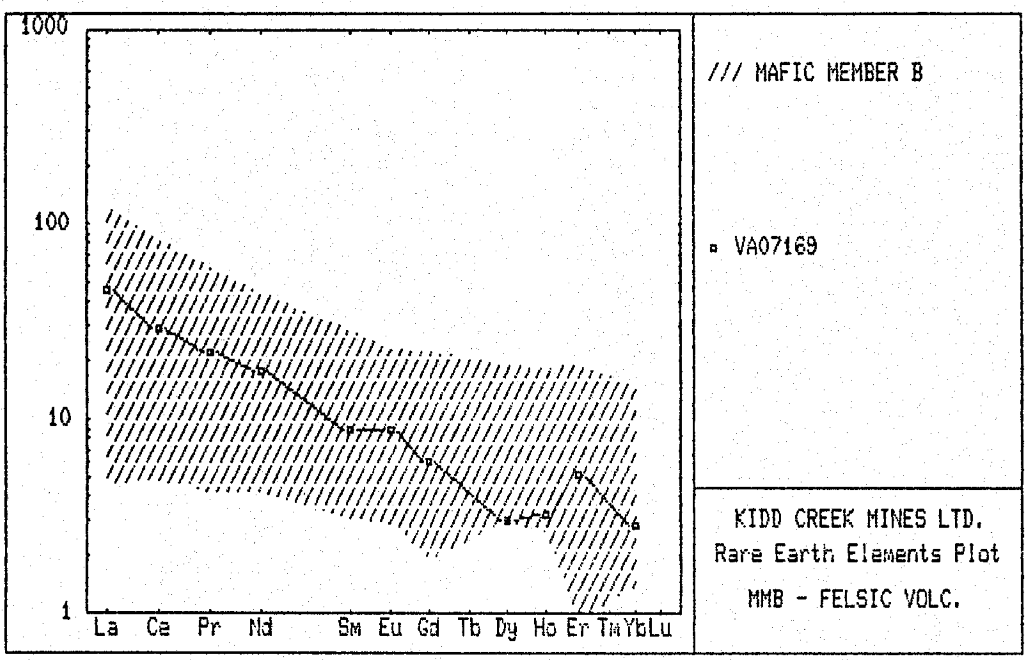

FIGURE 9c : Chondrite-normalized REE diagram; Mafic Member "B" - Felsic volcanic

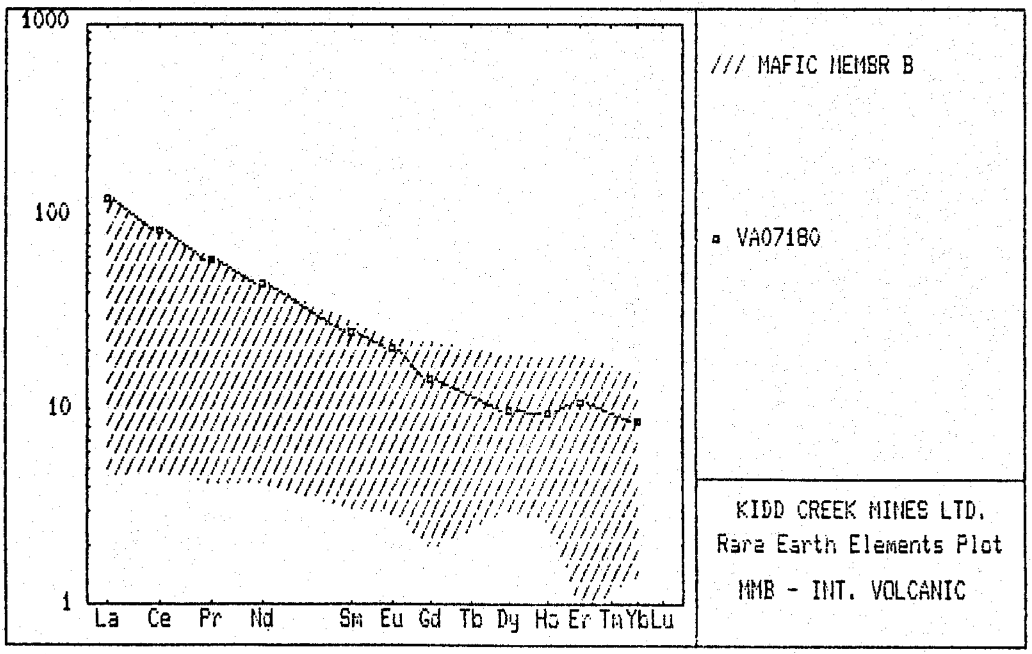

FIGURE 9d : Chondrite-normalized REE diagram; Mafic Member "B"- Intermediate volcanic

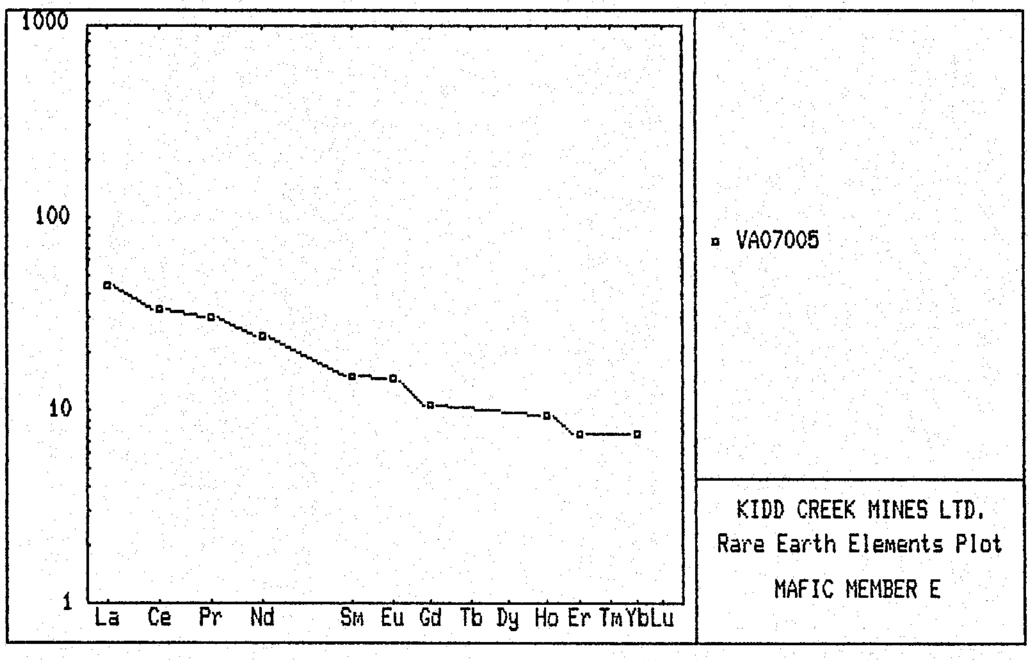

FIGURE 10: Chondrite-normalized REE diagram; Mafic Member "E"

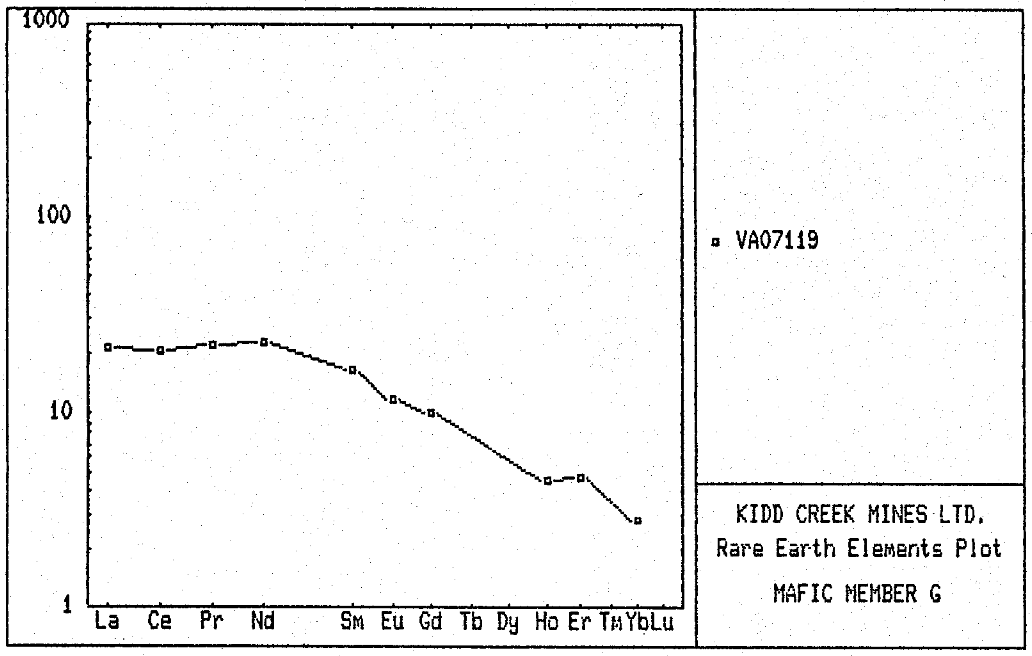

FIGURE 11 : Chondrite-normalized REE diagram; Mafic Member "G"

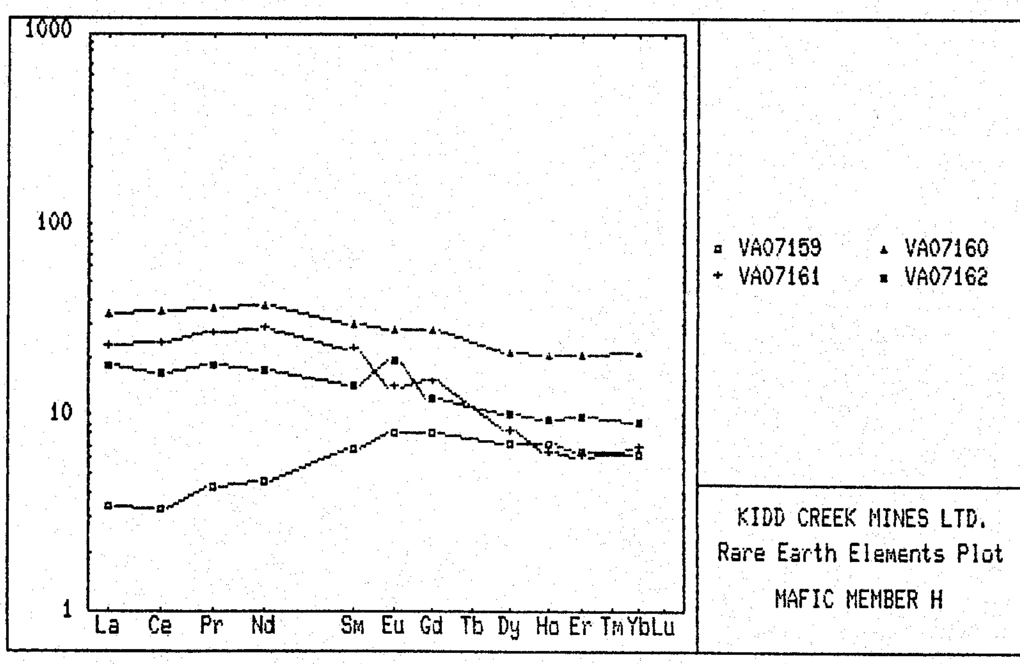

FIGURE 12 : Chondrite-normalized REE diagram; Mafic Member "H"

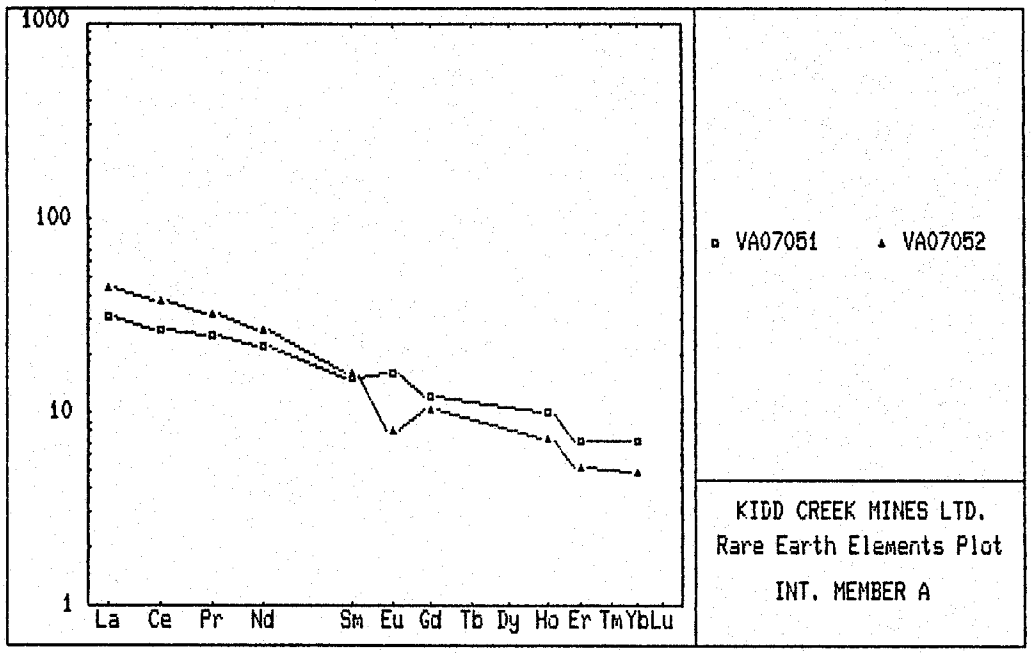

FIGURE 13 : Chondrite-normalized REE diagram; Intermediate Member "A"

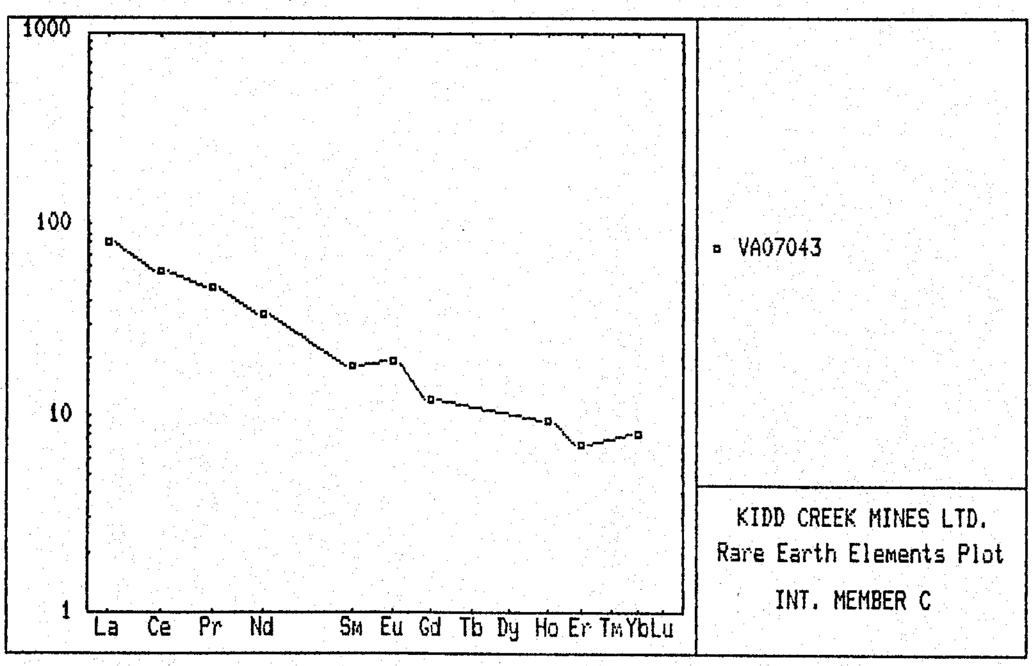

FIGURE 14 : Chondrite-normalized REE diagram; Intermediate Member "C"

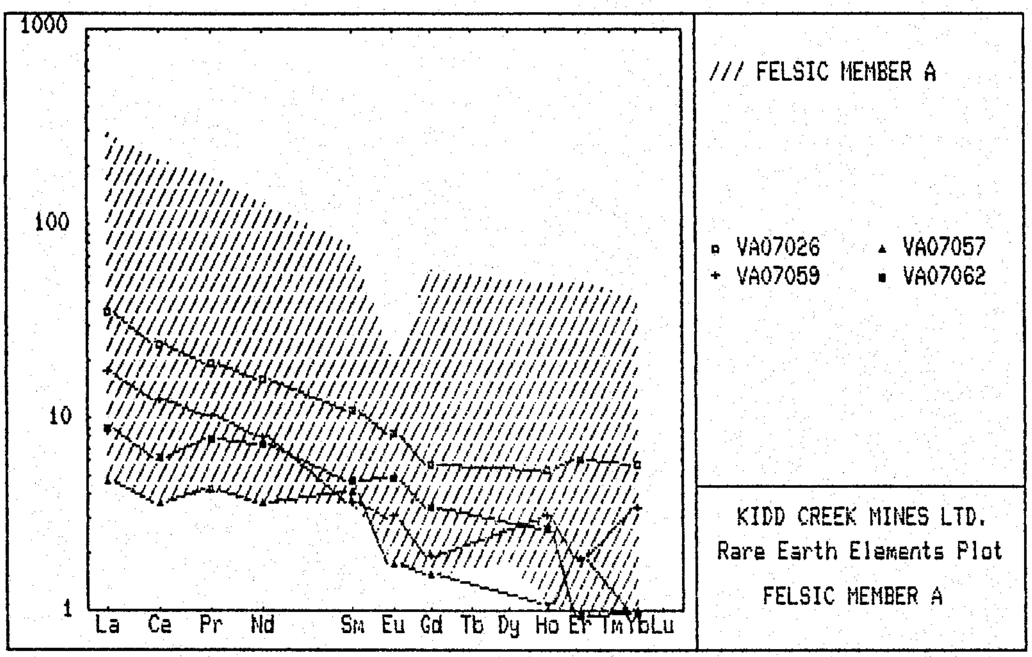

FIGURE 15a : Chondrite-normalized REE diagram; Felsic Member "A"

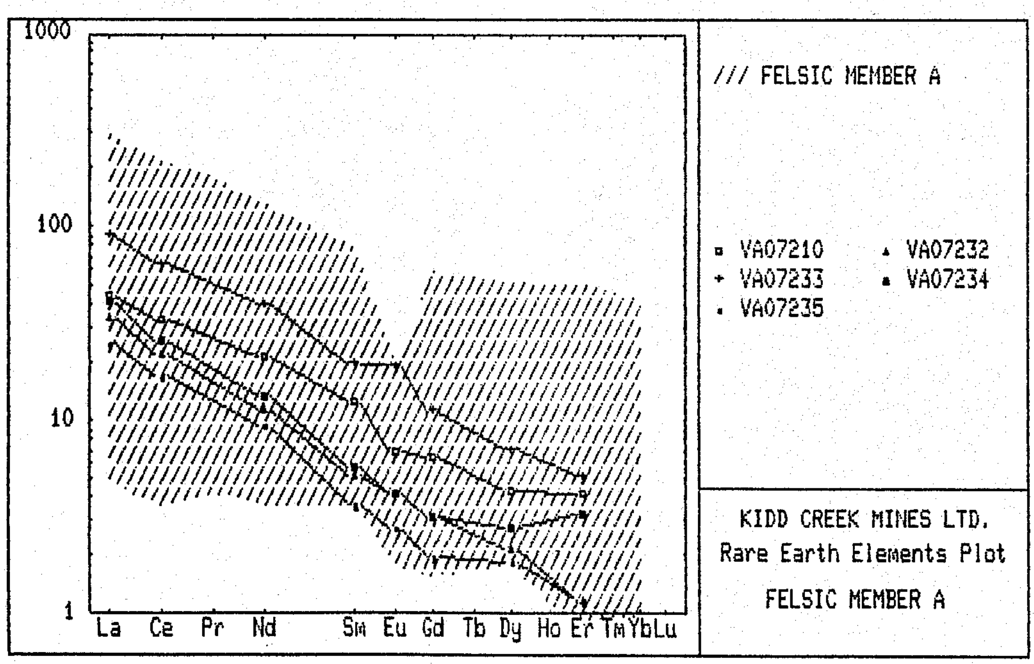

FIGURE 15b : Chondrite-normalized REE diagram; Felsic Member "A"

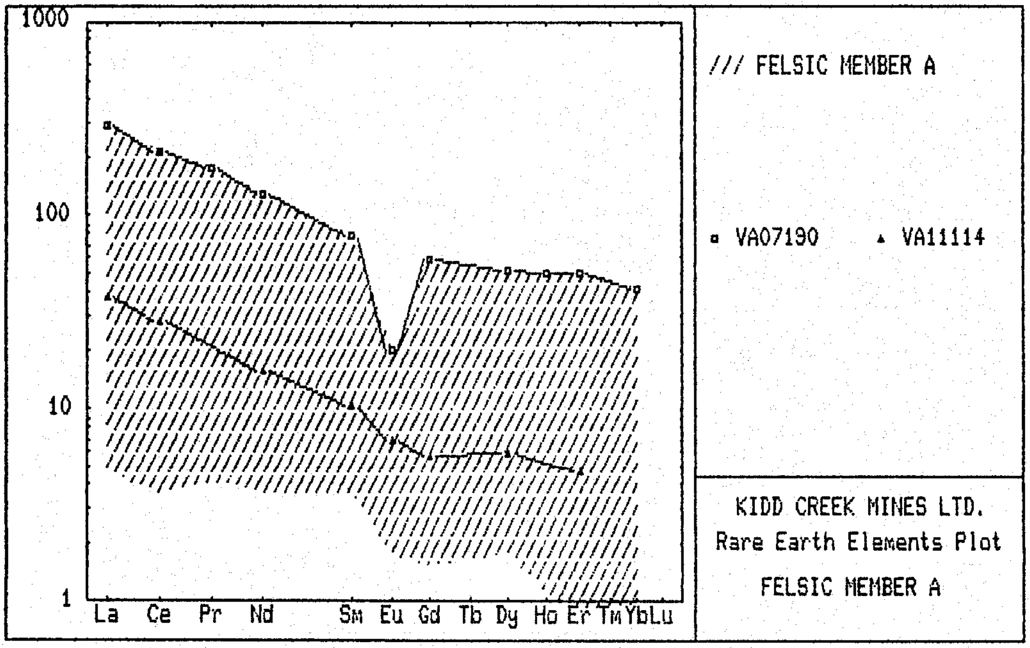

FIGURE 15c : Chondrite-normalized REE diagram; Felsic Member "A"

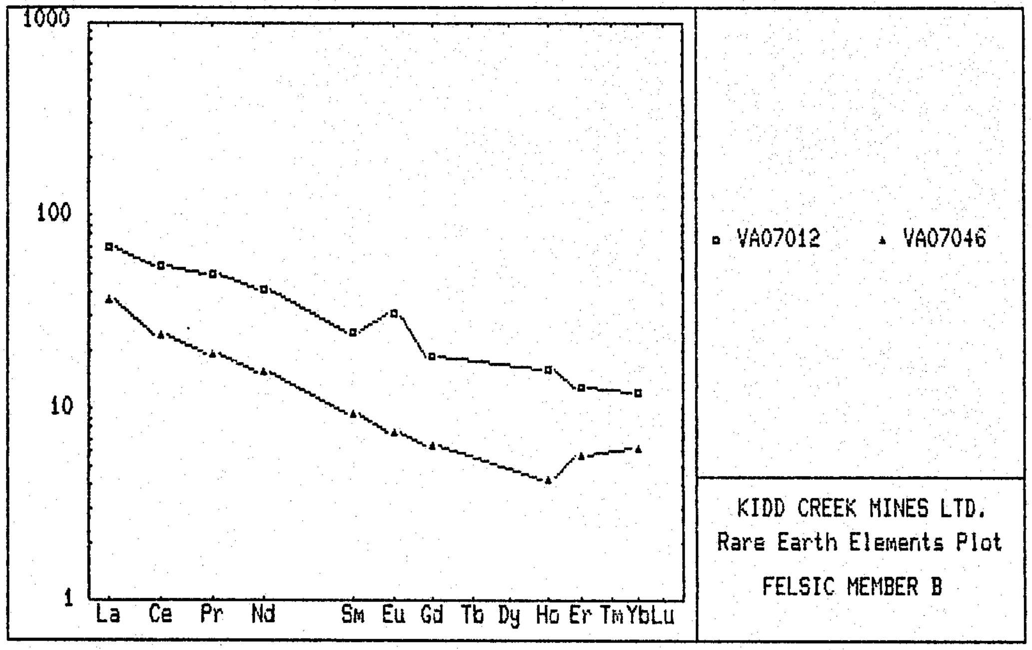

FIGURE 16 : Chondrite-normalized REE diagram; Felsic Member "B"

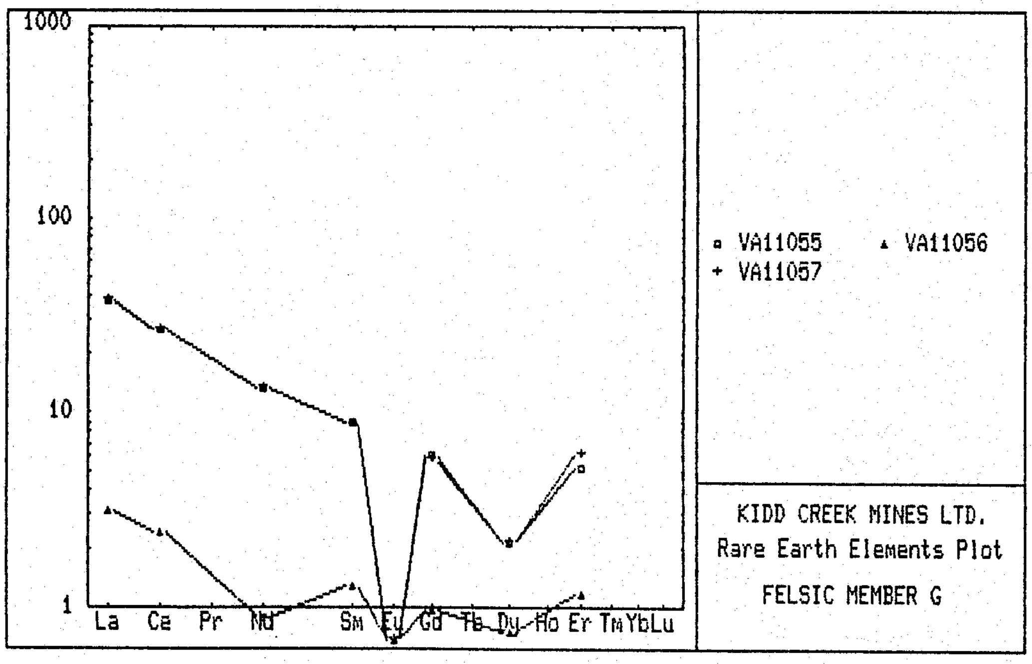

FIGURE 17 : Chondrite-normalized REE diagram; Felsic Member "G"

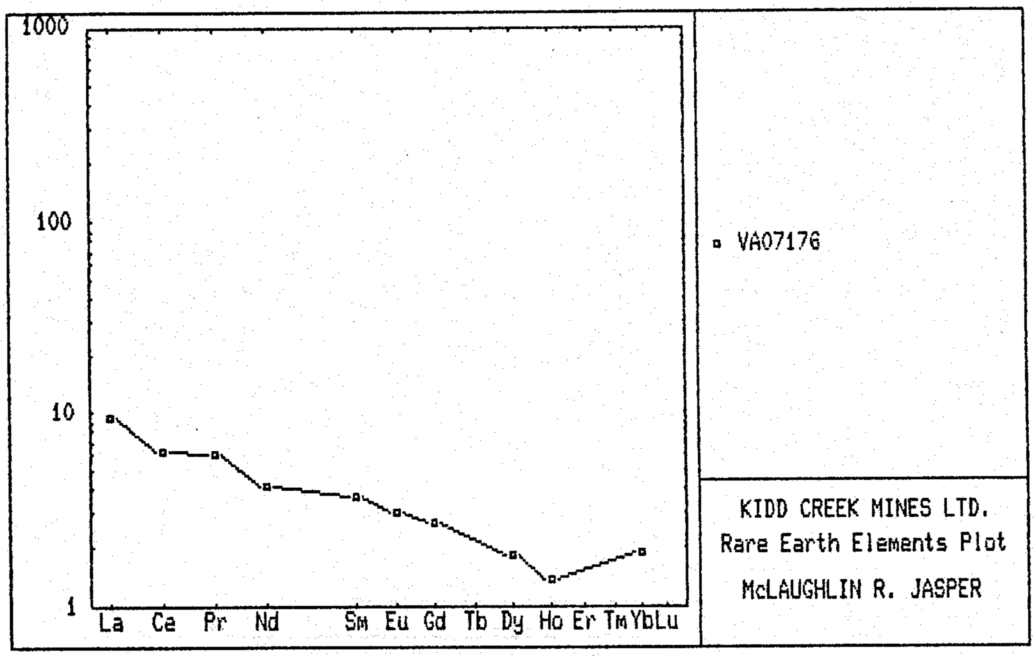

FIGURE 18 : Chondrite-normalized REE diagram; jasper, McLaughlin Ridge Fm.

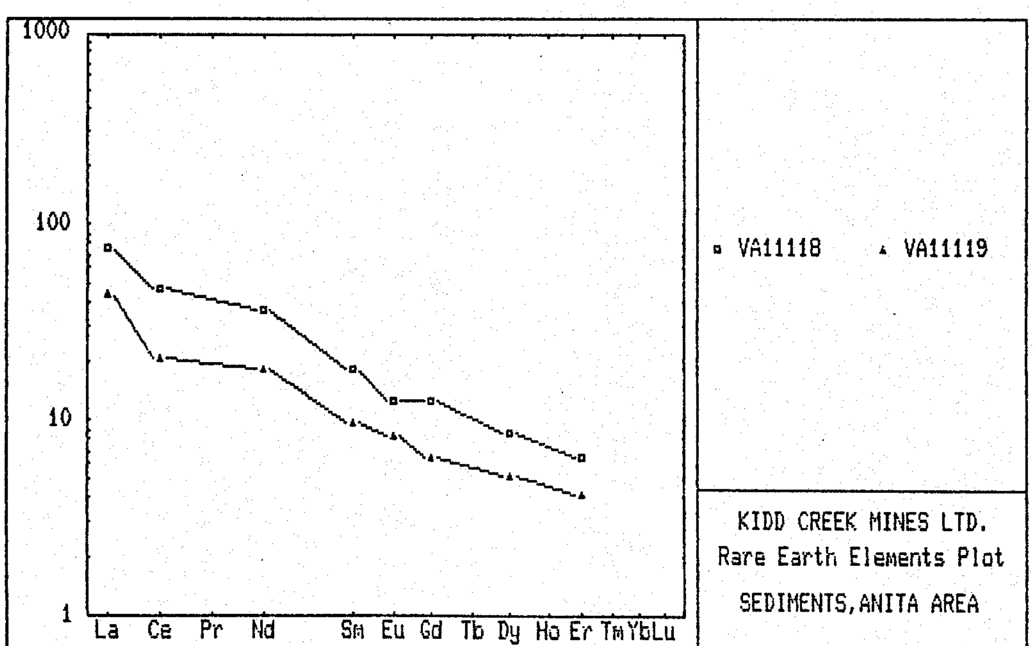

FIGURE 19 : Chondrite-normalized REE diagram; Ba-rich sediments, Anita area

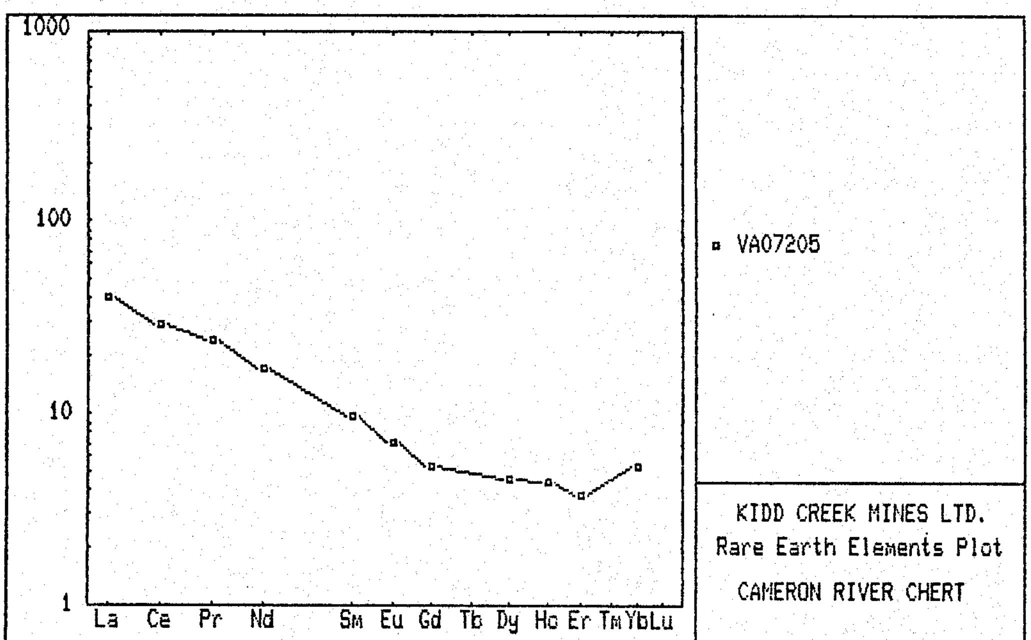

FIGURE 20 : Chondrite-normalized REE diagram; cherts, Cameron River Fm.

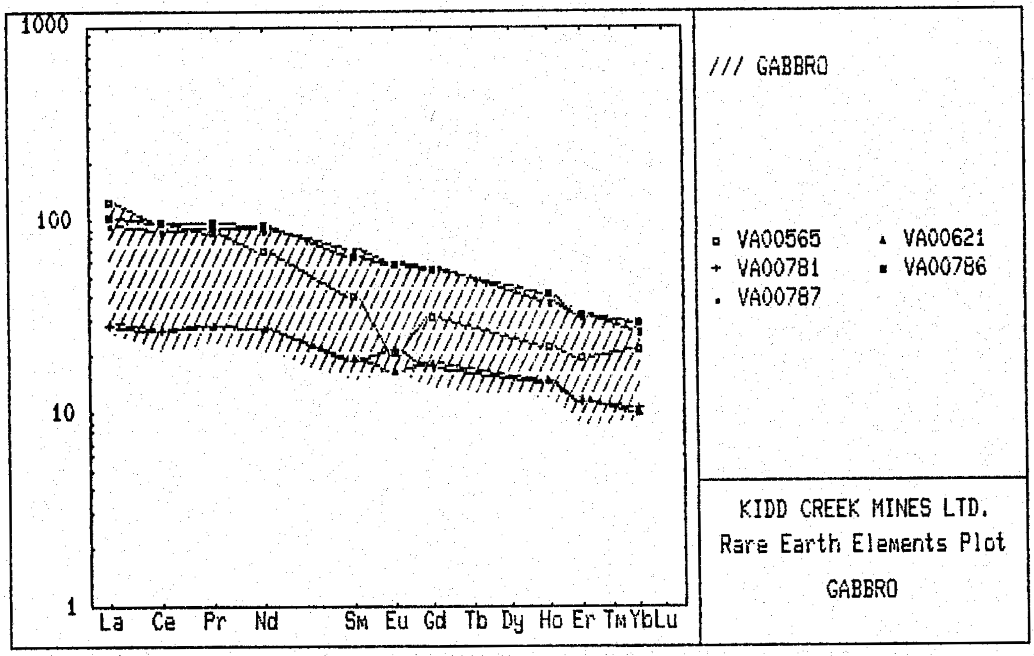

FIGURE 21a : Chondrite-normalized REE diagram; gabbros, diorites, Karmutsen Fm.

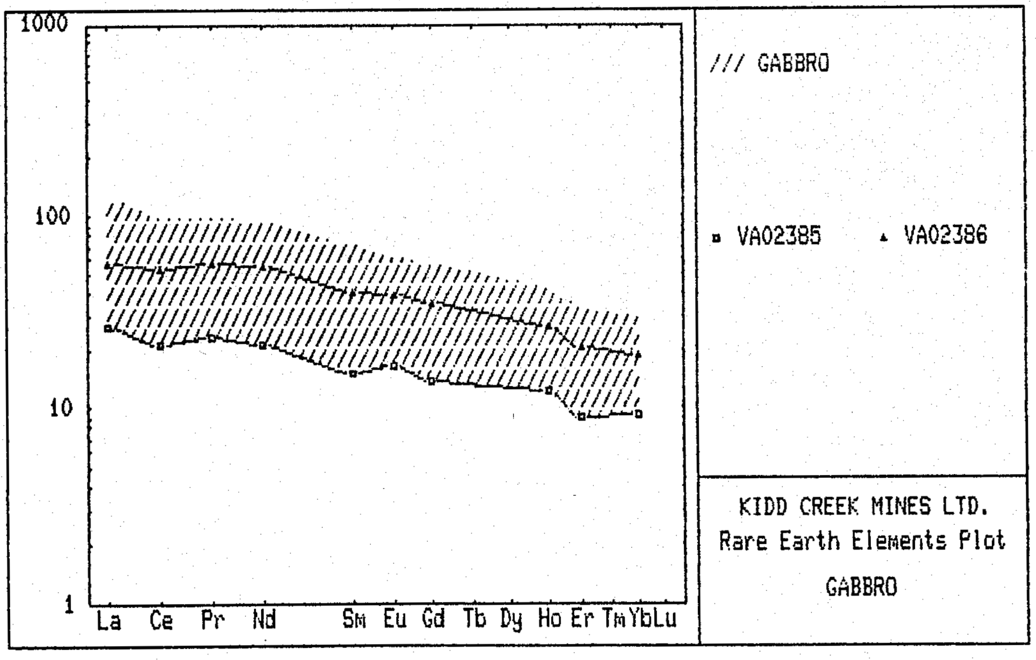

FIGURE 21b : Chondrite-normalized REE diagram; gabbros, diorites, Karmutsen Fm.

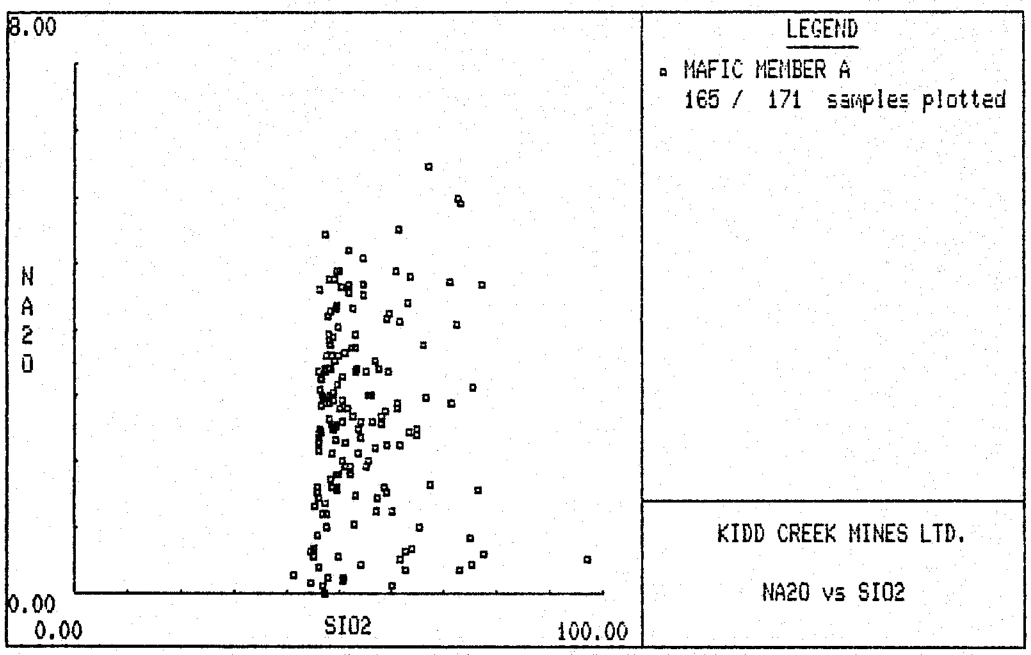

FIGURE: 22a : Na20 vs Si02 variation diagram; Mafic Member "A"

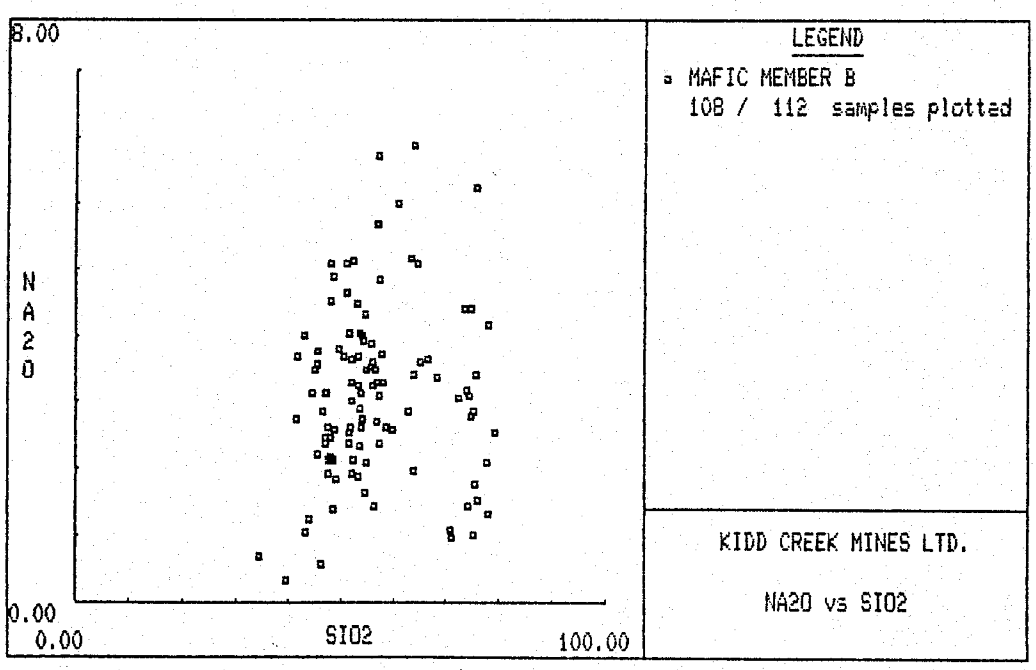

FIGURE 22b : Na20 vs Si02 variation diagram; Mafic Member "B"

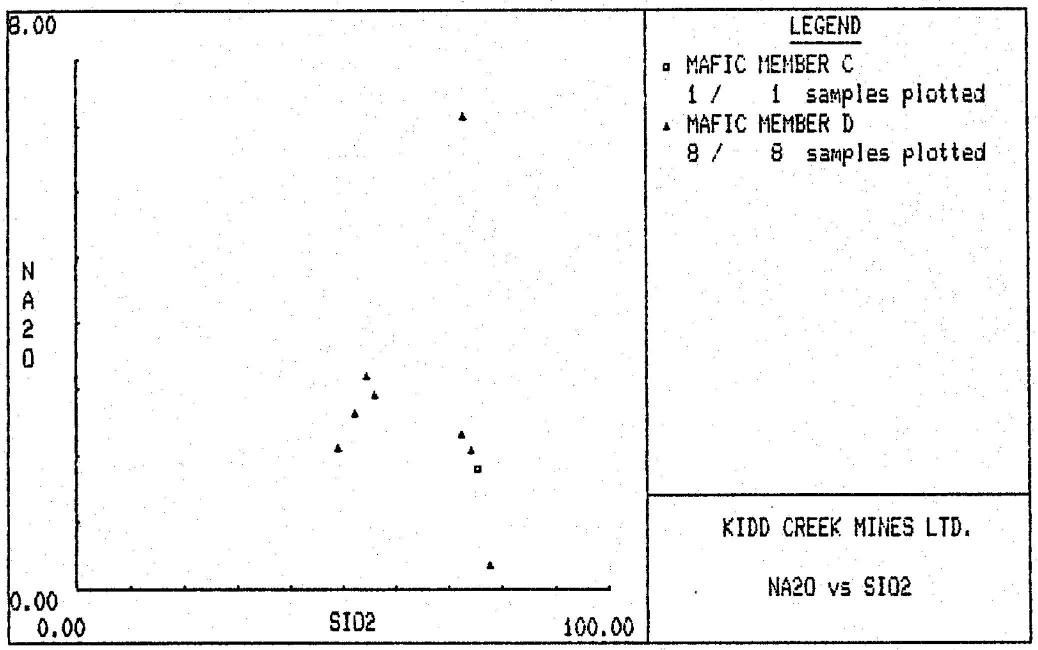

FIGURE 22c : Na2O vs SiO2 variation diagram; Mafic Members "C" & "D"

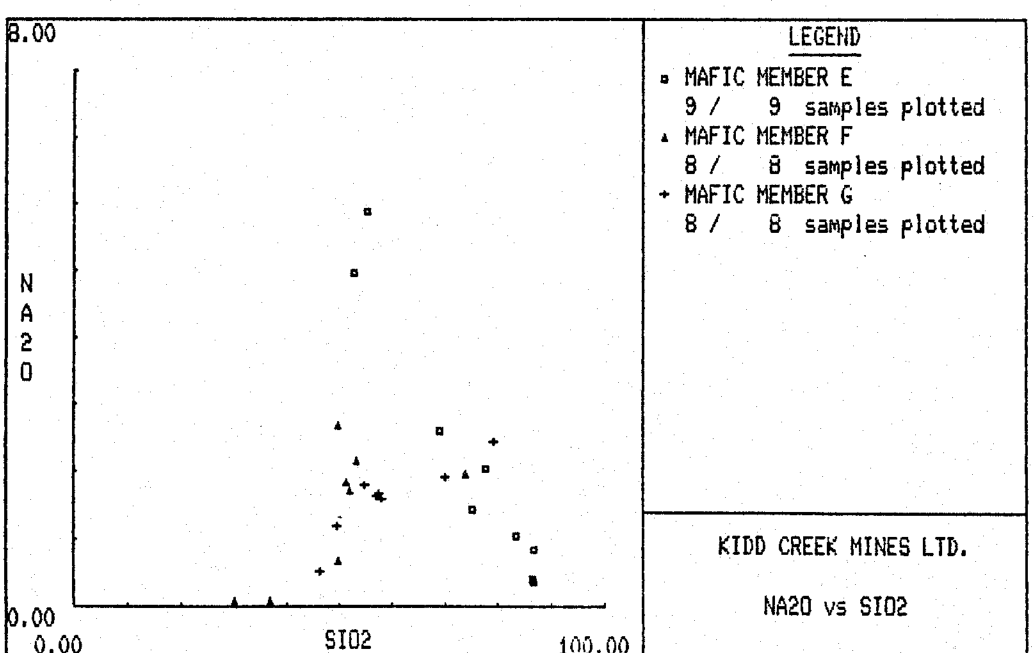

FIGURE 22d : Na2O vs SiO2 variation diagram; Mafic Members "E", "F", and "G"

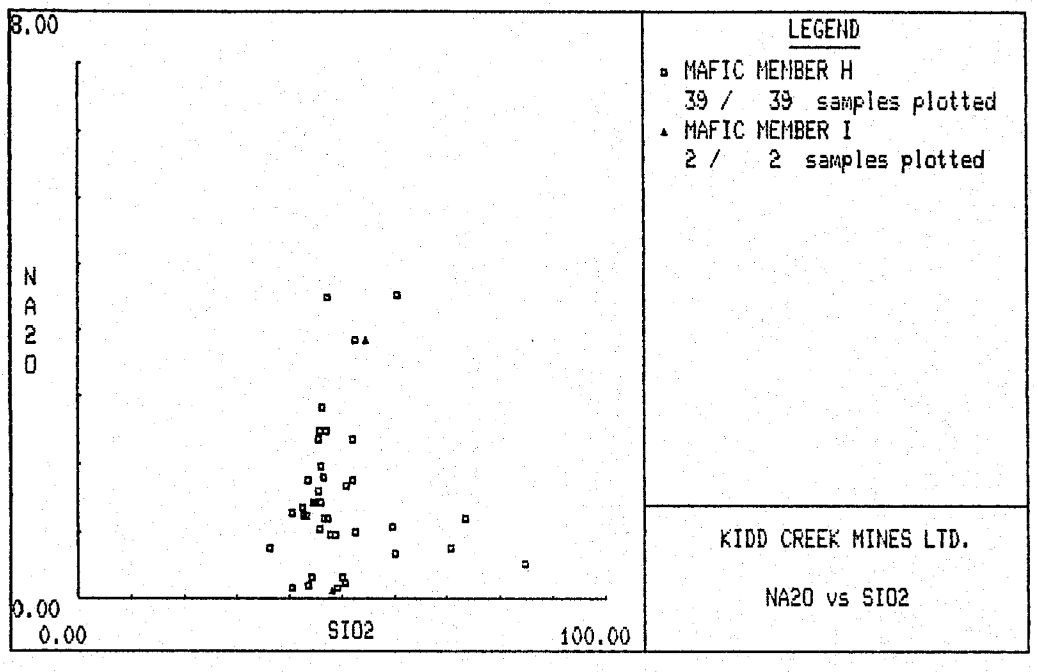

FIGURE 22e : Na2O vs SiO2 variation diagram; Mafic Members "H" and "I".

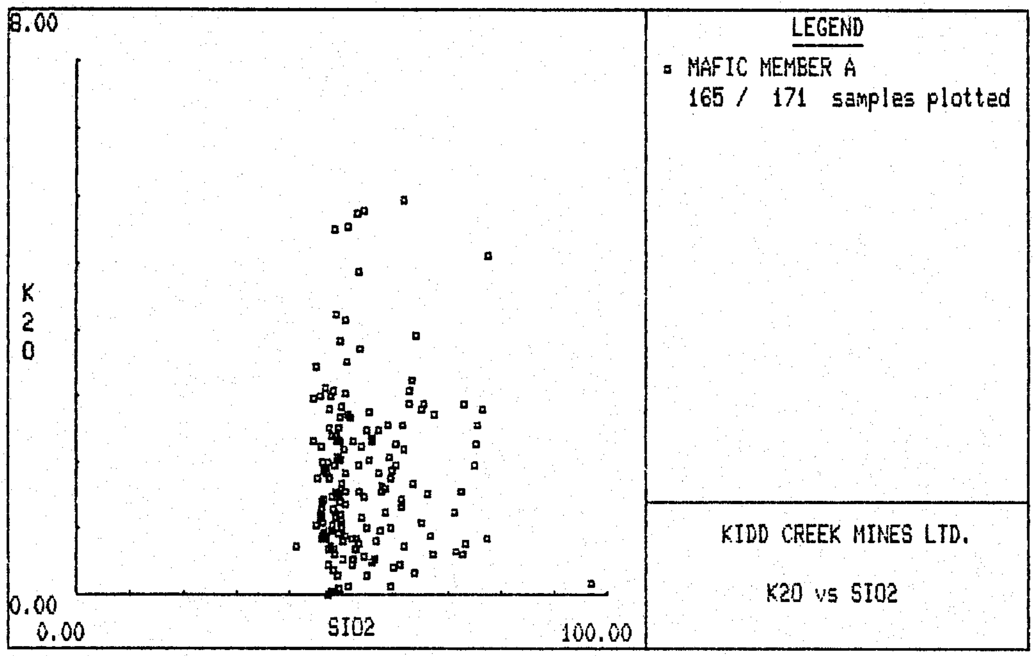

FIGURE 23a : K2O vs SiO2 variation diagram; Mafic Member "A"

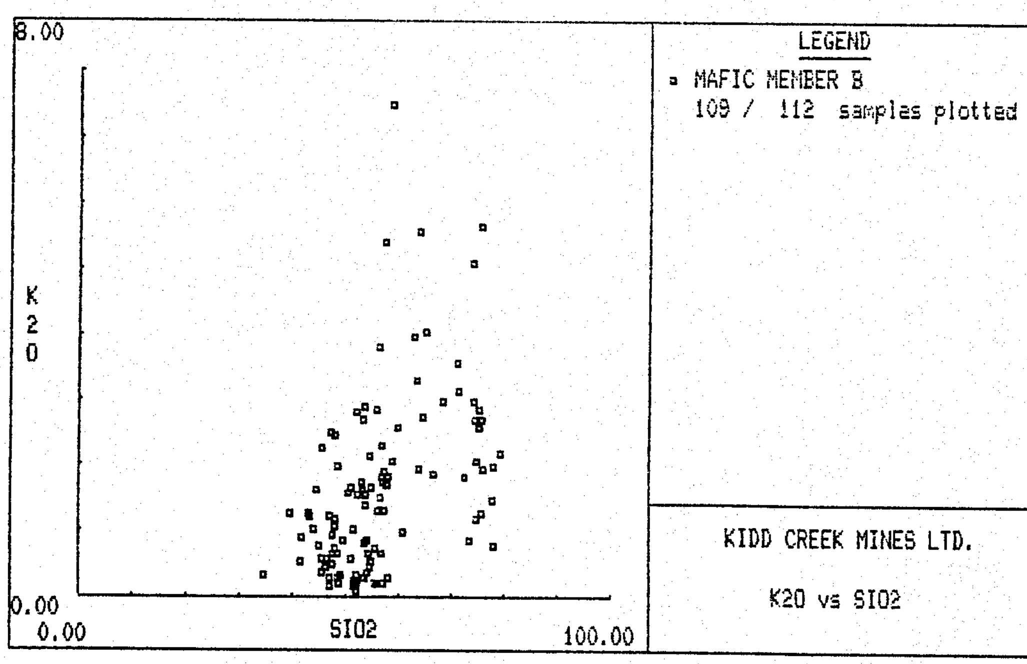

FIGURE 23b : K2O vs SiO2 variation diagram; Mafic Member "B"

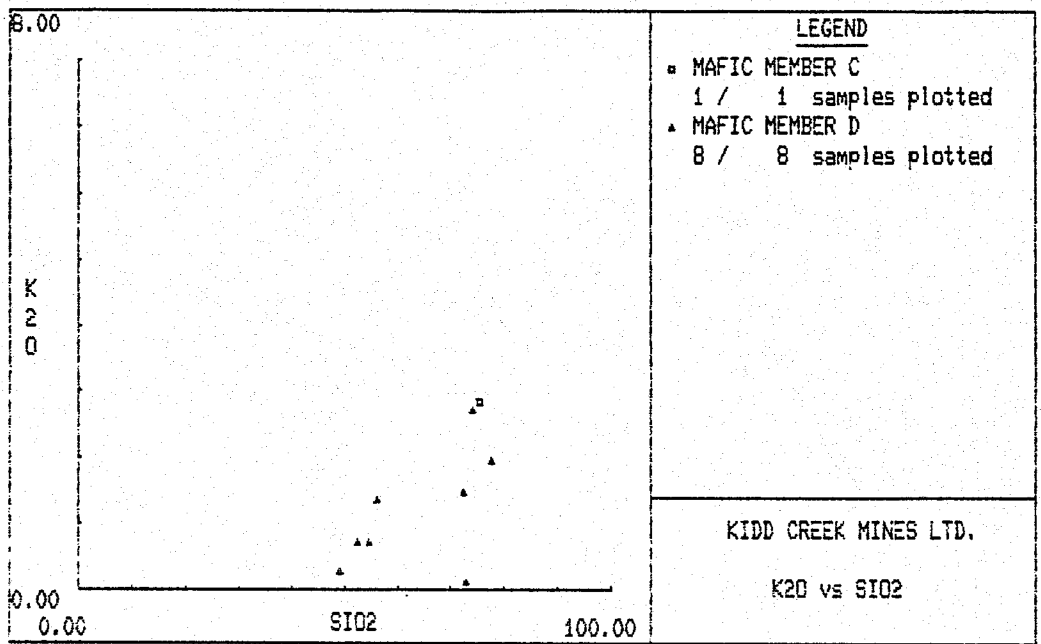

FIGURE 23c : K2O vs SiO2 variation diagram; Mafic Members "C" & "D"

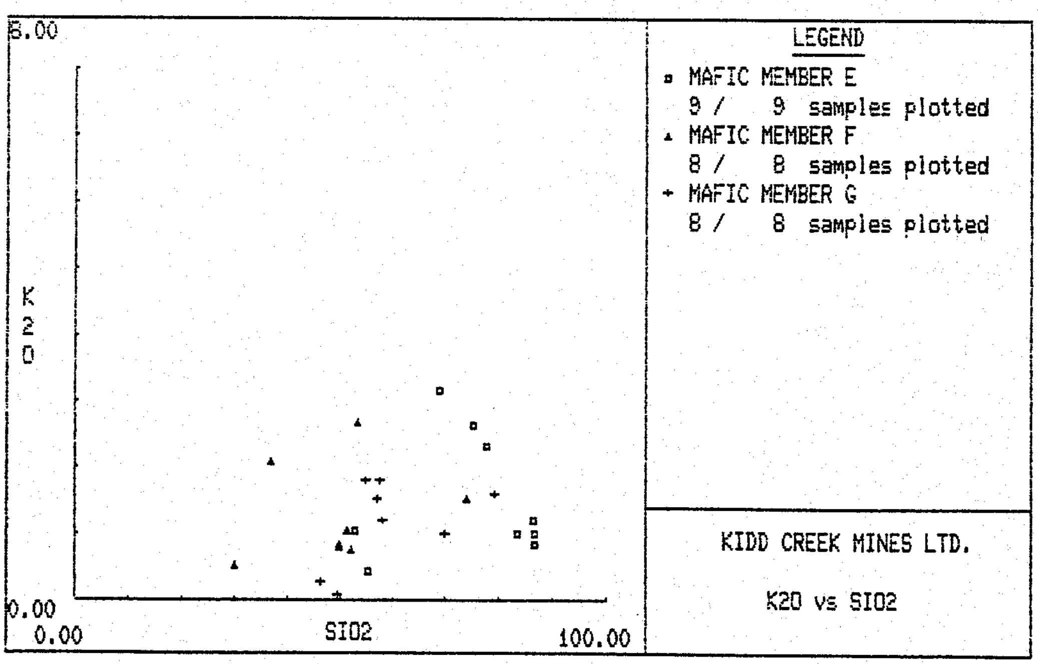

FIGURE 23d : K2O vs SiO2 variation diagram; Mafic Members "E", "F", and "G"

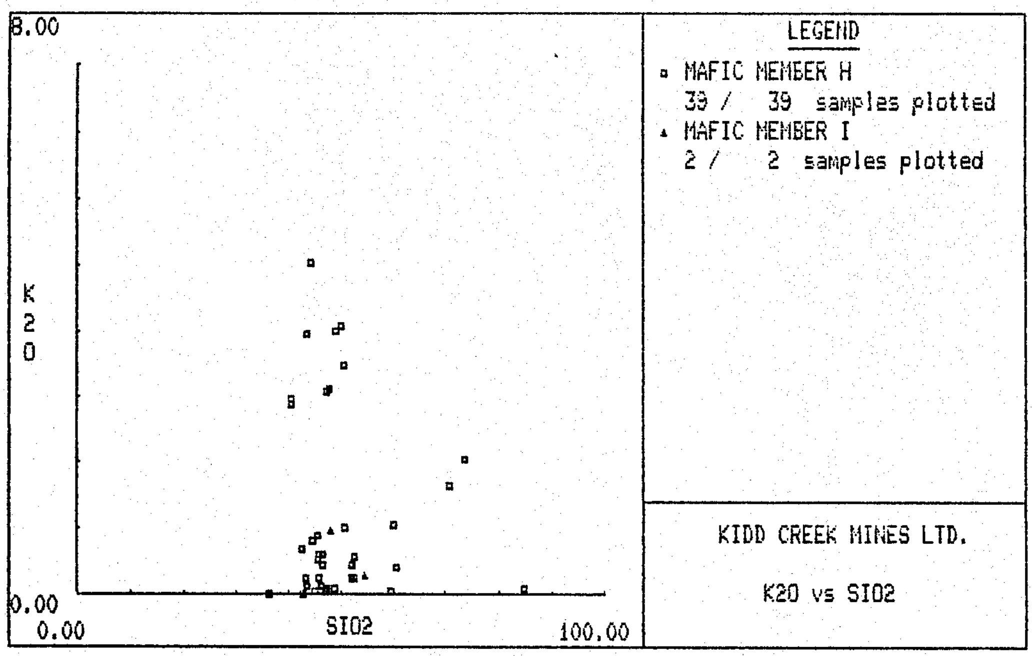

FIGURE 23e: K20 vs Si02 variation diagram; Mafic Members "H", and "I".

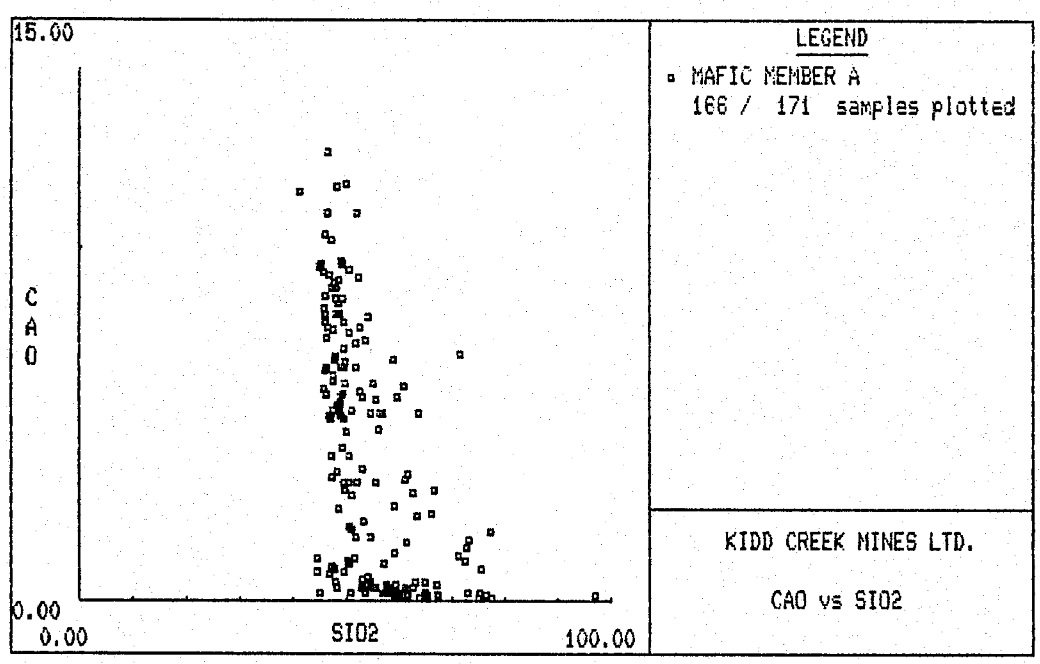

FIGURE 24a : CaO vs SiO2 variation diagram; Mafic Member "A"

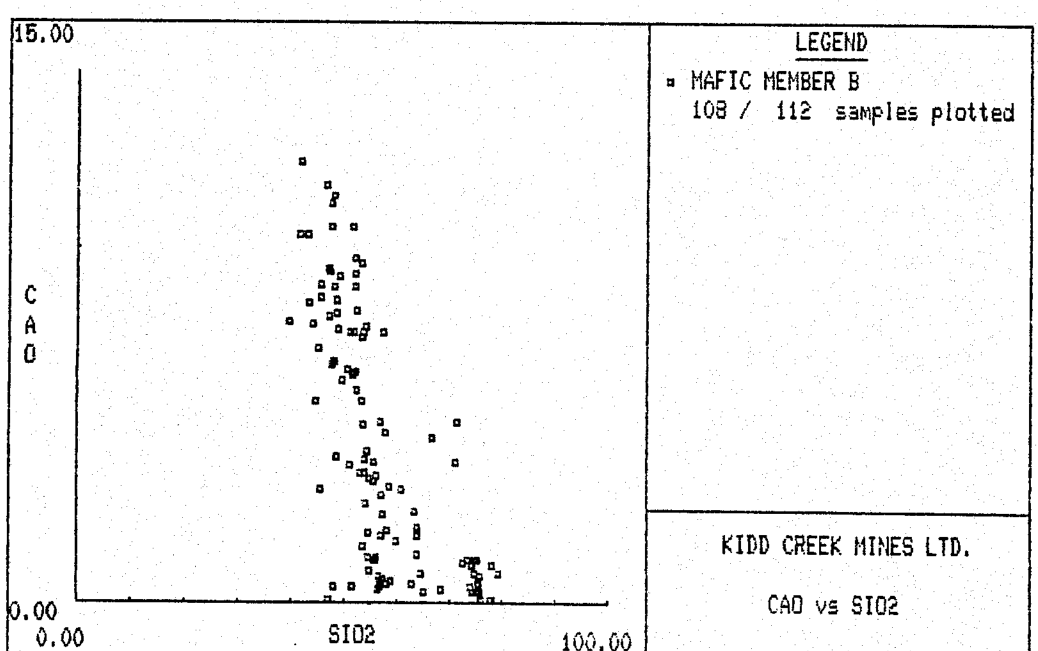

FIGURE 24b : CaO vs SiO2 variation diagram; Mafic Member "B"

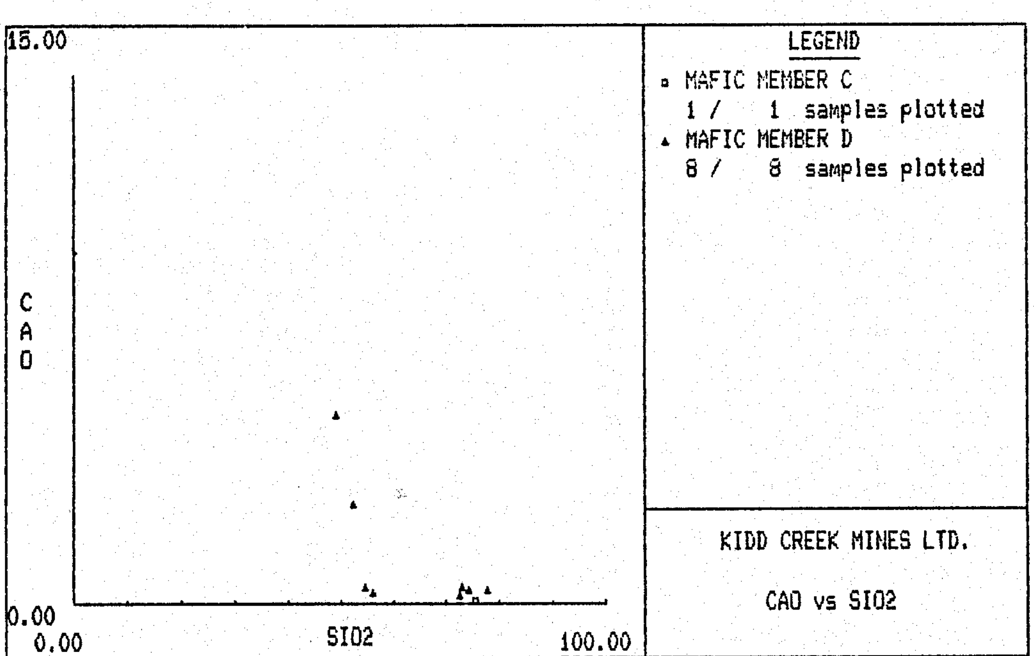

FIGURE 24c : CaO vs SiO2 variation diagram; Mafic Members "C", and "D"

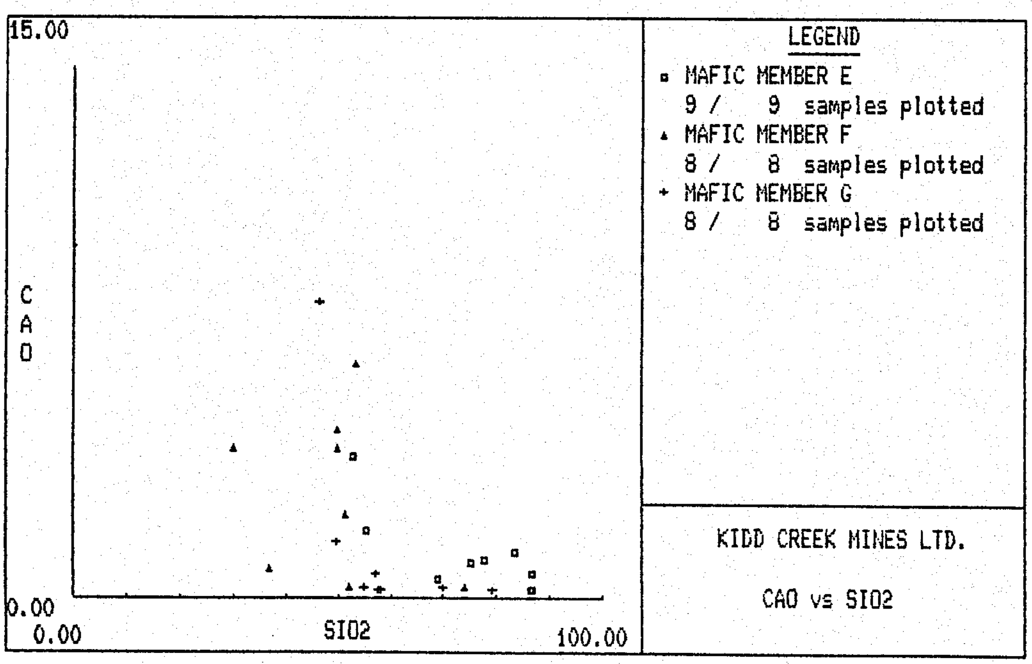

FIGURE 24d : CaO vs SiO2 variation diagram; Mafic Members "E", "F", and "G"

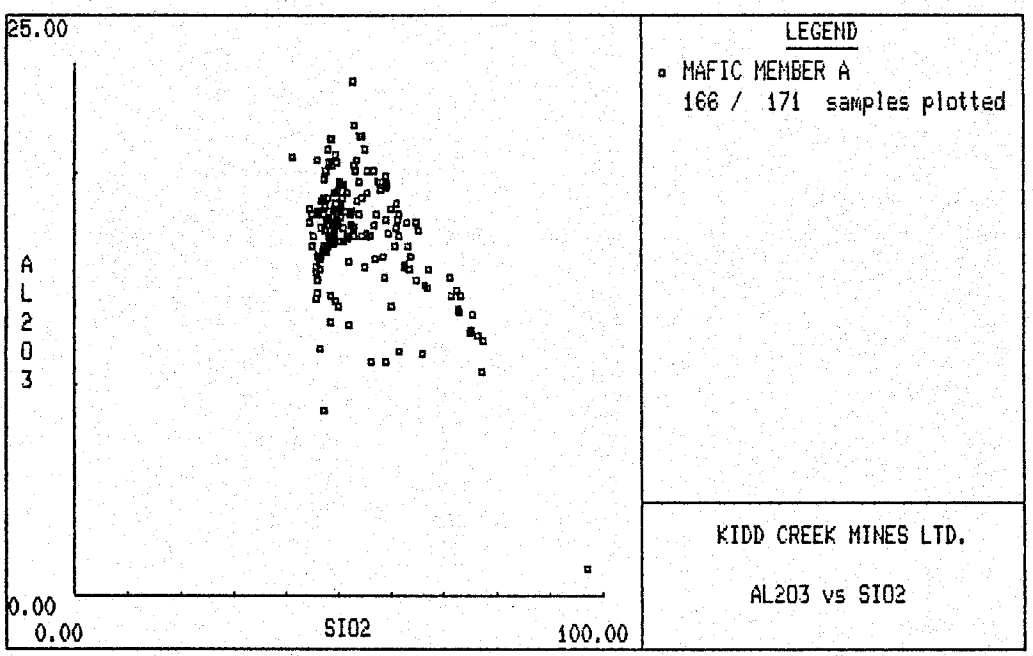

FIGURE 25a : Al2O3 vs SiO2 variation diagram; Mafic Member "A"

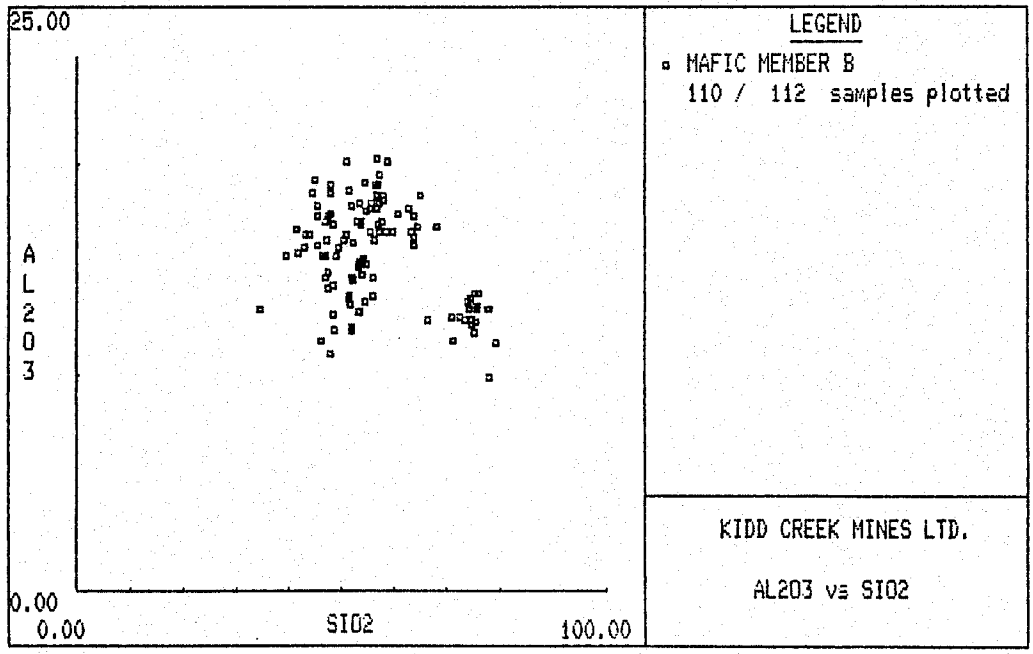

FIGURE 25b : Al2O3 vs SiO2 variation diagram; Mafic Member "B"

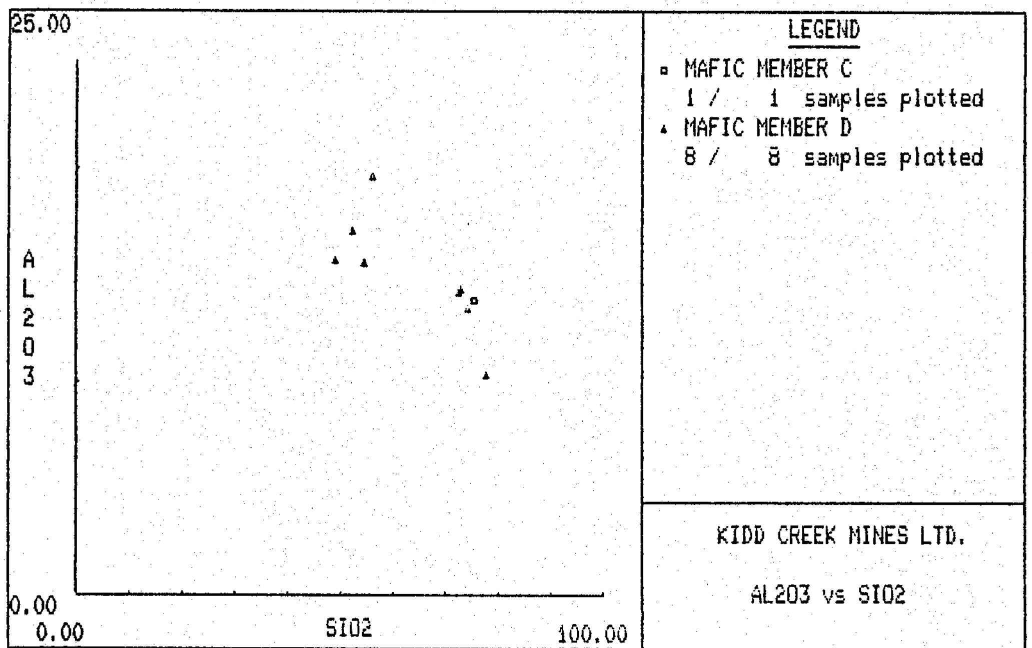

FIGURE 25c : Al2O3 vs SiO2 variation diagram; Mafic Members "C", and "D"

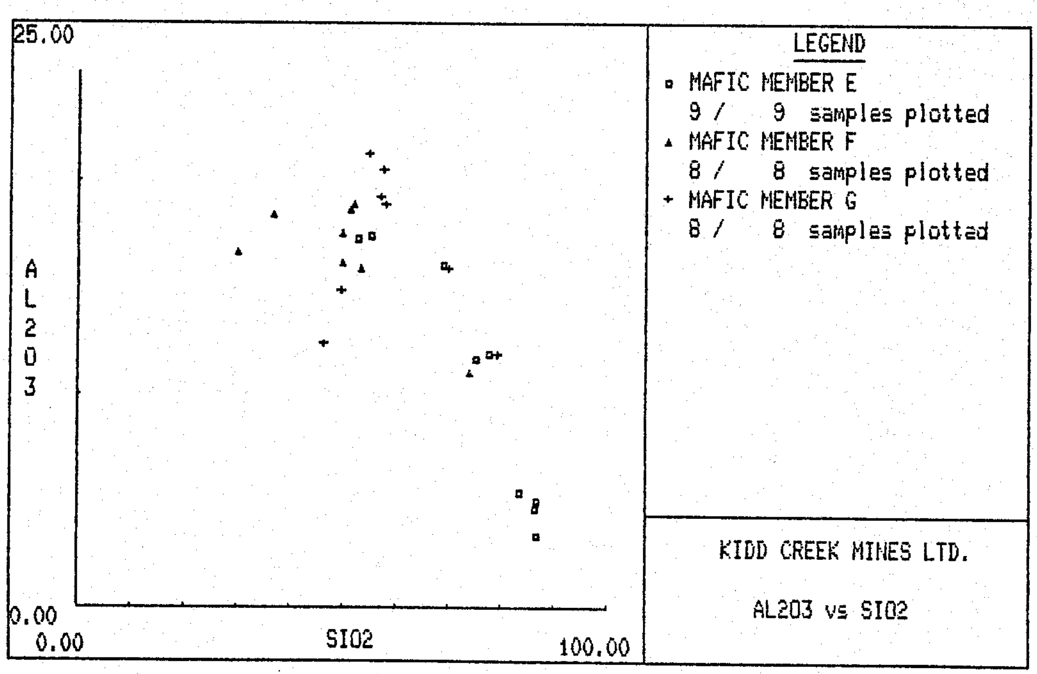

FIGURE 25d : Al2O3 vs SiO2 variation diagram; Mafic Members "E", "F", and "G"

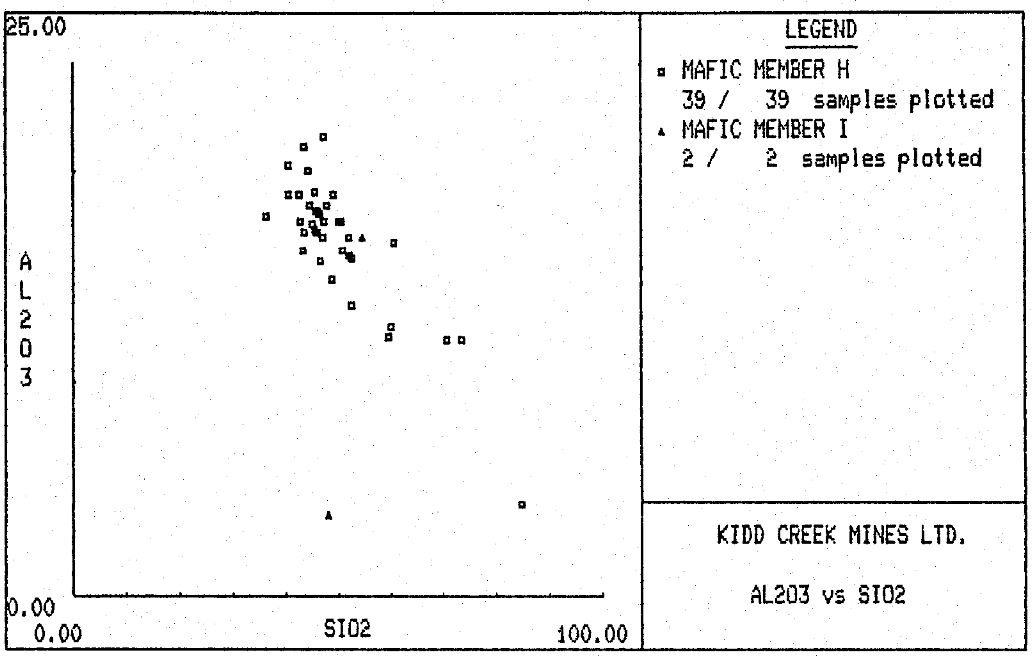

FIGURE 25e : Al2O3 vs SiO2 variation diagram; Mafic Members "H", and "I"

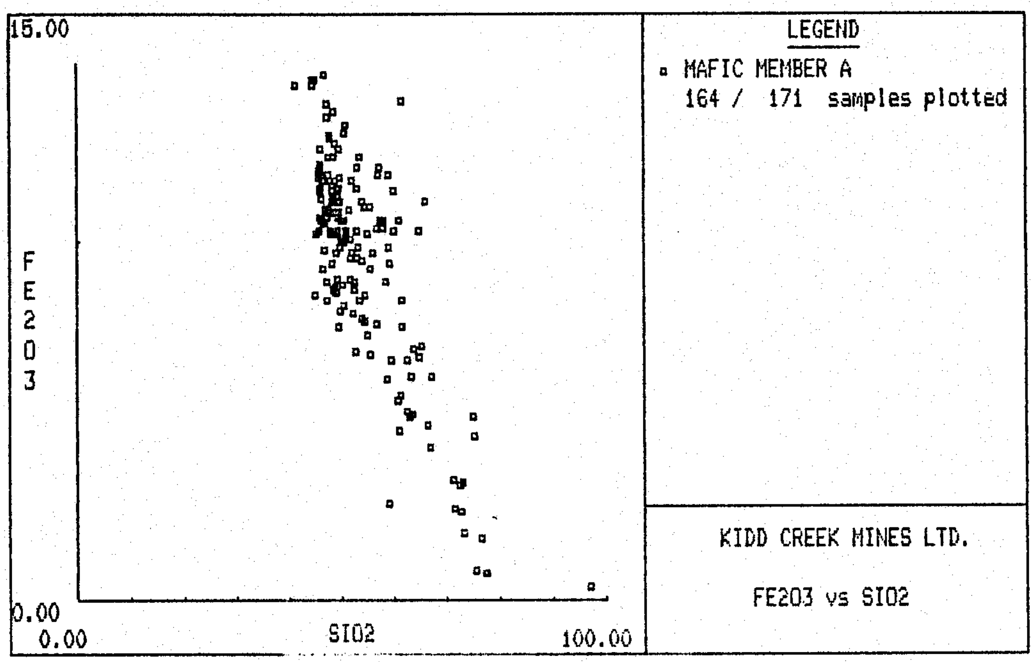

FIGURE 26a : Fe2O3 vs SiO2 variation diagram; Mafic Member "A"

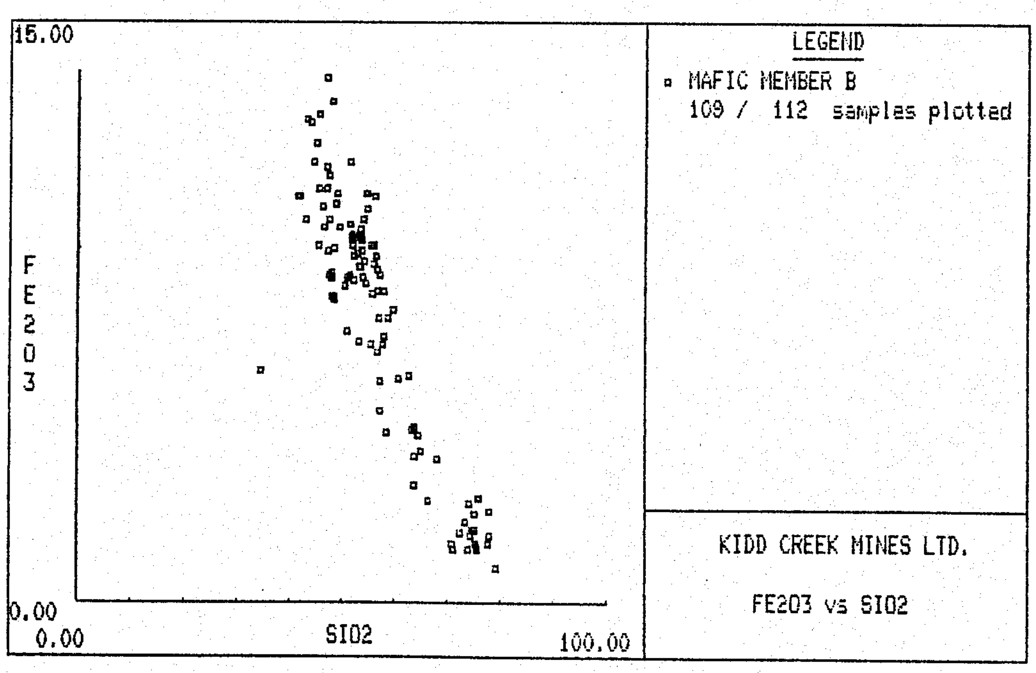

FIGURE 26b : Fe2O3 vs SiO2 variation diagram; Mafic Member "B"

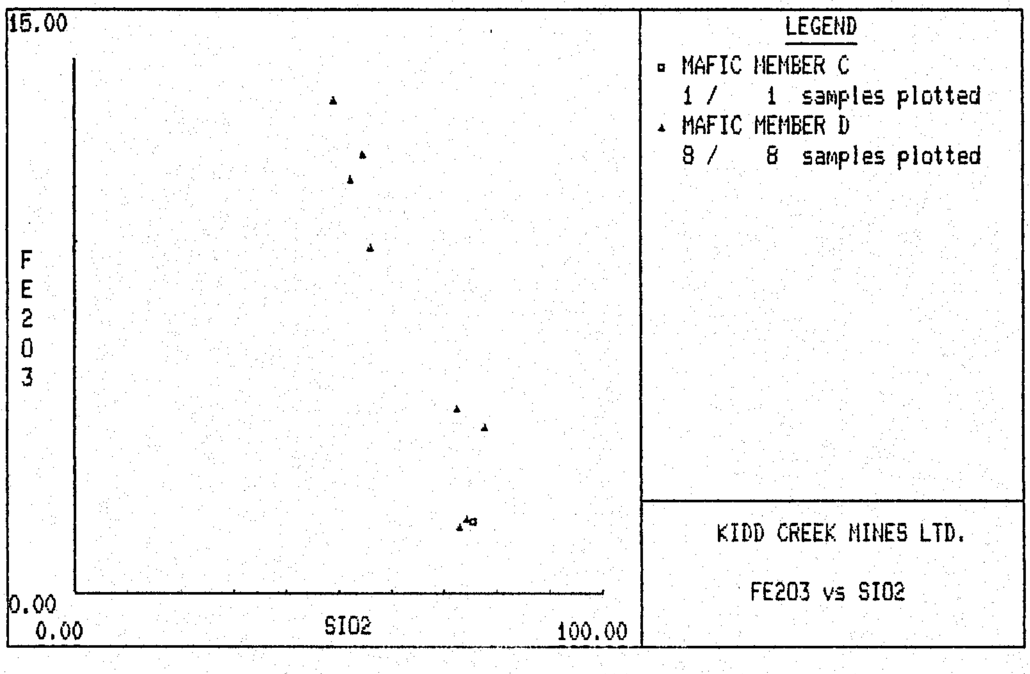

FIGURE 26c : Fe2O3 vs SiO2 variation diagram; Mafic Members "C", and "D"

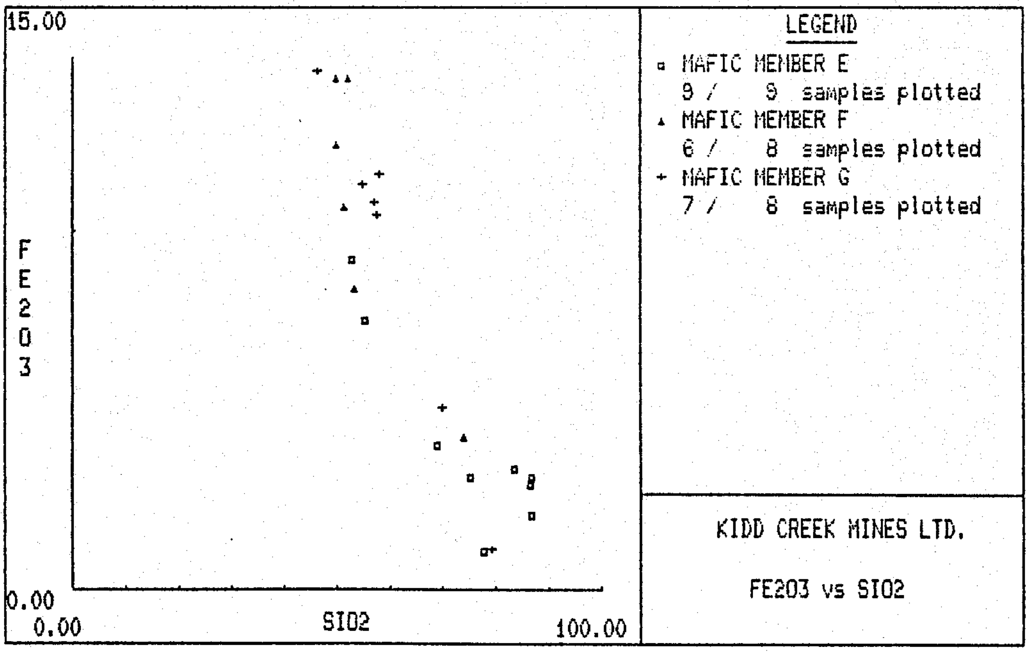

FIGURE 26d : Fe2O3 vs SiO2 variation diagram; Mafic Members "E", "F", and "G"

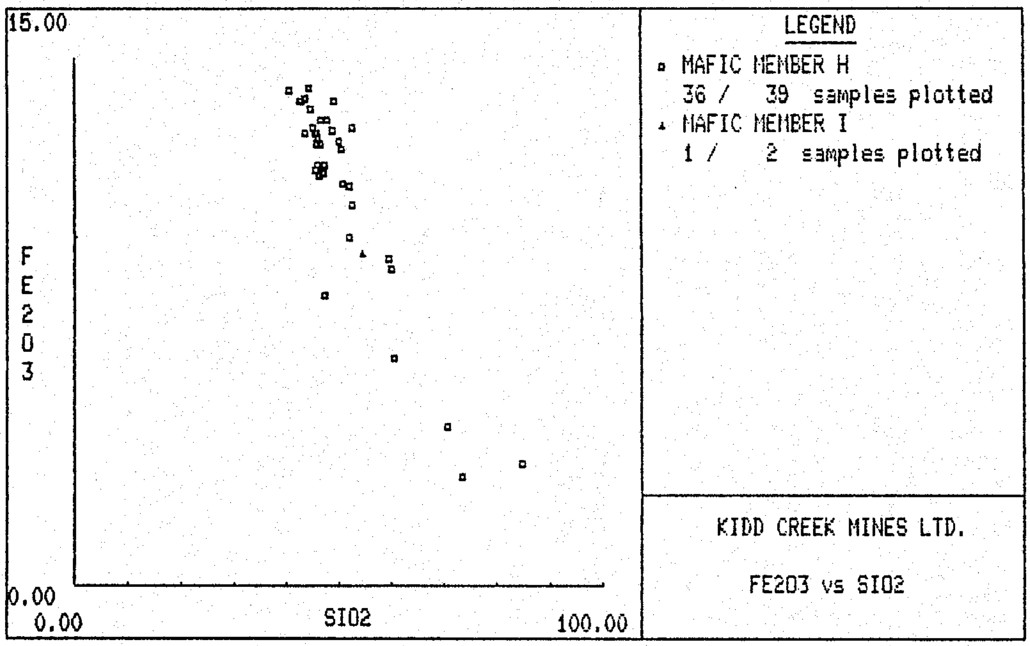

FIGURE 26e : Fe2O3 vs SiO2 variation diagram; Mafic Members "H", and "I"

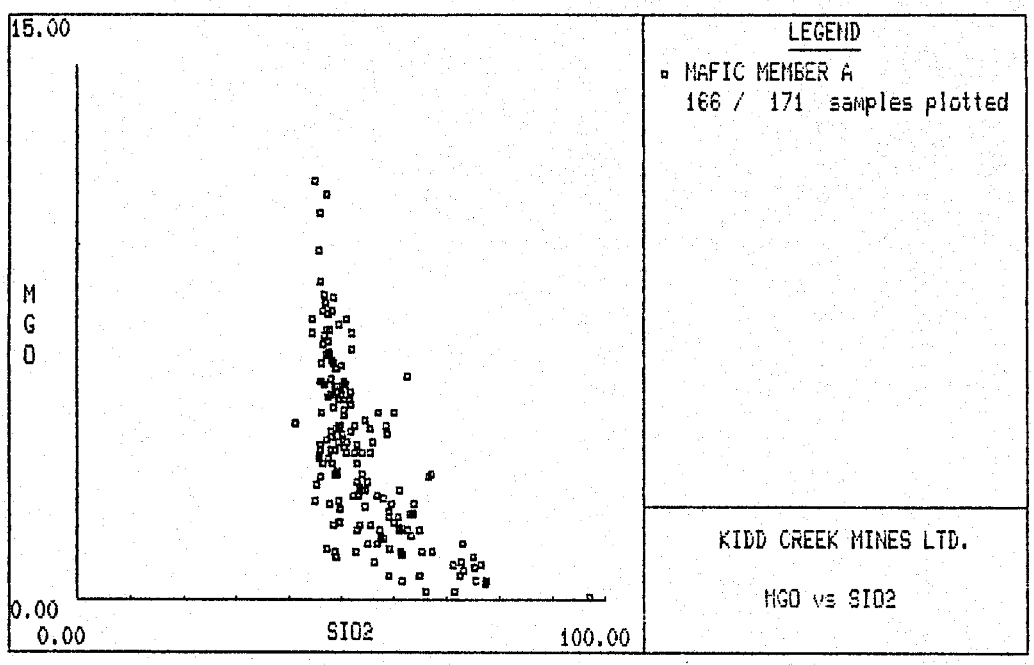

FIGURE 27a : MgO vs SiO2 variation diagram; Mafic Member "A"

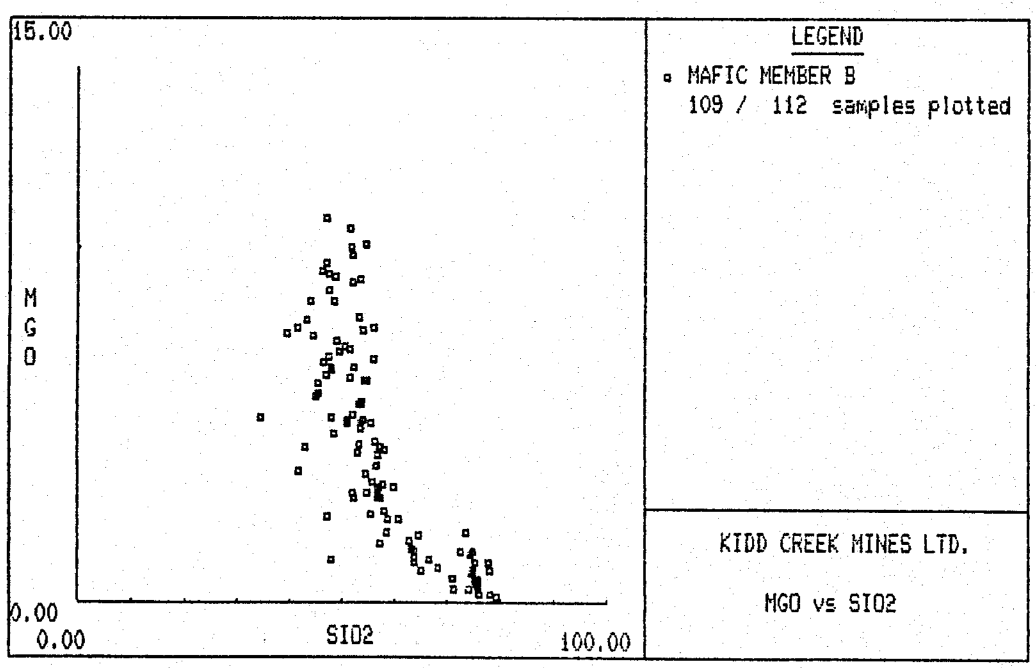

FIGURE 27b : MgO vs SiO2 variation diagram; Mafic Member "B"

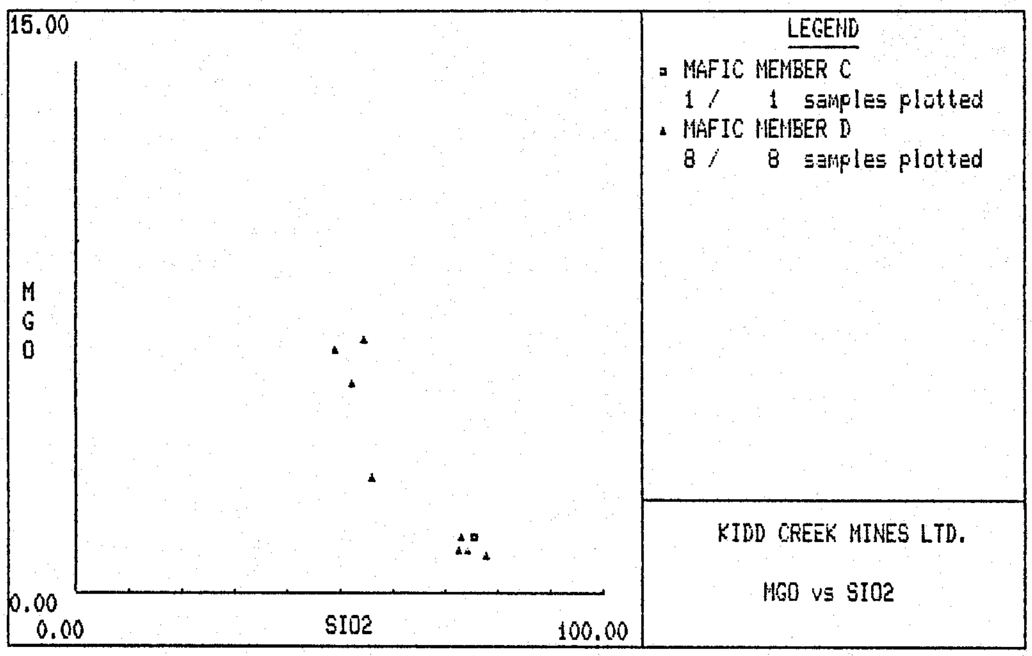

FIGURE 27c : MgO vs SiO2 variation diagram; Mafic Member "C", and "D"

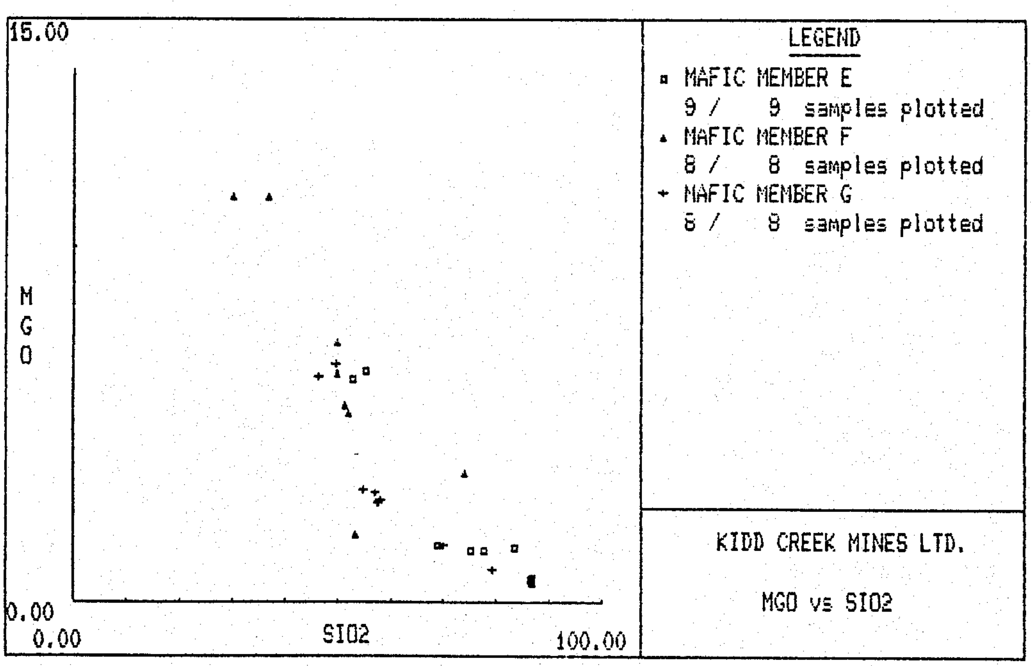

FIGURE 27d : Mgo vs SiO2 variation diagram; Mafic Member "E", "F", and "G"

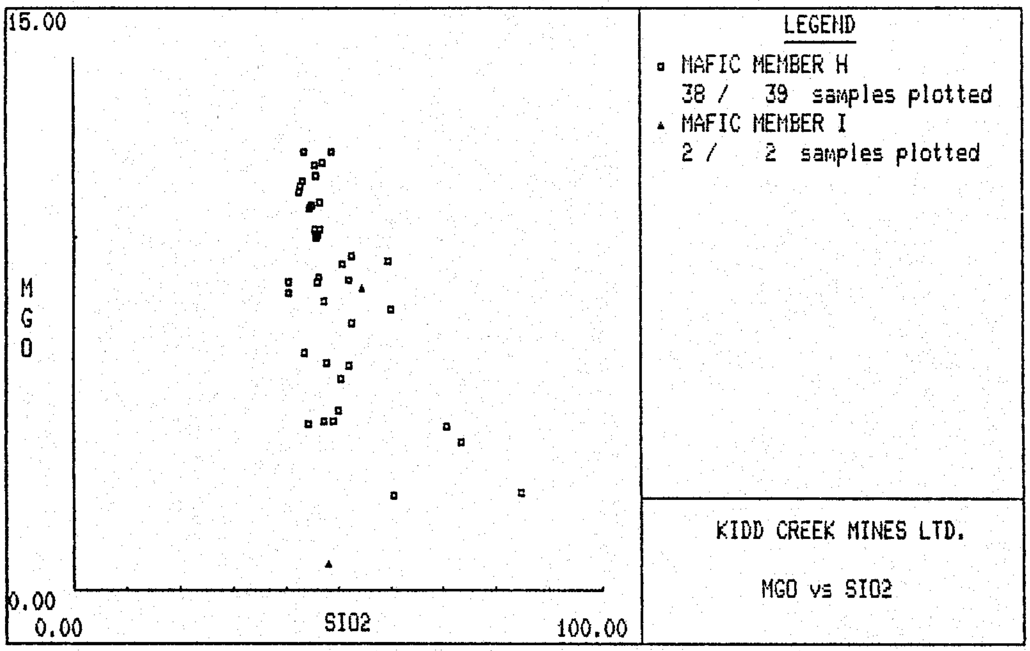

FIGURE 27e : MgO vs SiO2 variation diagram; Mafic Member "H", and "I"

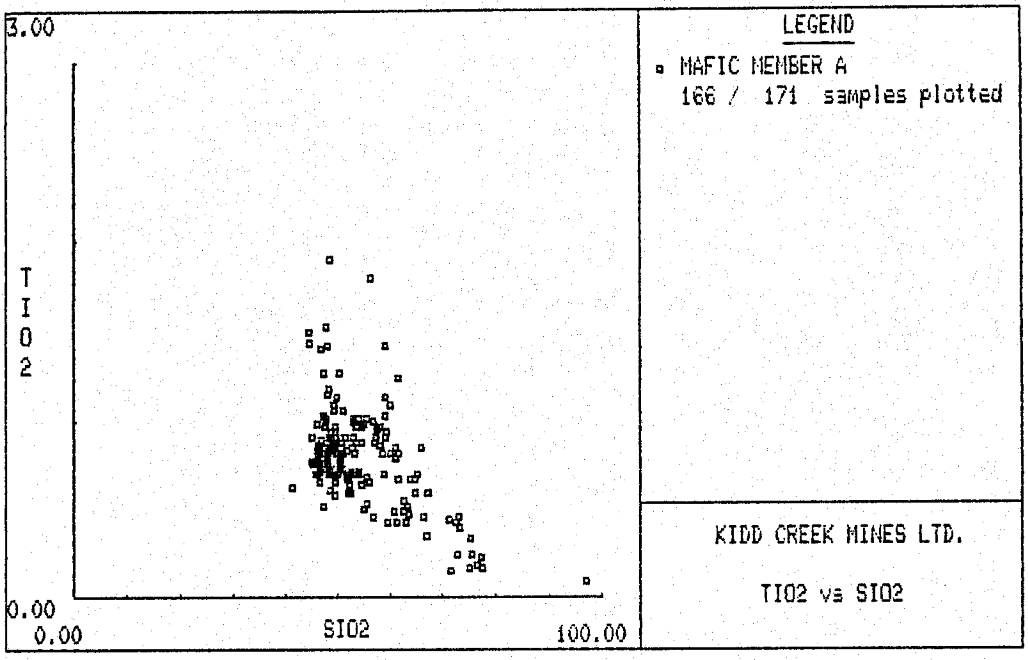

FIGURE 28 a: Ti02 vs Si02 variation diagram; Mafic Member "A"

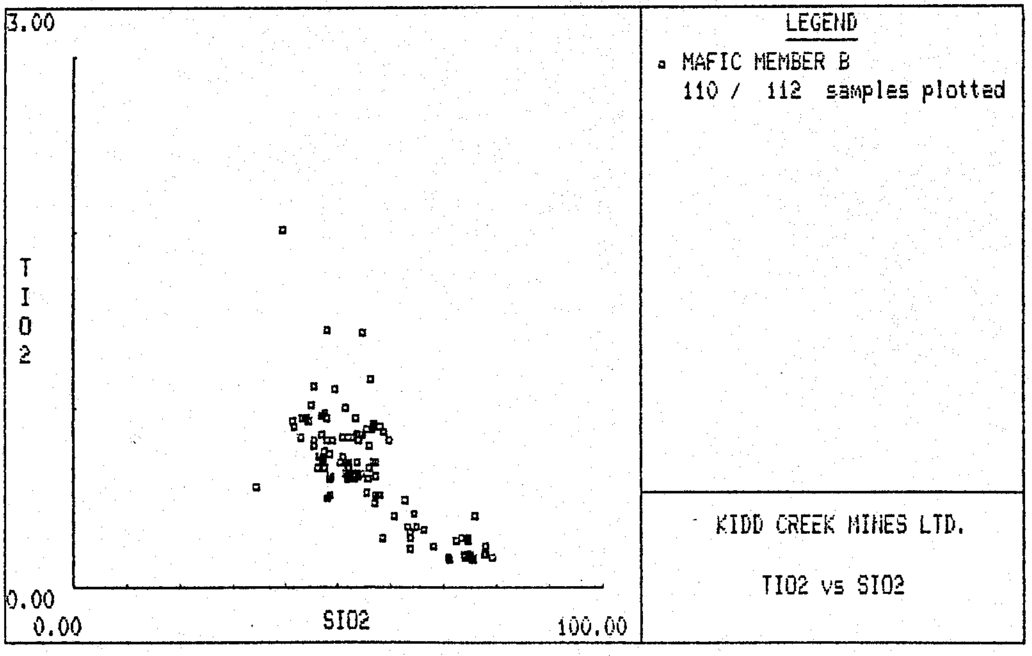

FIGURE 28b: Ti02 vs Si02 variation diagram; Mafic Member "B"

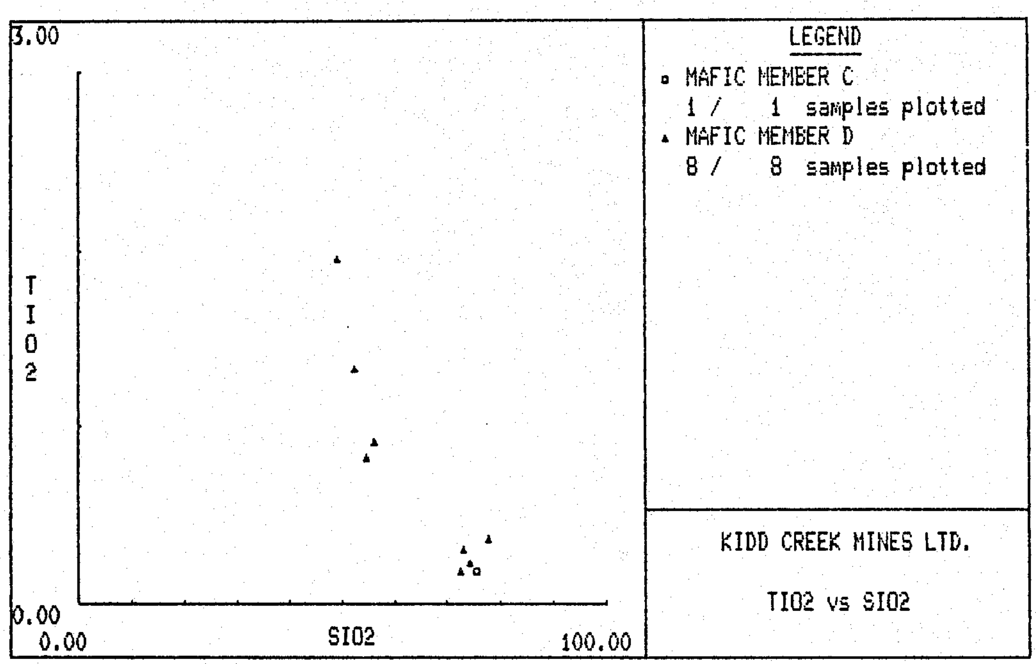

FIGURE 28c : Ti02 vs Si02 variation diagram; Mafic Member "C", and "D"

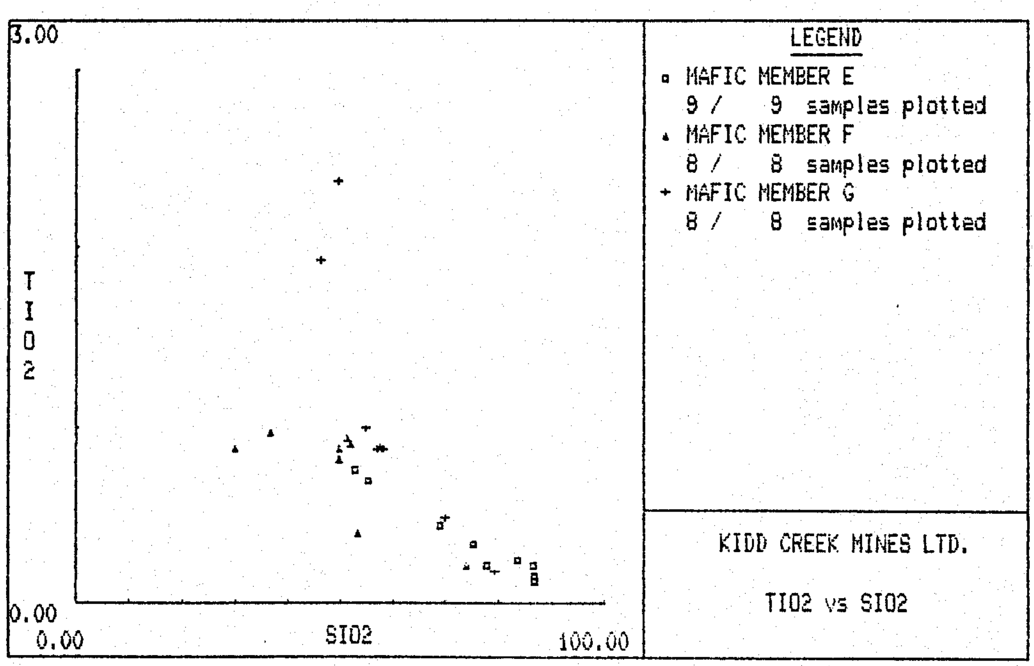

FIGURE 28D : Ti02 vs Si02 variation diagram; Mafic Member "E", "F", and "G"

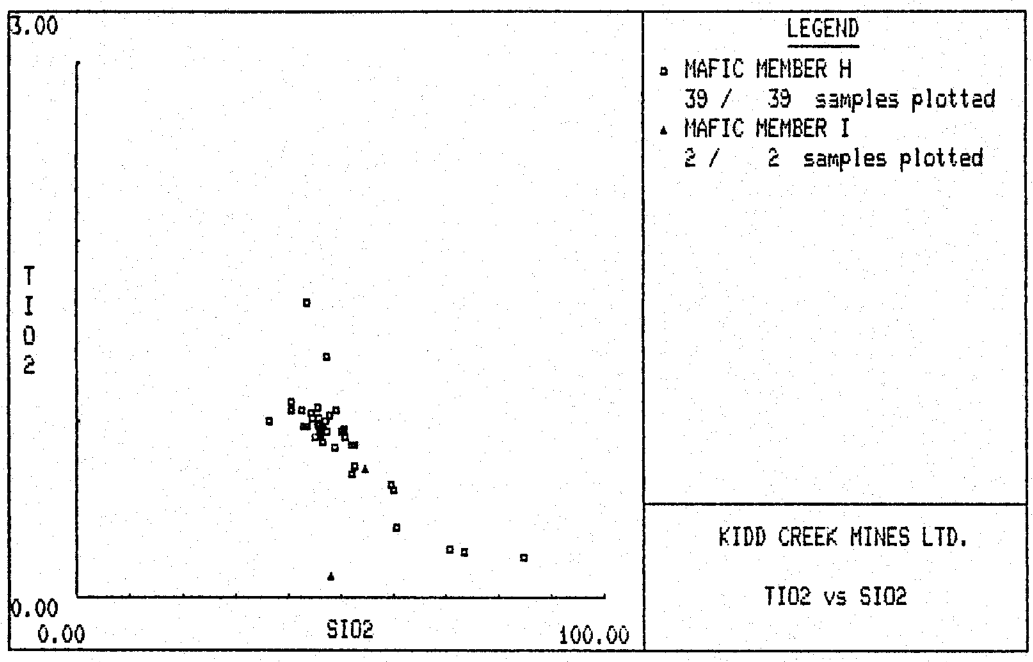

FIGURE 28E : TiO2 vs SiO2 variation diagram; Mafic Members "H", and "I"

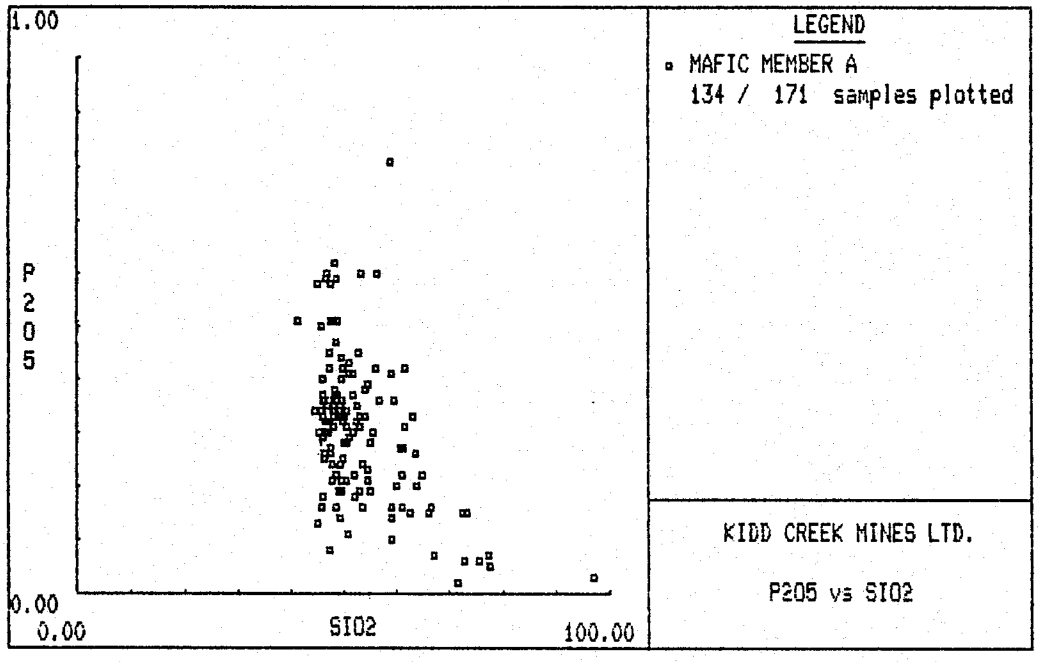

FIGURE 29a : P2O5 vs SiO2 variation diagram; Mafic Member "A"

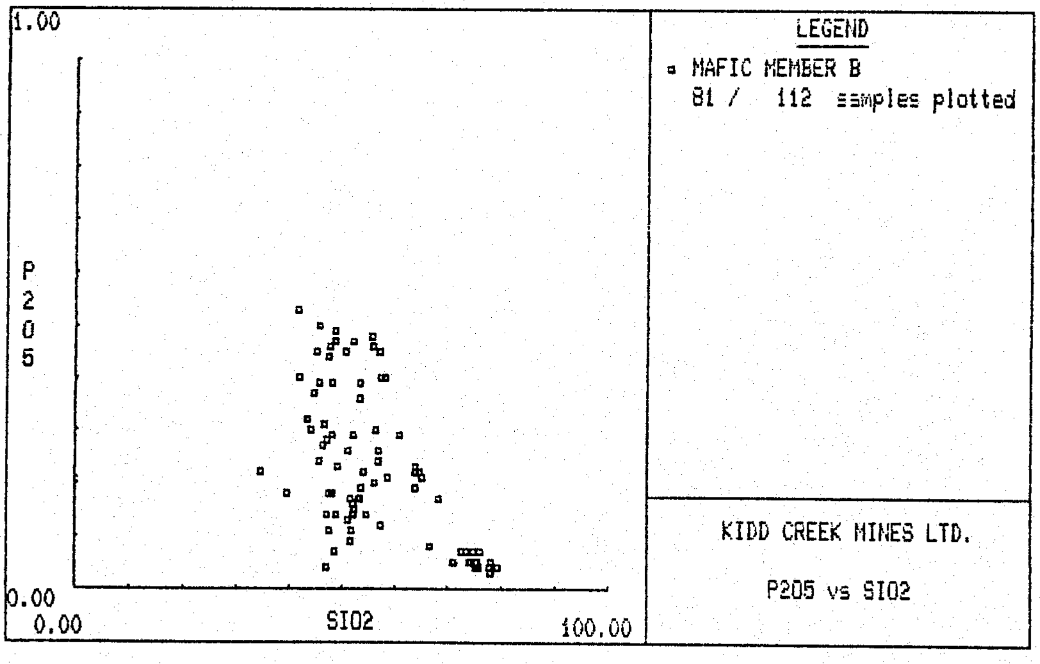

FIGURE 29b : P2O5 vs SiO2 variation diagram; Mafic Member "B"

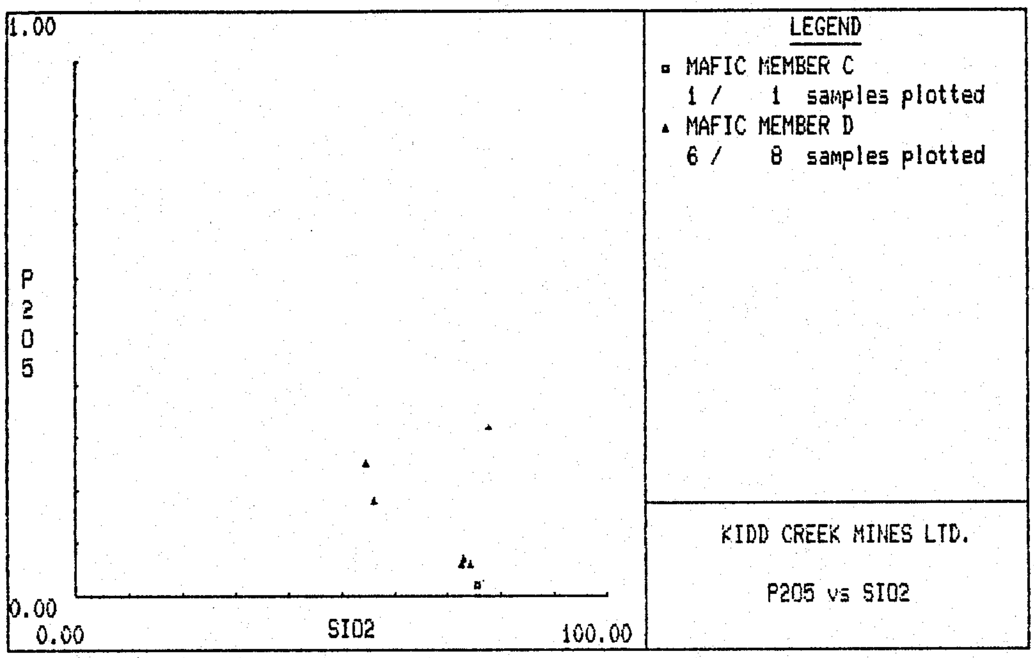

FIGURE 29c : P2O5 vs SiO2 variation diagram; Mafic Members "C", and "D"

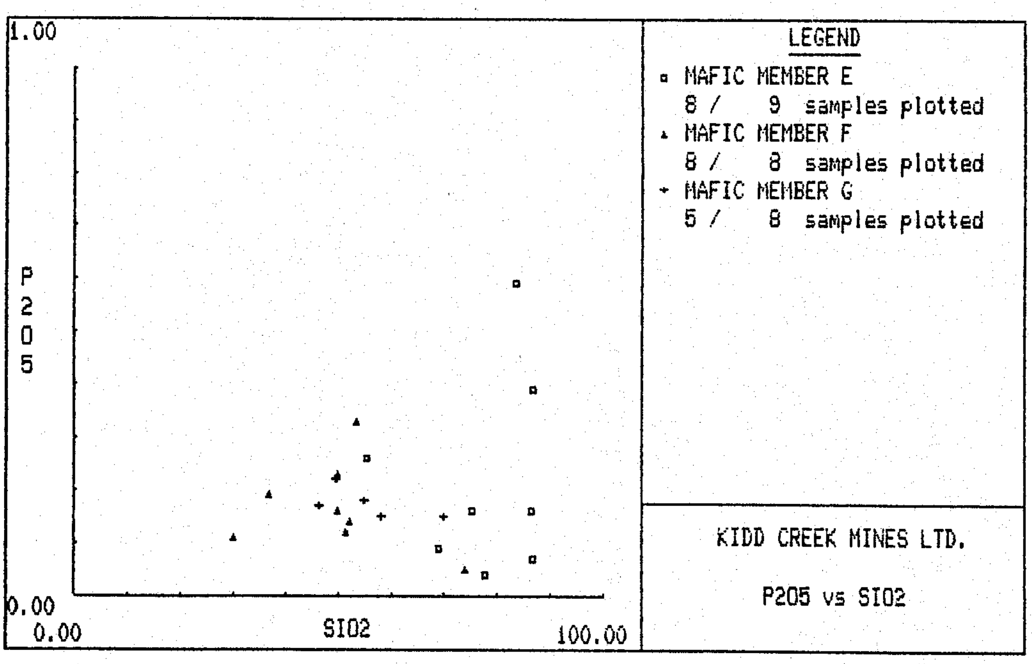

FIGURE 29d : P2O5 vs SiO2 variation diagram; Mafic Members "E", "F", and "G"

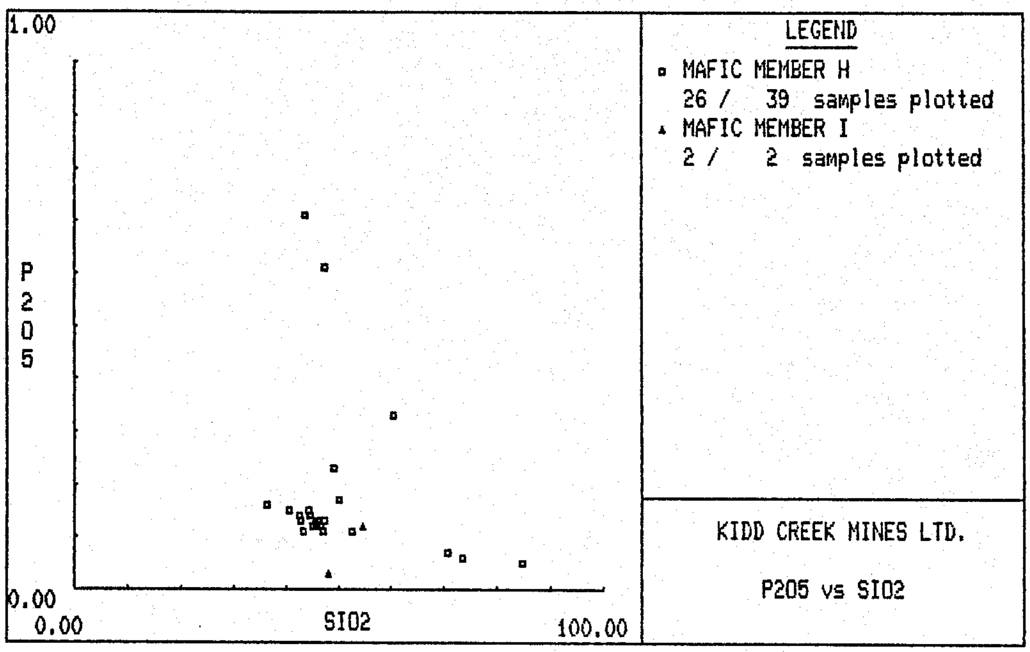

FIGURE 29e : P2O5 vs SiO2 variation diagram; Mafic Members "H", and "I"

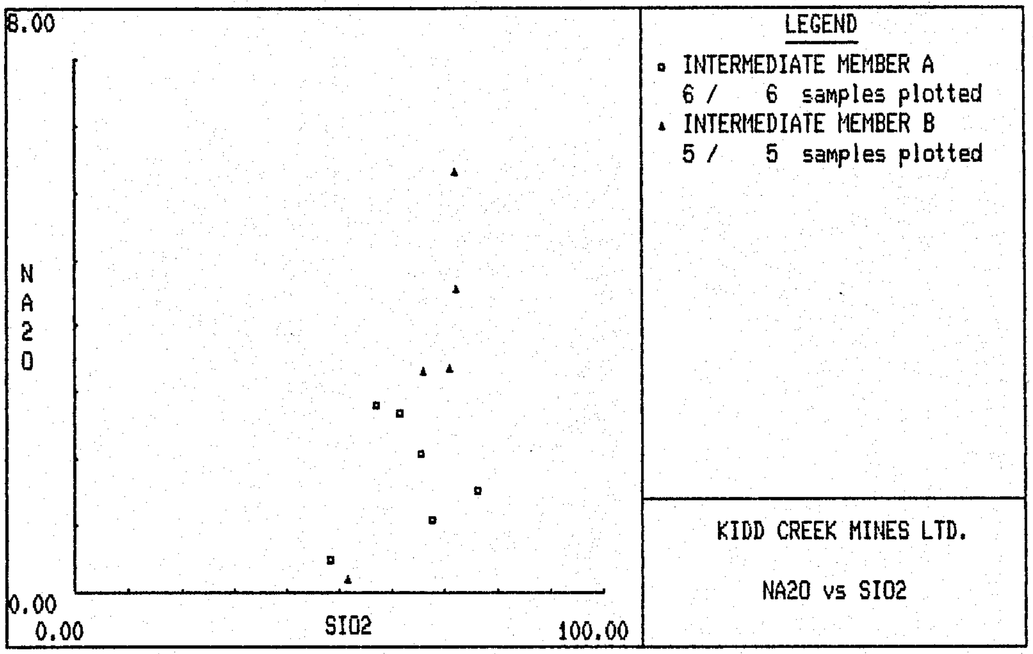

FIGURE 30a : Na2O vs SiO2 variation diagram; Intermediate Members "A", and "B"

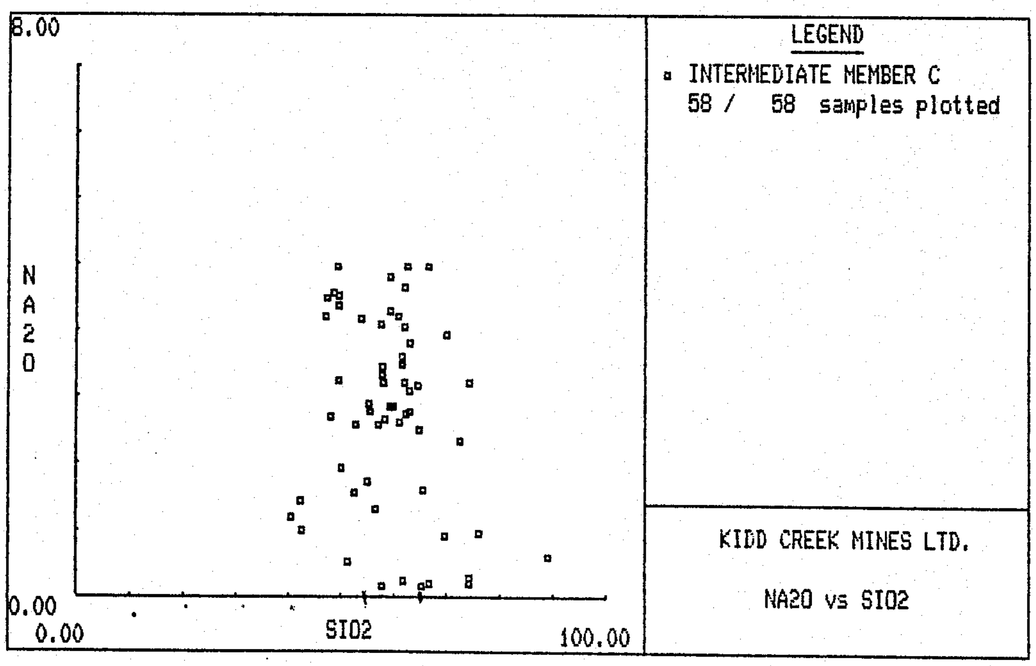

FIGURE 30b : Na2O vs SiO2 variation diagram; Intermediate Member "C"

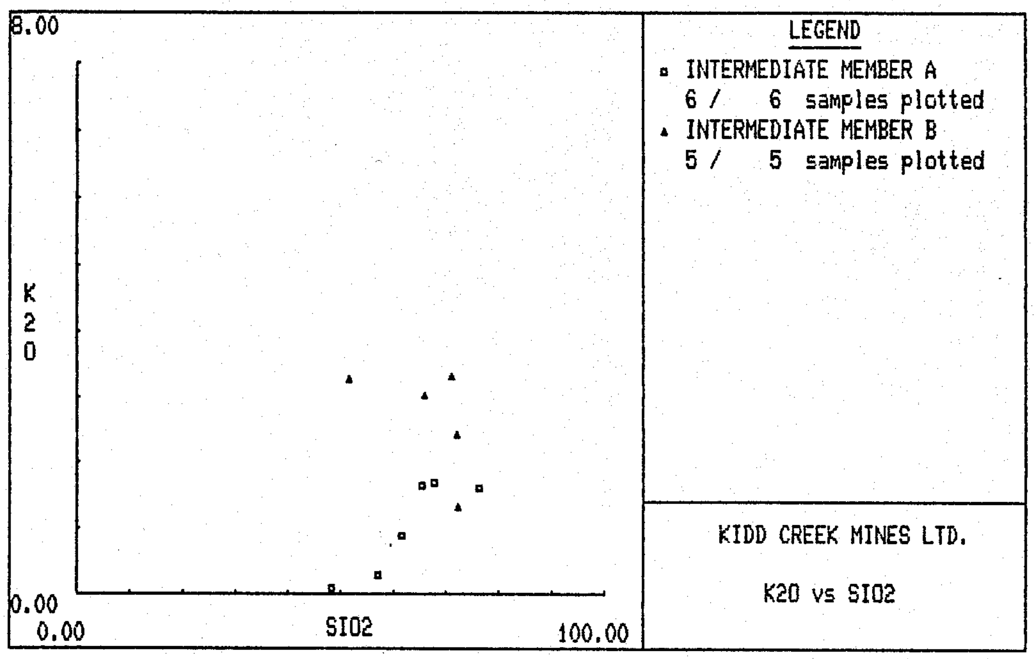

FIGURE 31a : K2O vs SiO2 variation diagram; Intermediate Members "A", and "B"

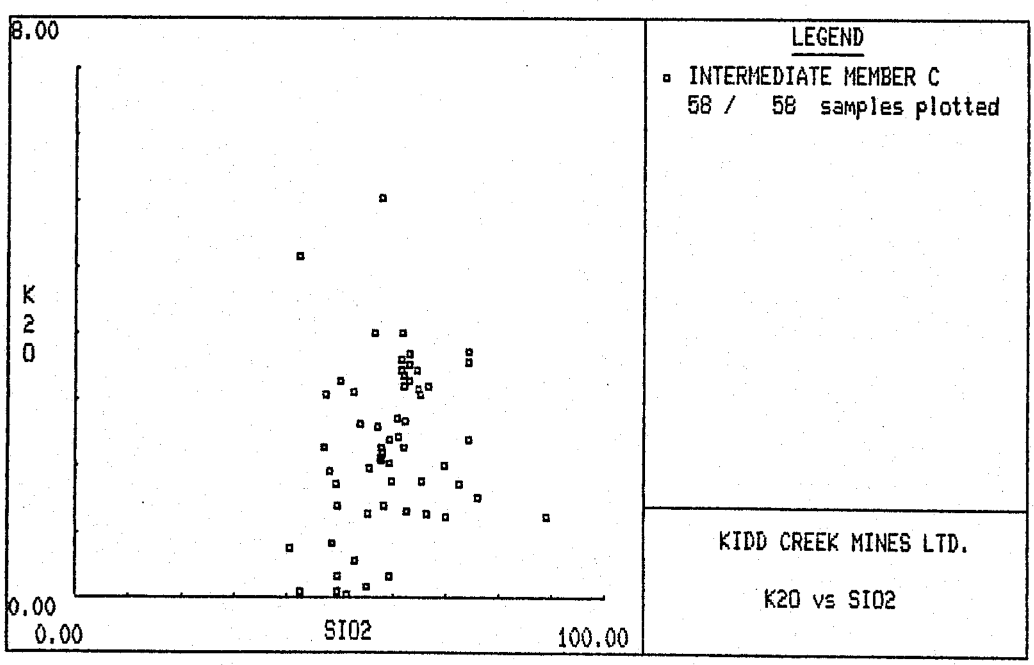

FIGURE 31b : K2O vs SiO2 variation diagram; Intermediate Member "C"

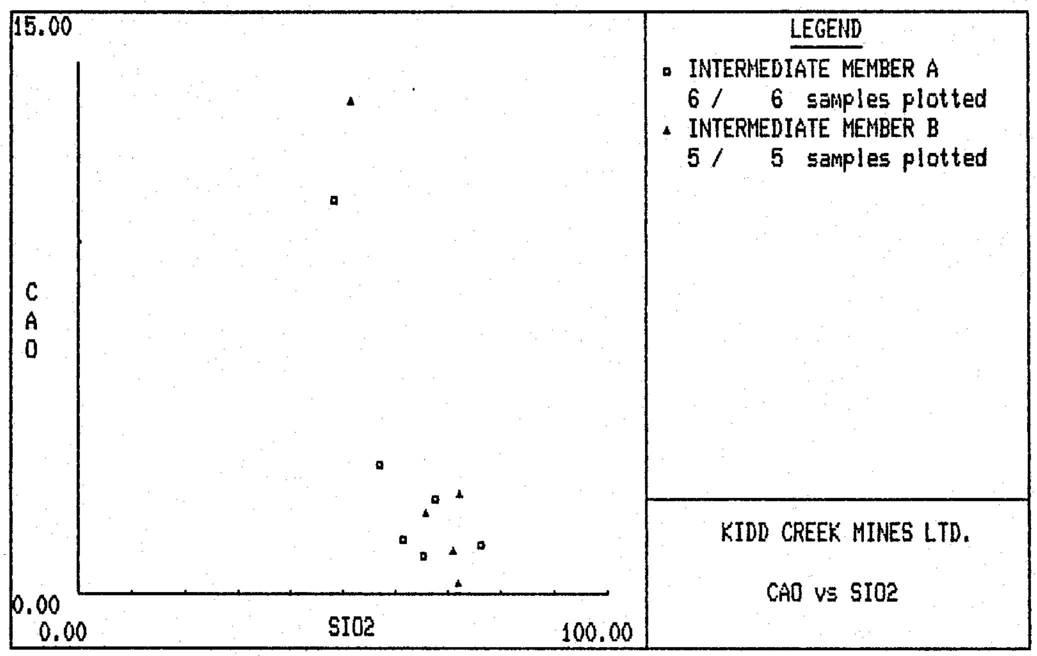

FIGURE 32a : CaO vs SiO2 variation diagram; Intermediate Members "A", and "B"

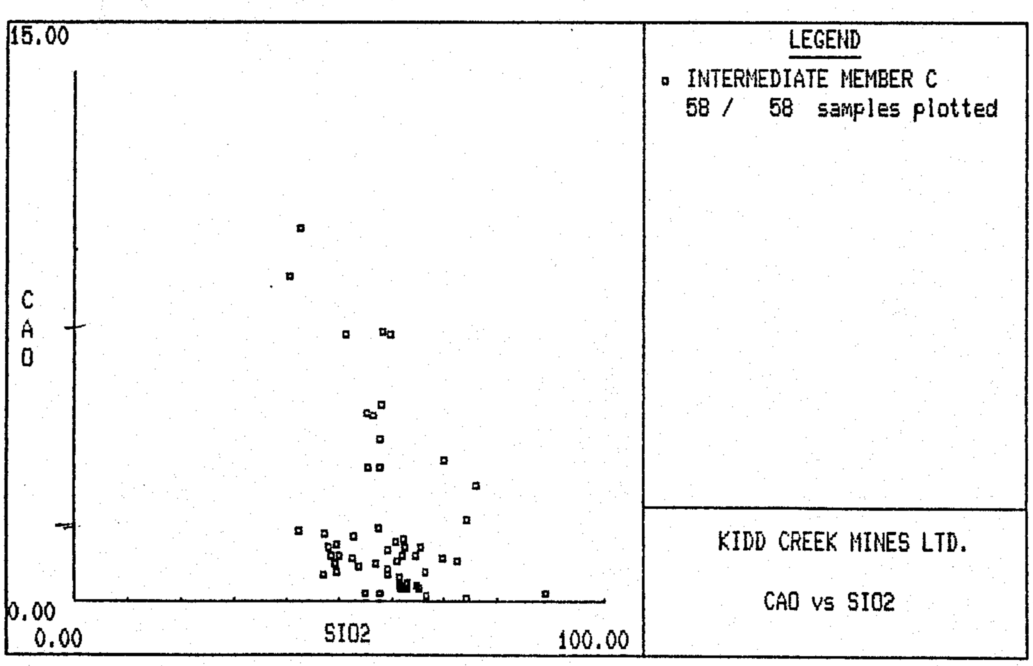

FIGURE 32b : CaO vs SiO2 variation diagram; Intermediate Member "C"

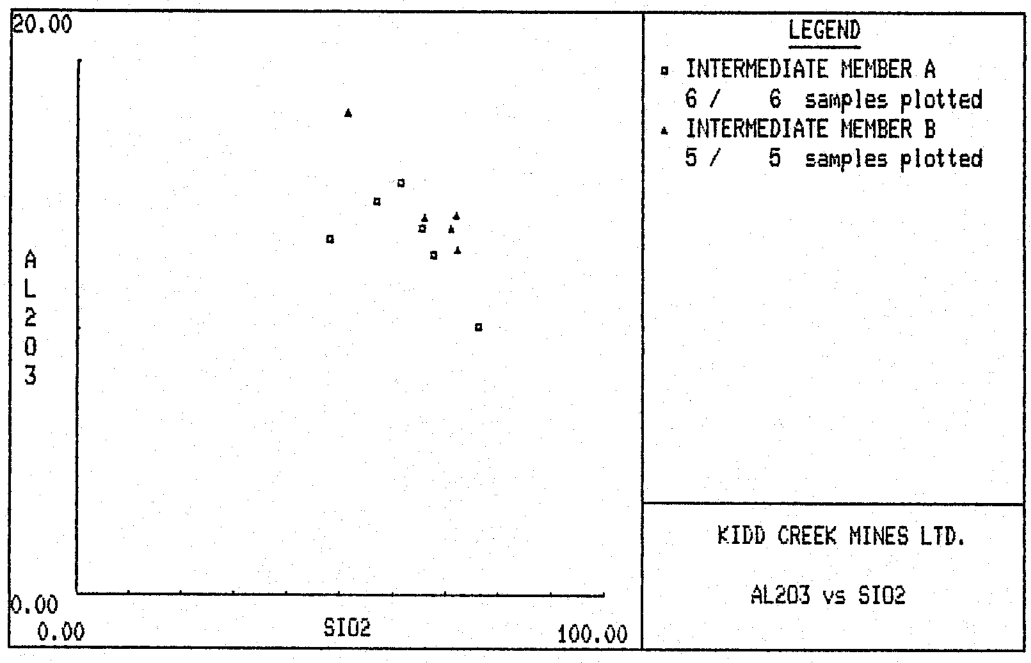

FIGURE 33a : Al2O3 vs SiO2 variation diagram; Intermediate Members "A",aand "B"

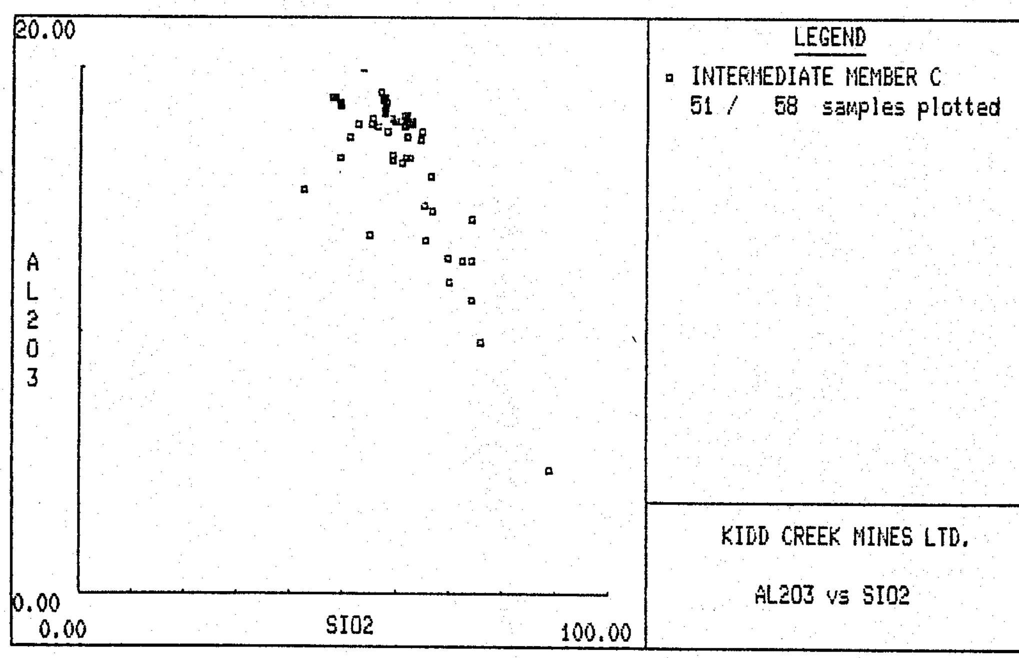

FIGURE 33b : Al2O3 vs SiO2 variation diagram; Intermediate Member "C"

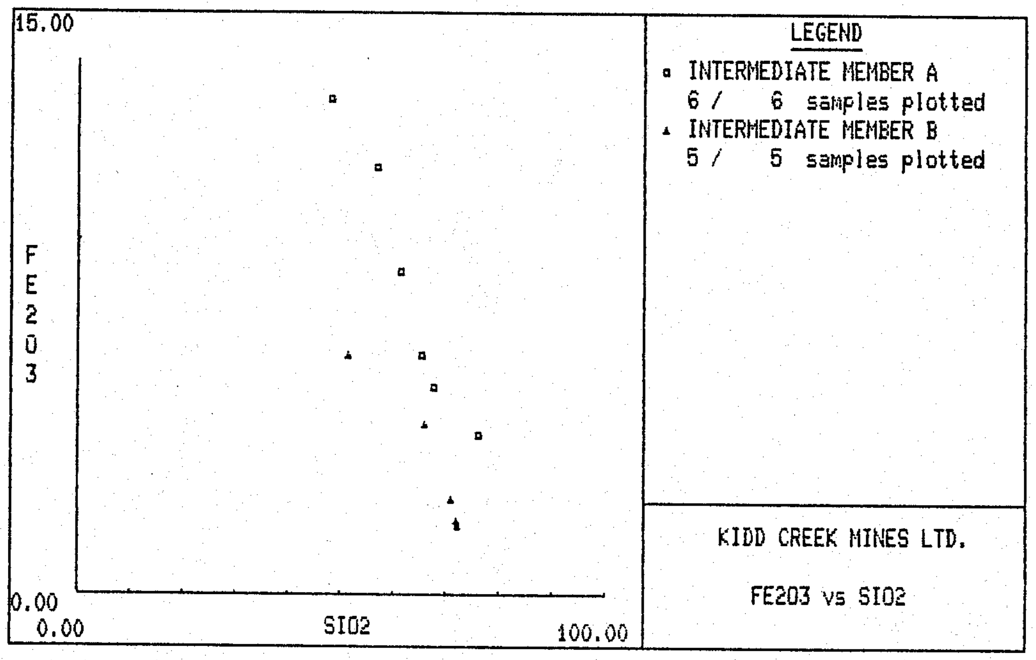

FIGURE 34a : Fe2O3 vs SiO2 variation diagram; Intermediate Members "A", and "B"

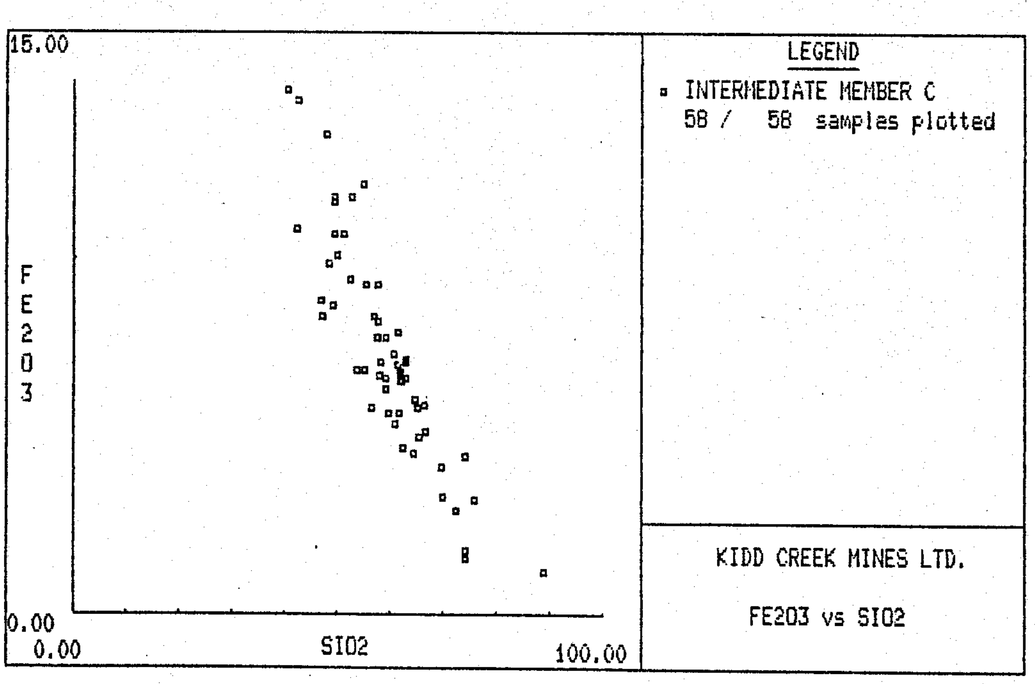

FIGURE 34b : Fe2O3 vs SiO2 variation diagram; Intermediate Member "C"

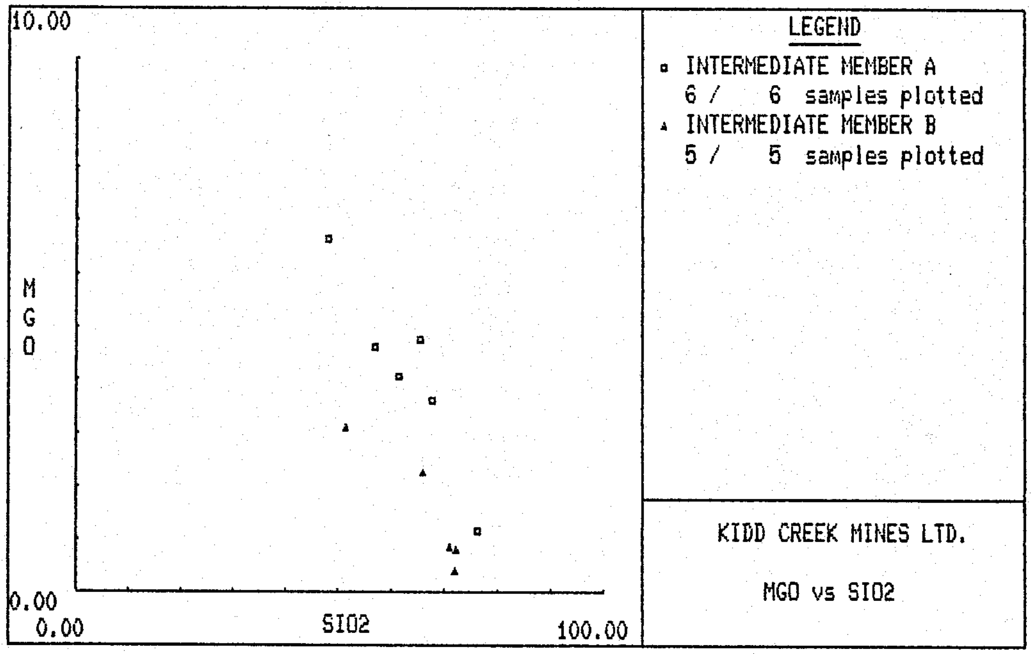

FIGURE 35a : MgO vs SiO2 variation diagram; Intermediate Members "A", and "B"

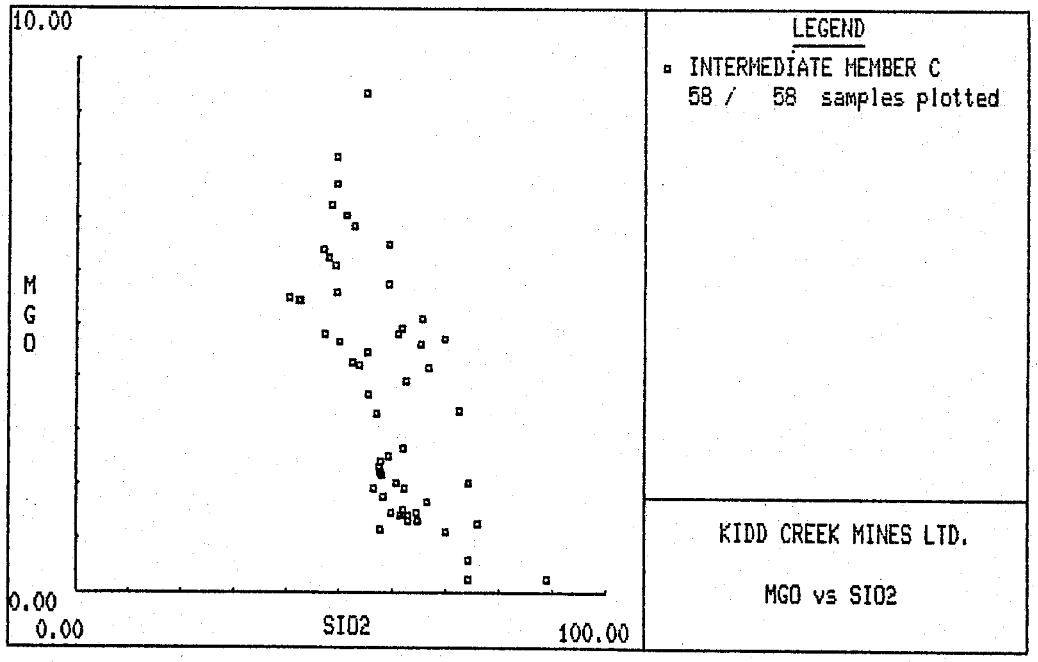

FIGURE 35b : MgO vs SiO2 variation diagram; Intermediate Member "C"

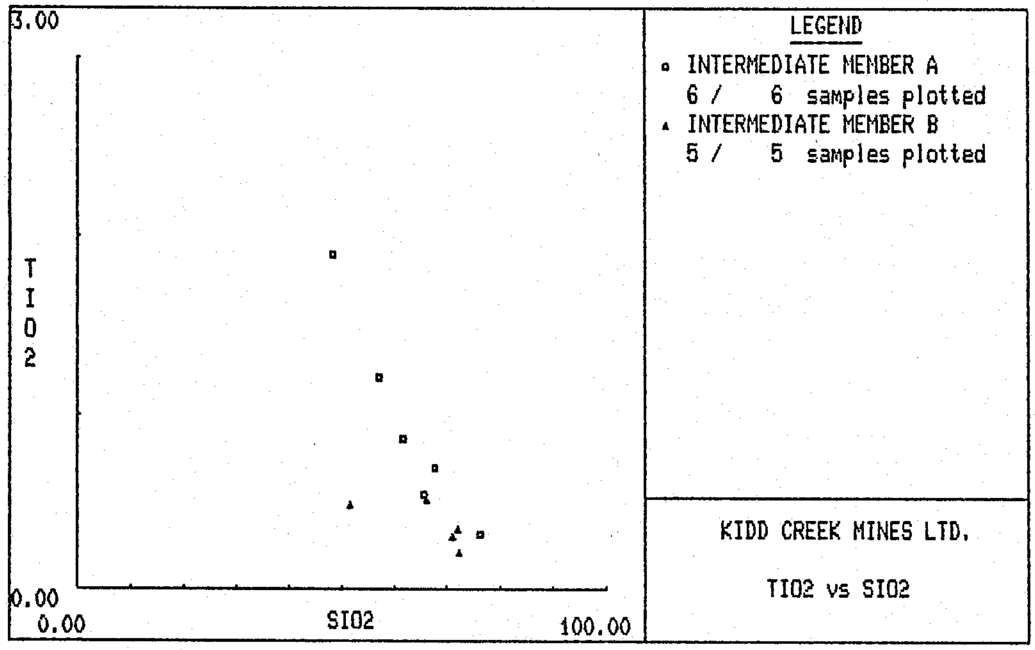

FIGURE 36a : TiO2 vs SiO2 variation diagram; Intermediate Members "A", and "B"

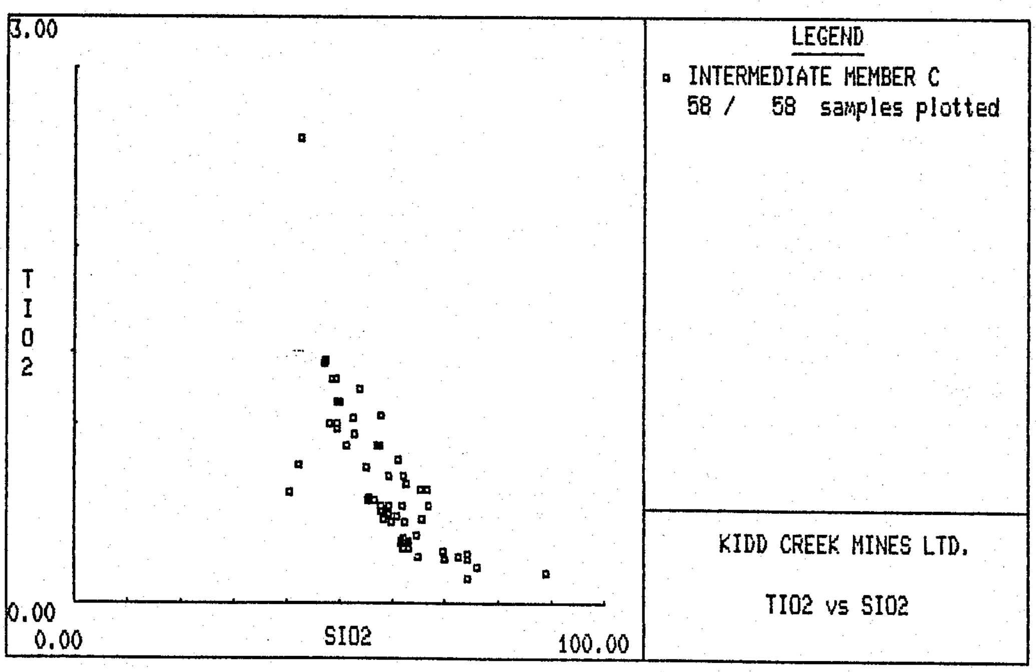

FIGURE 36b : TiO2 vs SiO2 variation diagram; Intermediate Member "C"

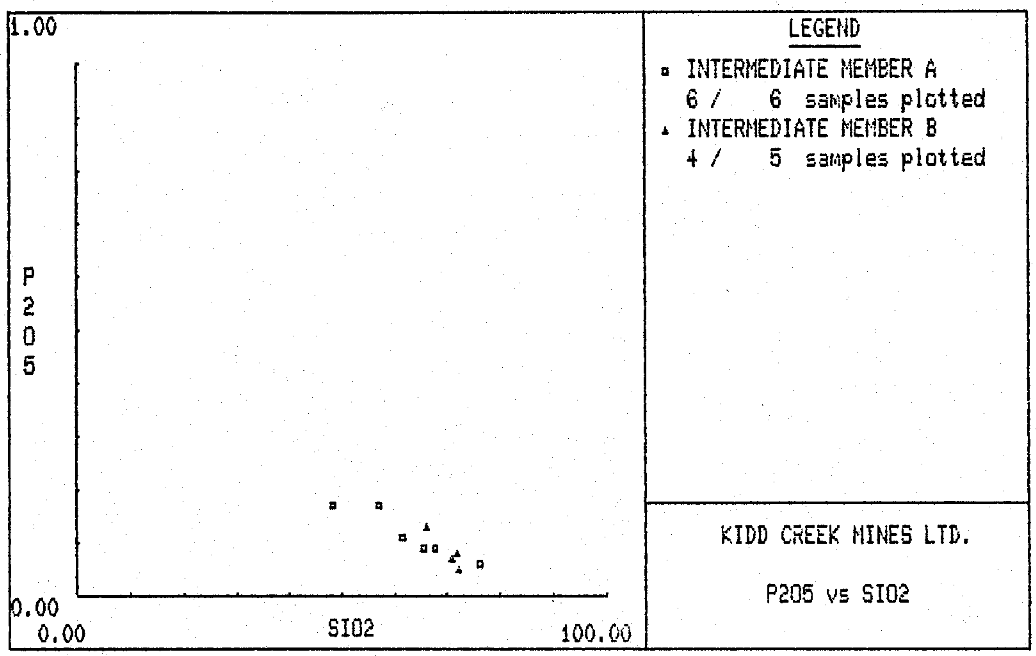

FIGURE 37A : P2O5 vs SiO2 variation diagram; Intermediate Members 'A", and "B"

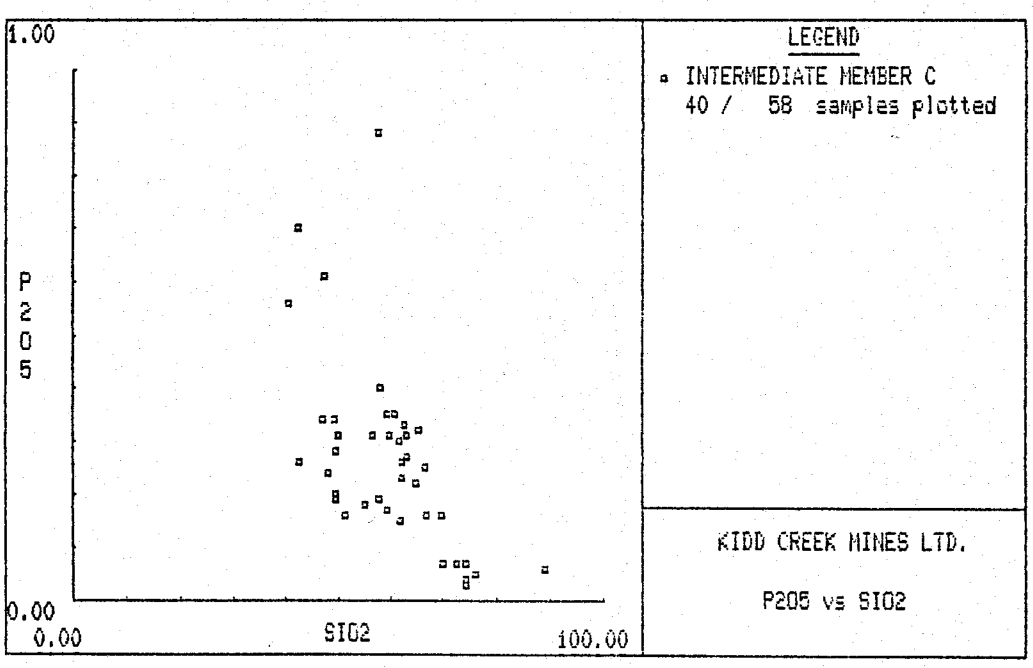

FIGURE 37B : P2O5 vs SiO2 variation diagram; Intermediate Member "C"

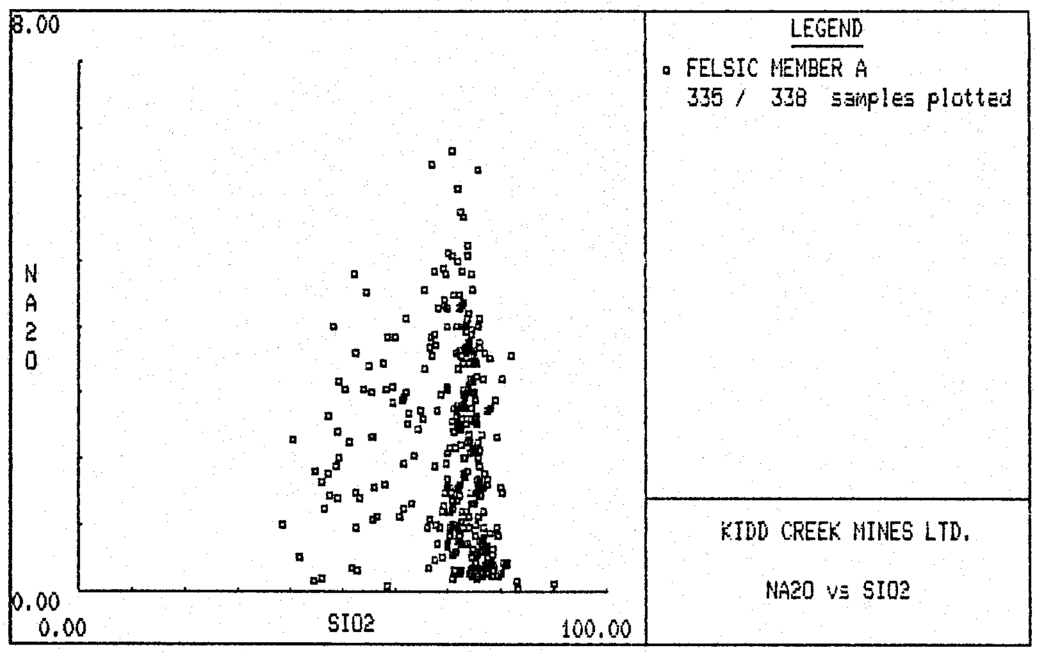

FIGURE 38a : Na20 vs Si02 variation diagram; Felsic Member "A"

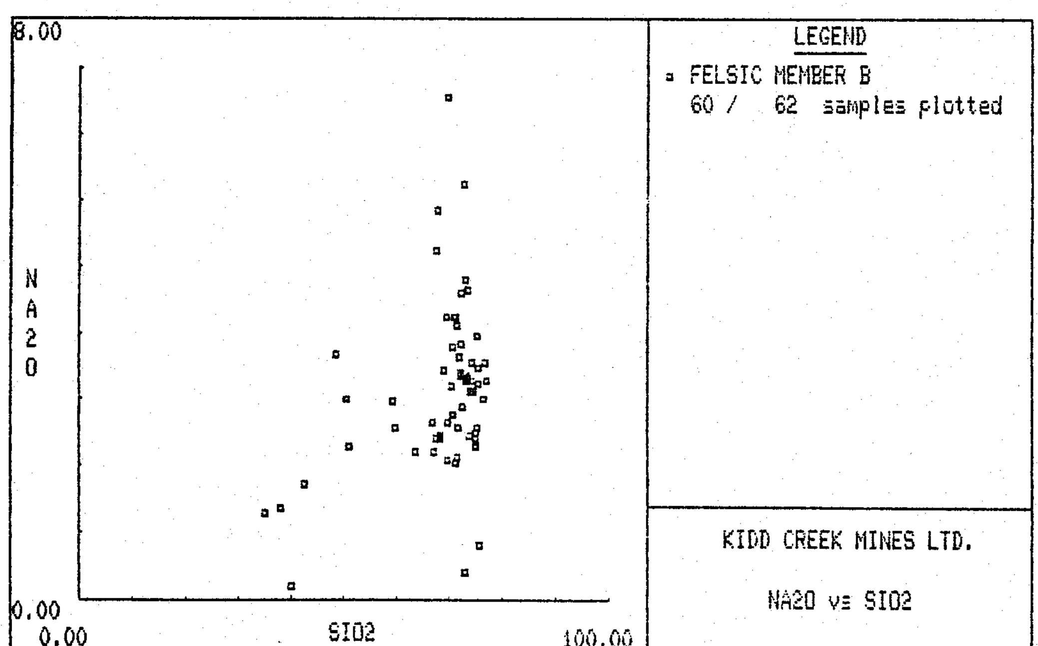

FIGURE 38b : Na20 vs Si02 variation diagram, Felsic Member "B"

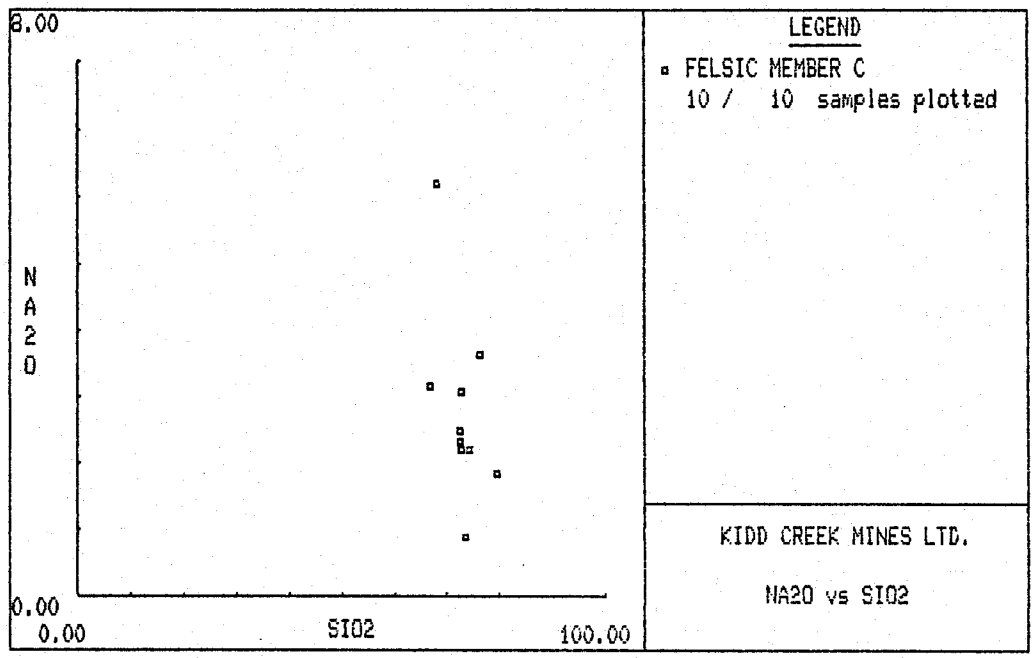

FIGURE 38c : Na20 vs Si02 variation diagram; Felsic Member "C"

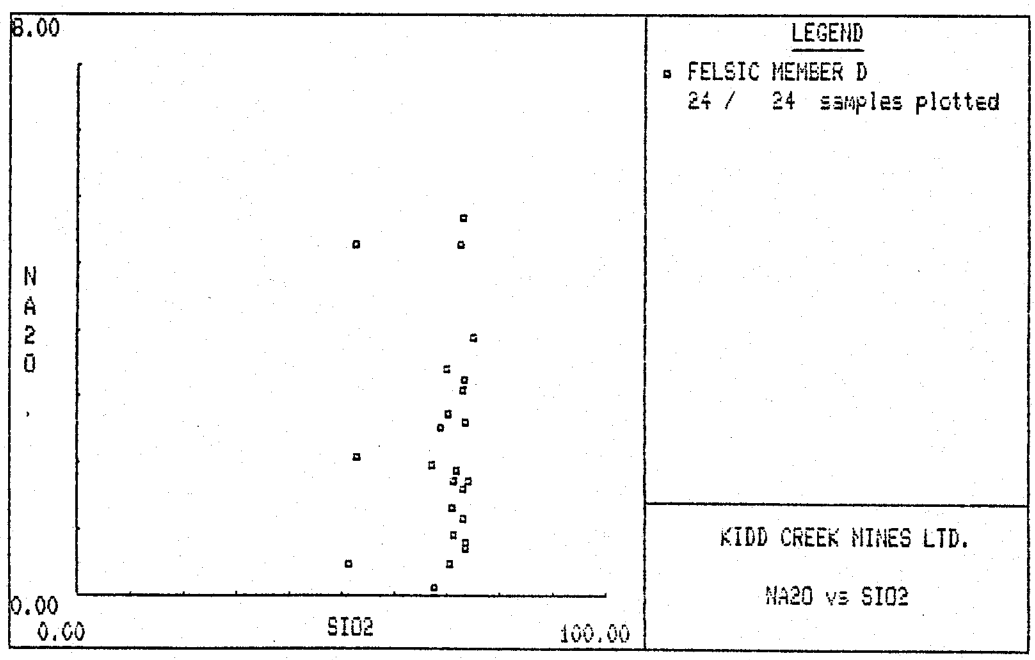

FIGURE 38d : Na20 vs Si02 variation diagram; Felsic Member "D"

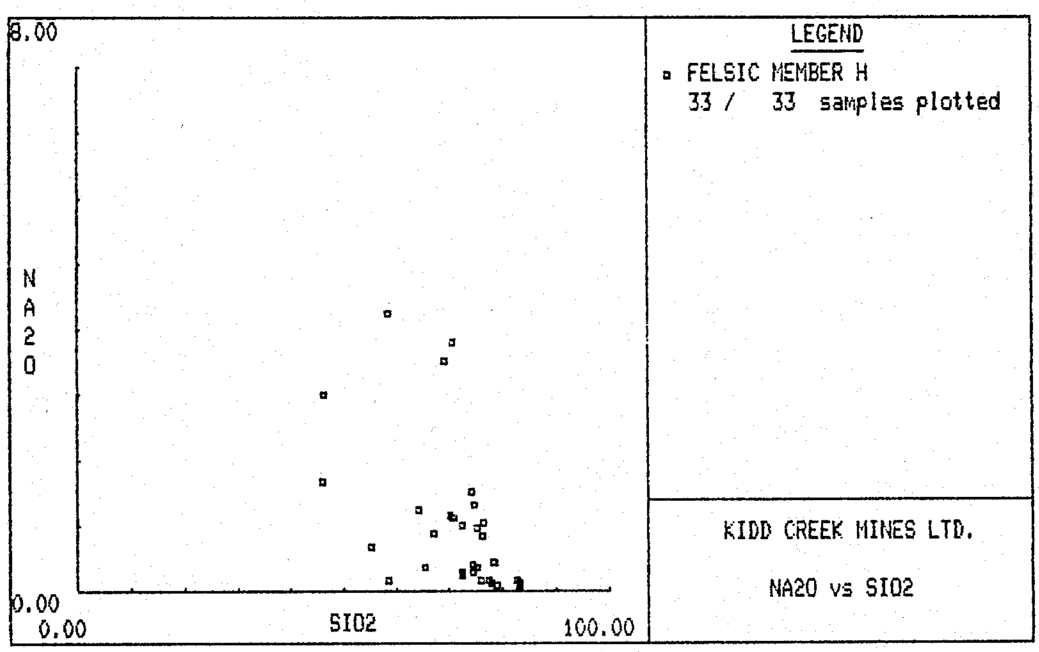

FIGURE 38g : Na2O vs SiO2 variation diagram; Felsic Member "H"

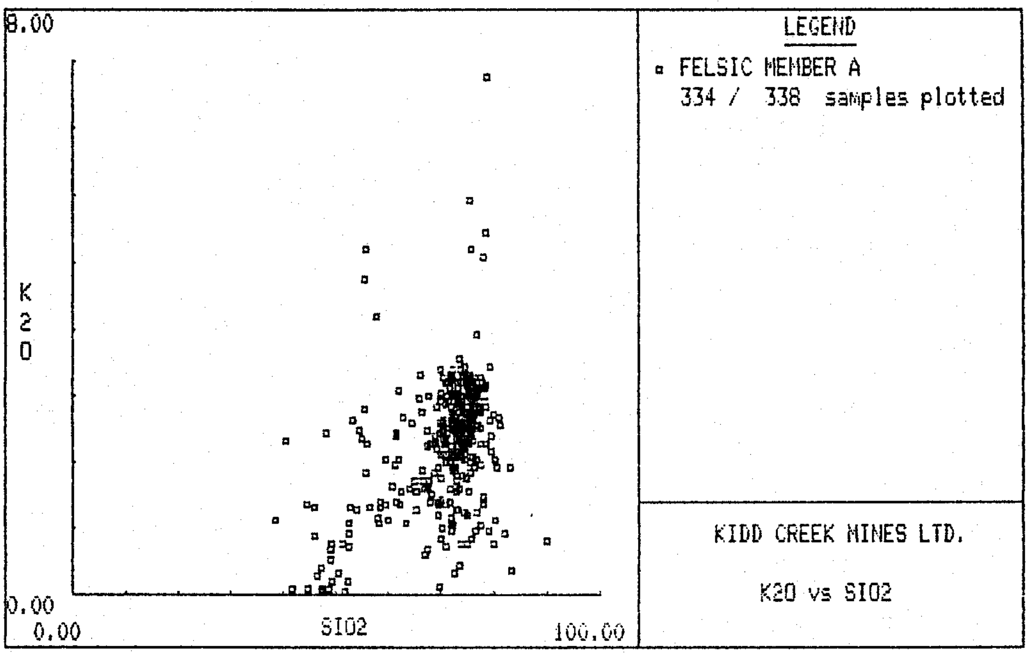

FIGURE 39a : K20 vs Si02 variation diagram; Felsic Member "A"

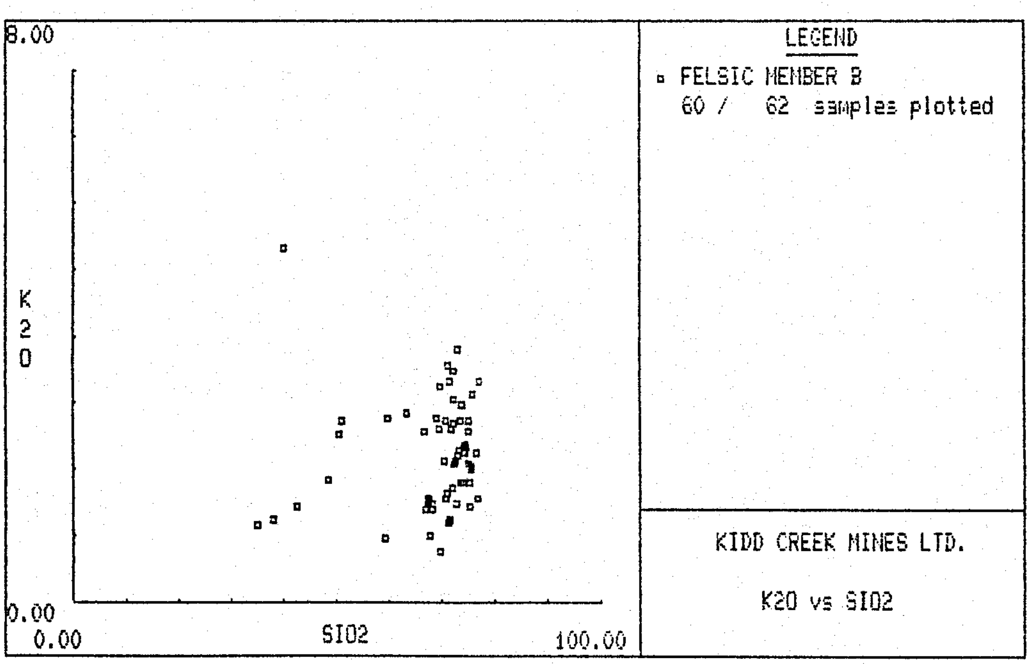

FIGURE 39b : K20 vs Si02 variation diagram; Felsic Member "B"

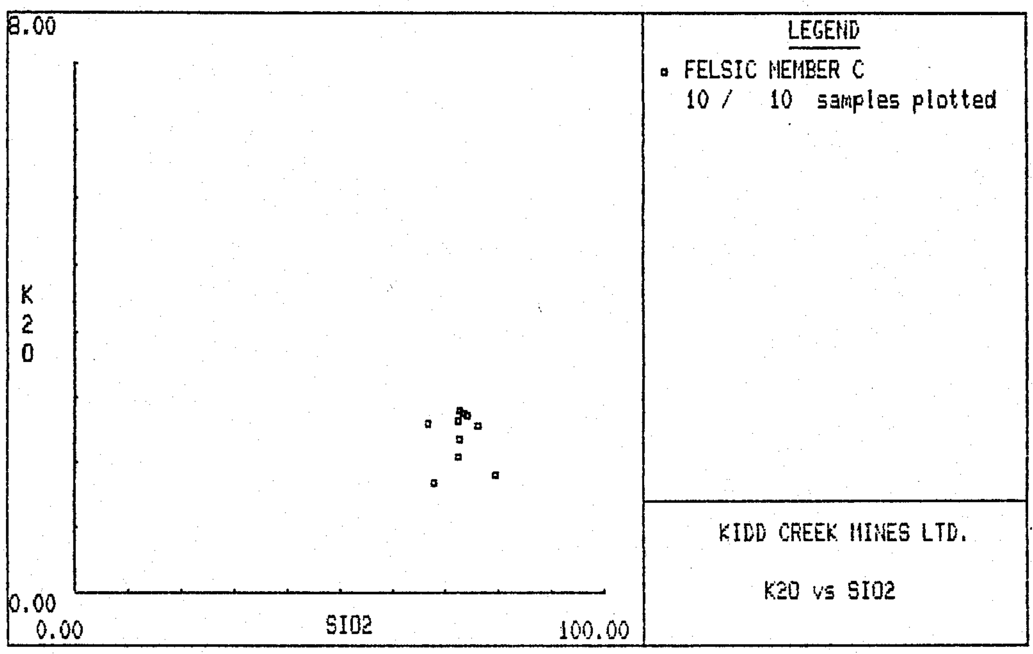

FIGURE 39c : K2O vs SiO2 variation diagram; Felsic Member "C"

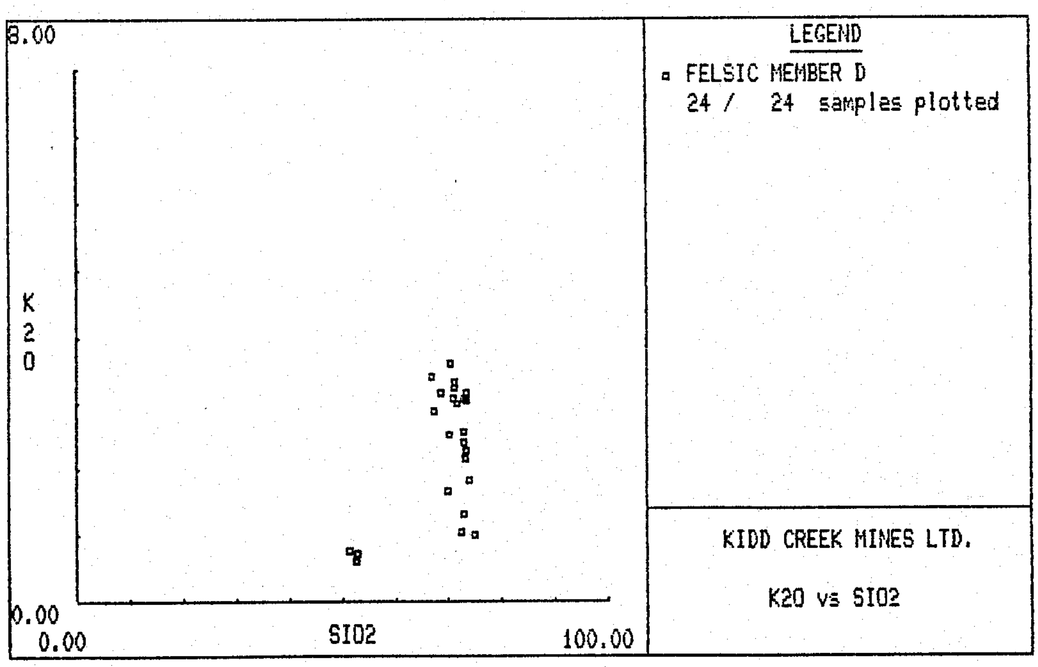

FIGURE 39d : K2O vs SiO2 variation diagram; Felsic Member "D"

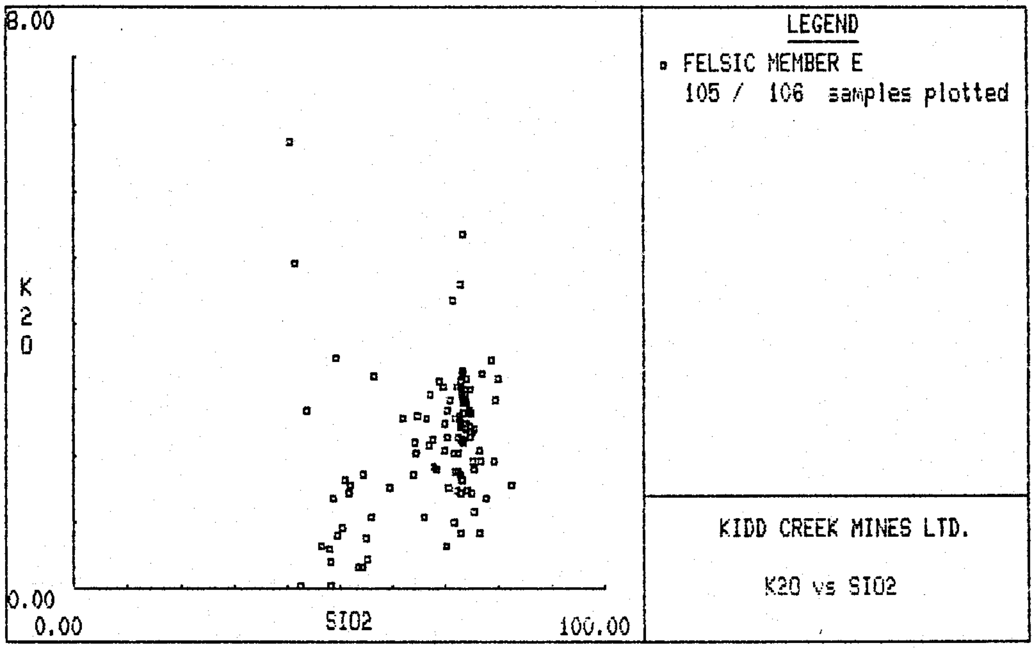

FIGURE 39e : K2O vs SiO2 variation diagram;Felsic Member "E"

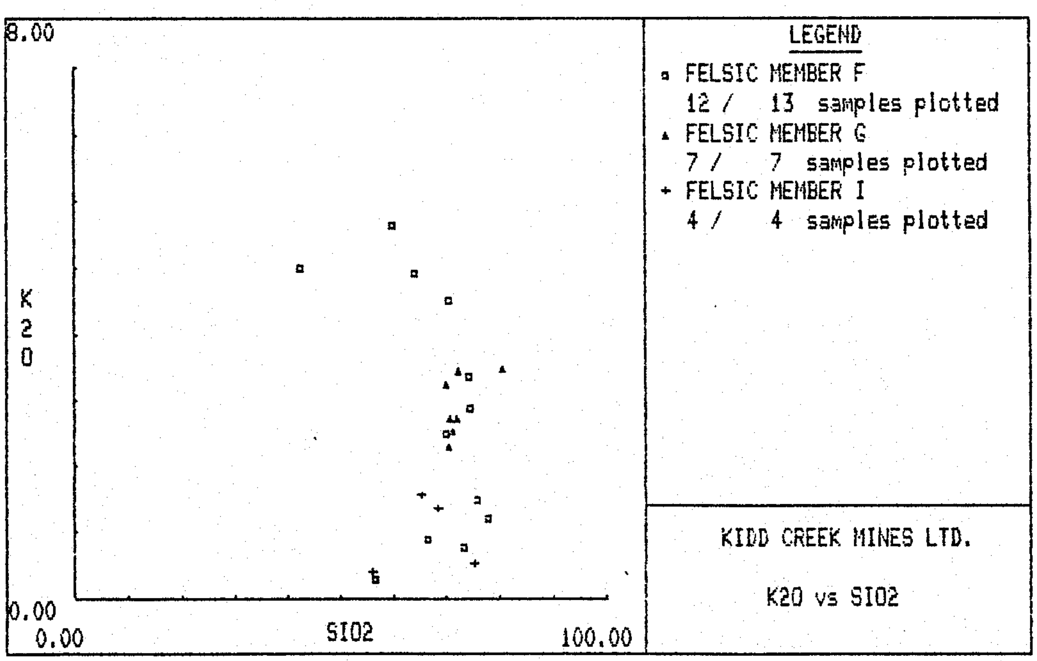

FIGURE 39f : K2O vs SiO2 variation diagram; Felsic Members "F", "G", and "I"

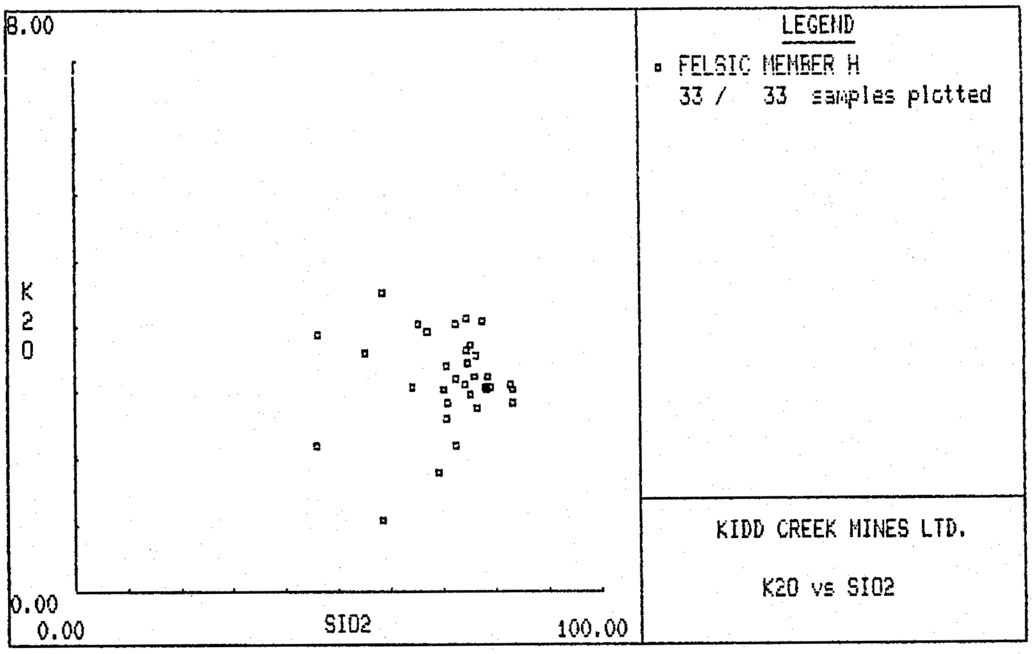

FIGURE 39g: K2O vs SiO2 variation diagram; Felsic Member "H"

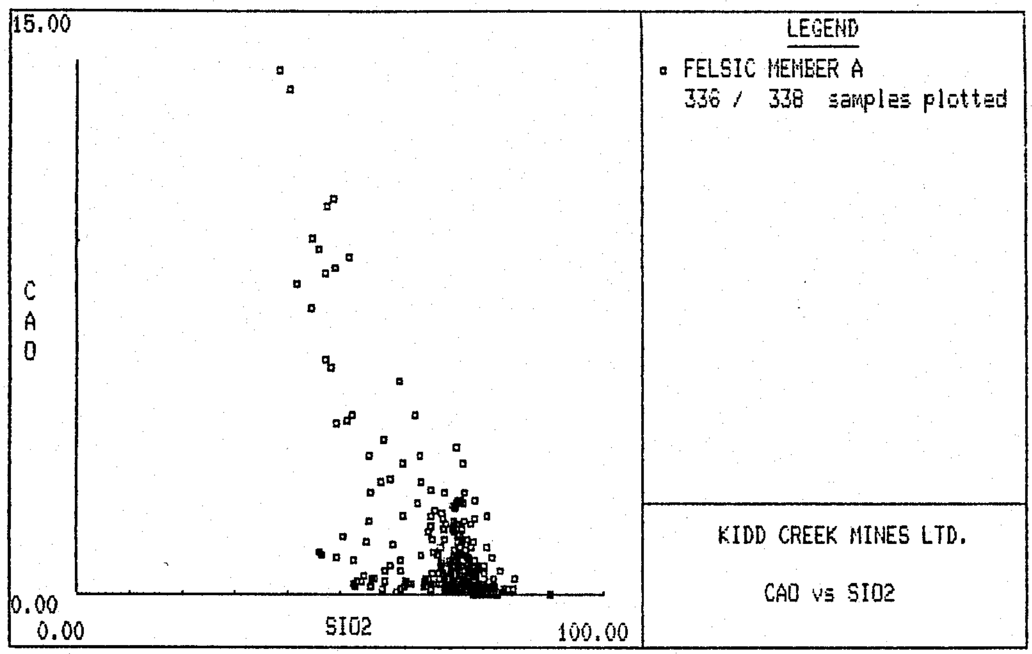

FIGURE 40a : CaO vs SiO2 variation diagram; Felsic Member "A"

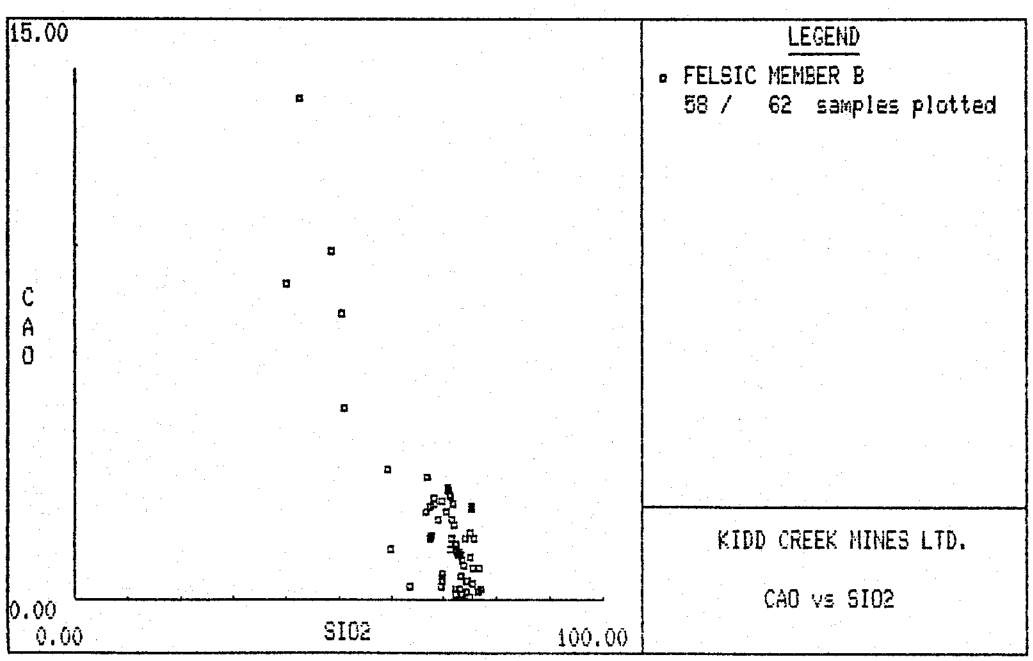

FIGURE 40b : CaO vs SiO2 variation diagram; Felsic Member "B"

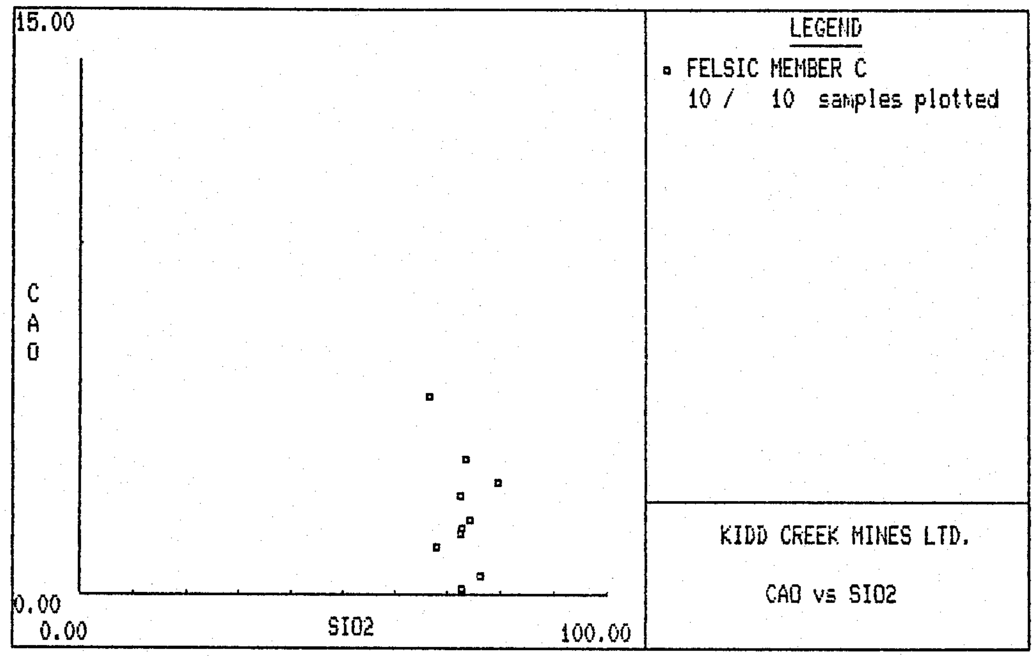

FIGURE 40c : CaO vs SiO2 variation diagram; Felsic Member "C"

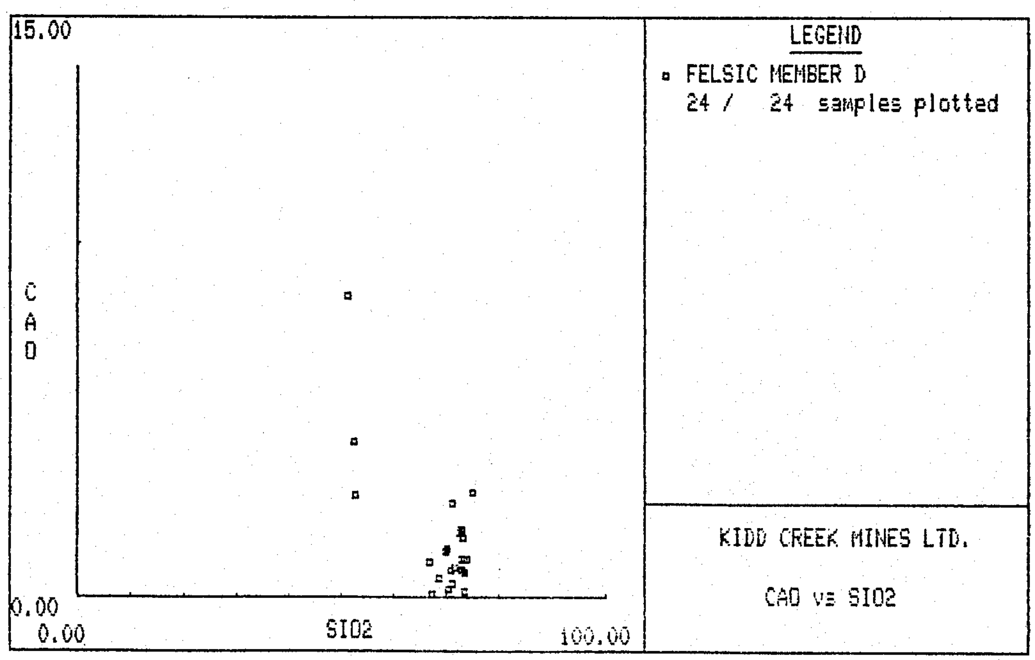

FIGURE 40d : CaO vs SiO2 variation diagram; Felsic Member "D"

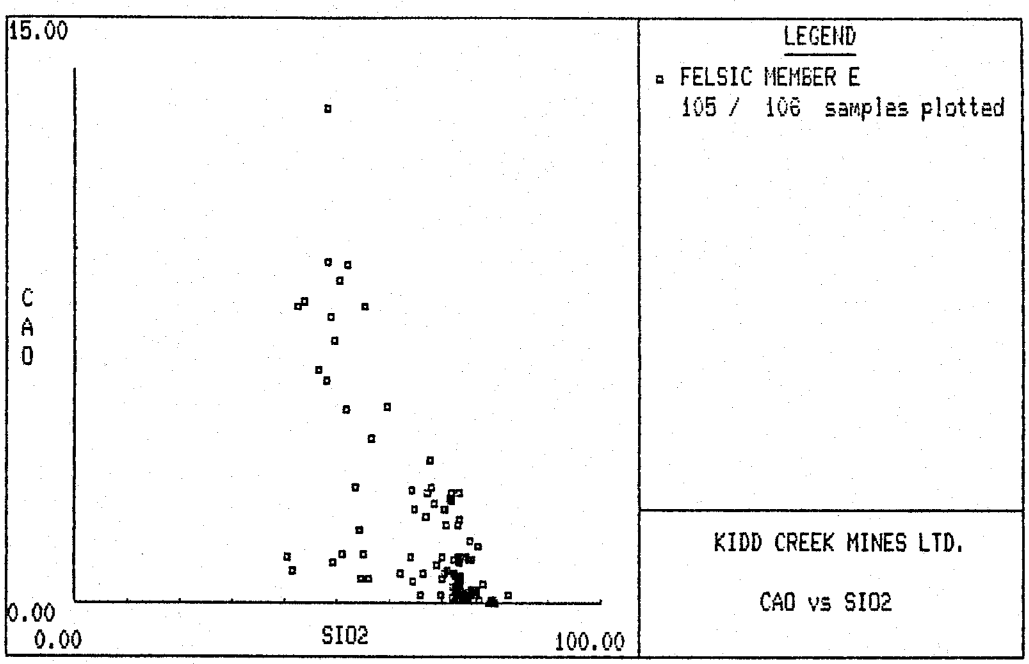

FIGURE 40e : CaO vs SiO2 variation diagram; Felsic Member "E"

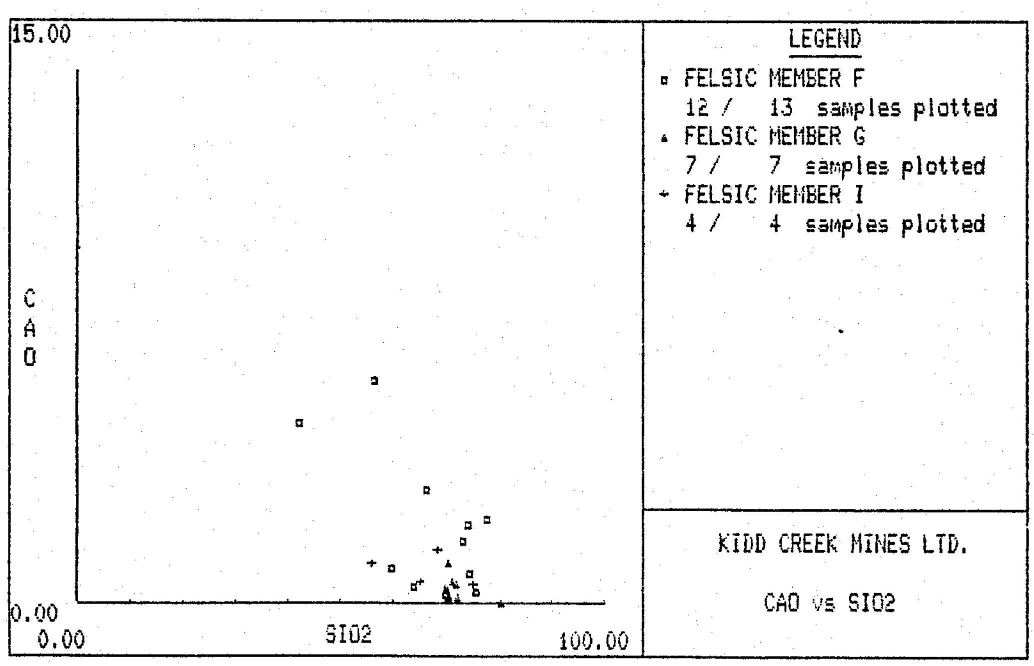

FIGURE 40f : CaO vs SiO2 variation diagram; Felsic Members "F", "G", and "I"

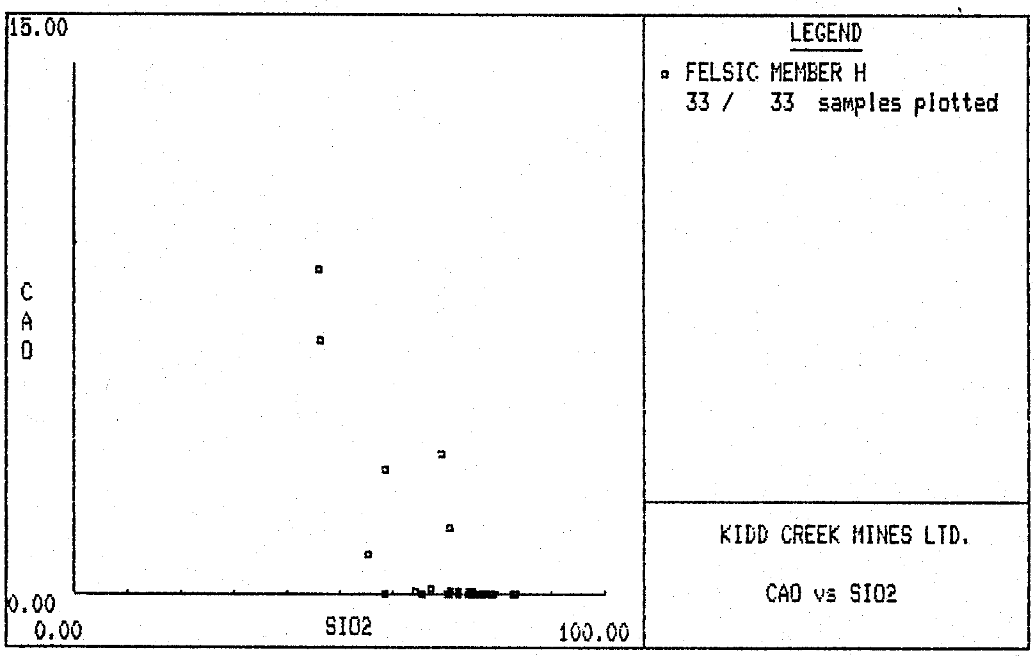

FIGURE 40g : CaO vs SiO2 variation diagram; Felsic Member "H"

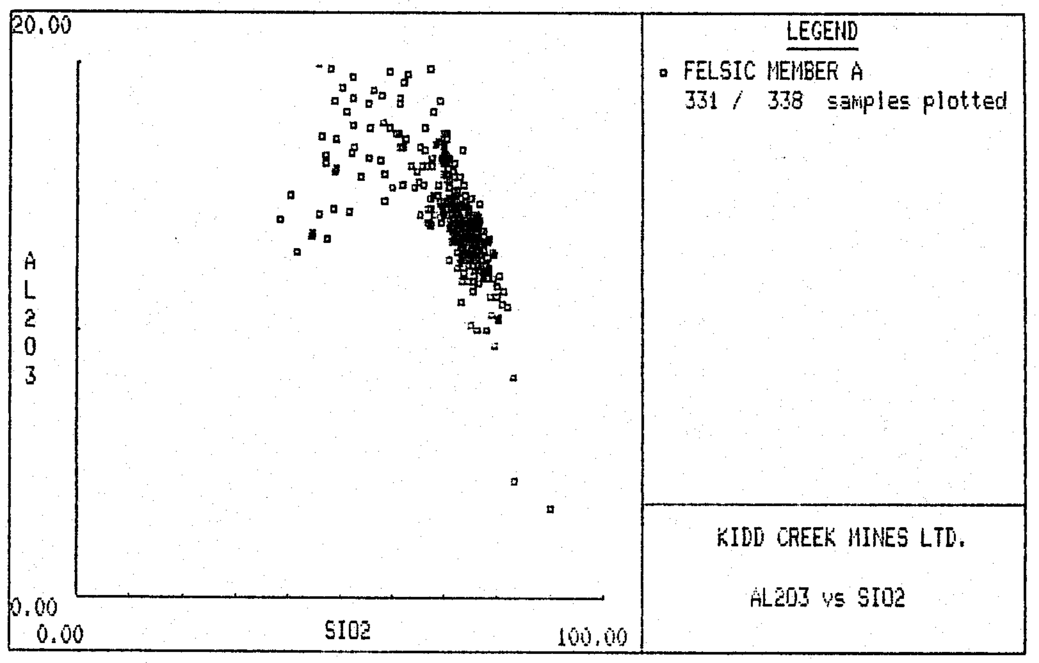

FIGURE 41a : Al2O3 vs SiO2 variation diagram; Felsic Member "A"

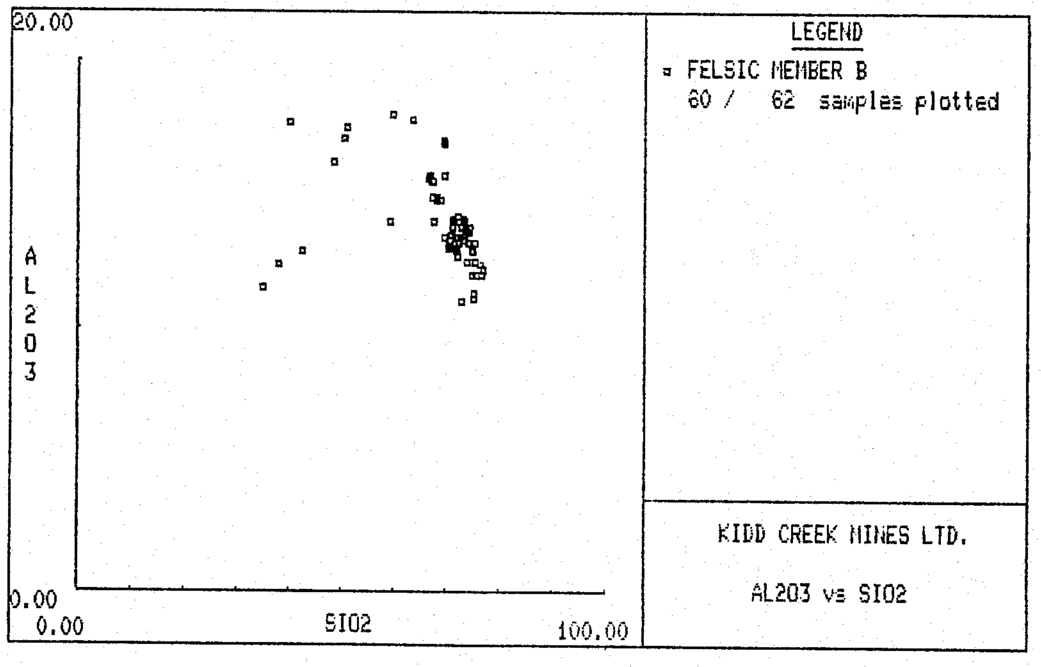

FIGURE 41b : Al2O3 vs SiO2 variation diagram; Felsic Member "A"

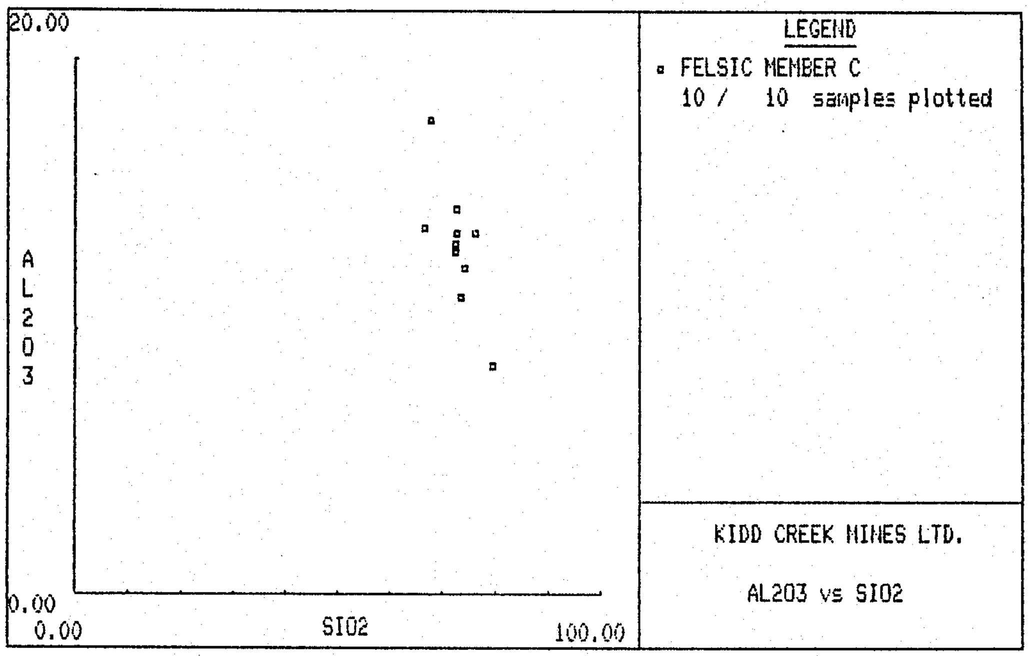

FIGURE 41c : Al2O3 vs SiO2 variation diagram; Felsic Member "C"

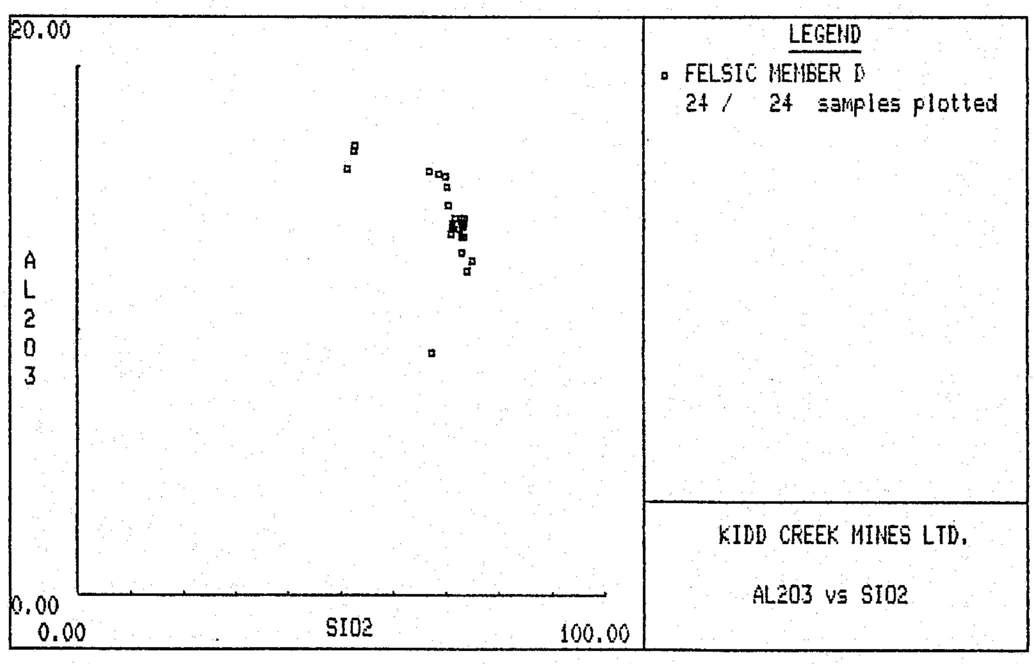

FIGURE 41d : Al2O3 vs SiO2 variation diagram; Felsic Member "D"

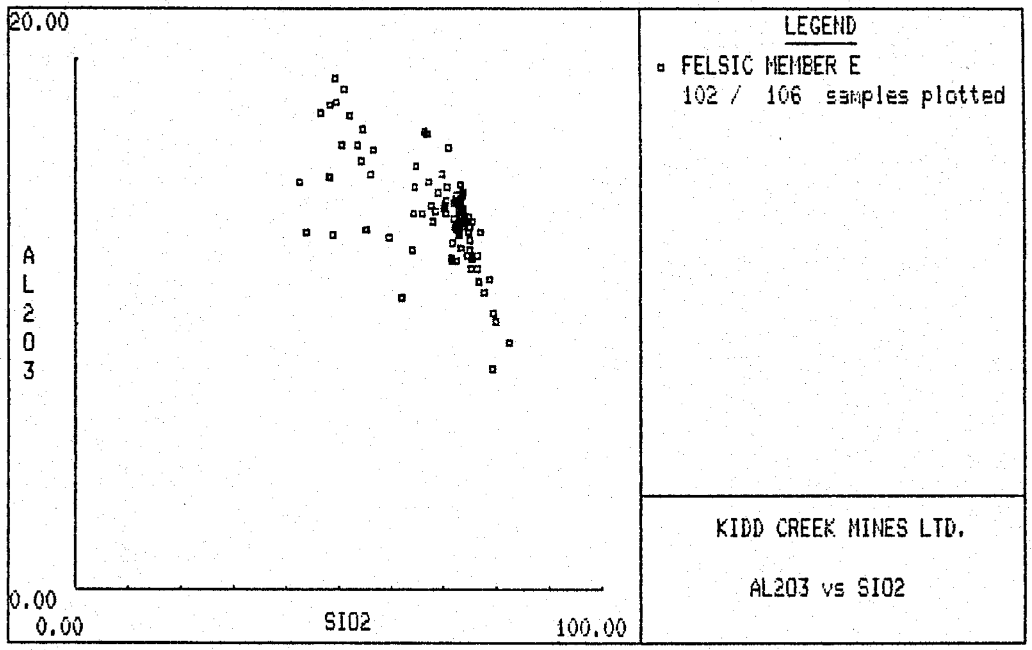

FIGURE 41e : Al2O3 vs SiO2 variation diagram; Felsic Member "E"

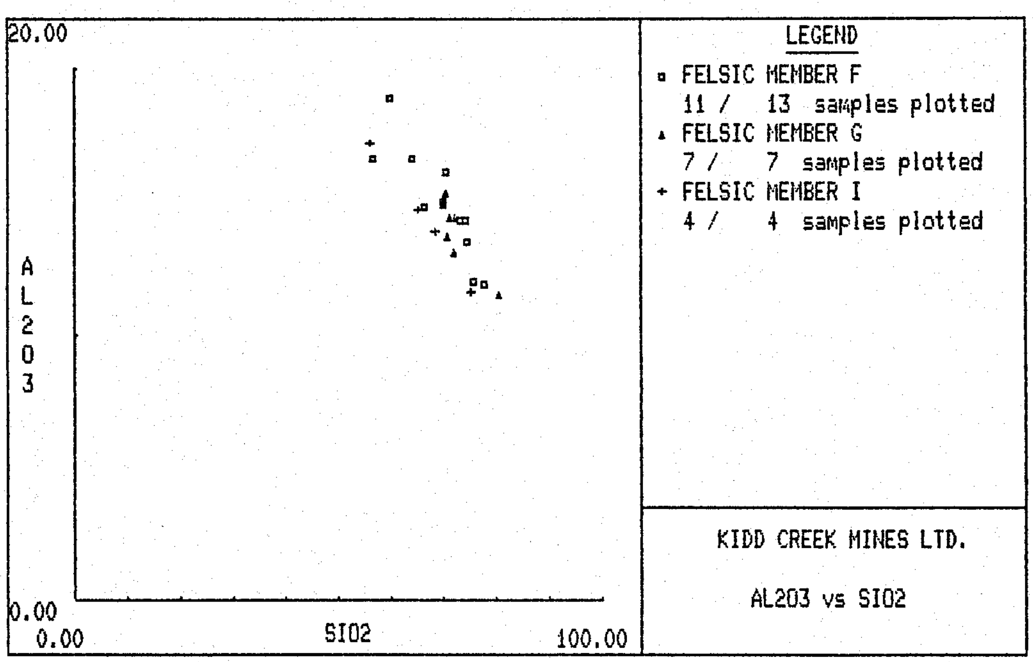

FIGURE 41f : Al2O3 vs SiO2 variation diagram; Felsic Member "F", "G", and "I"

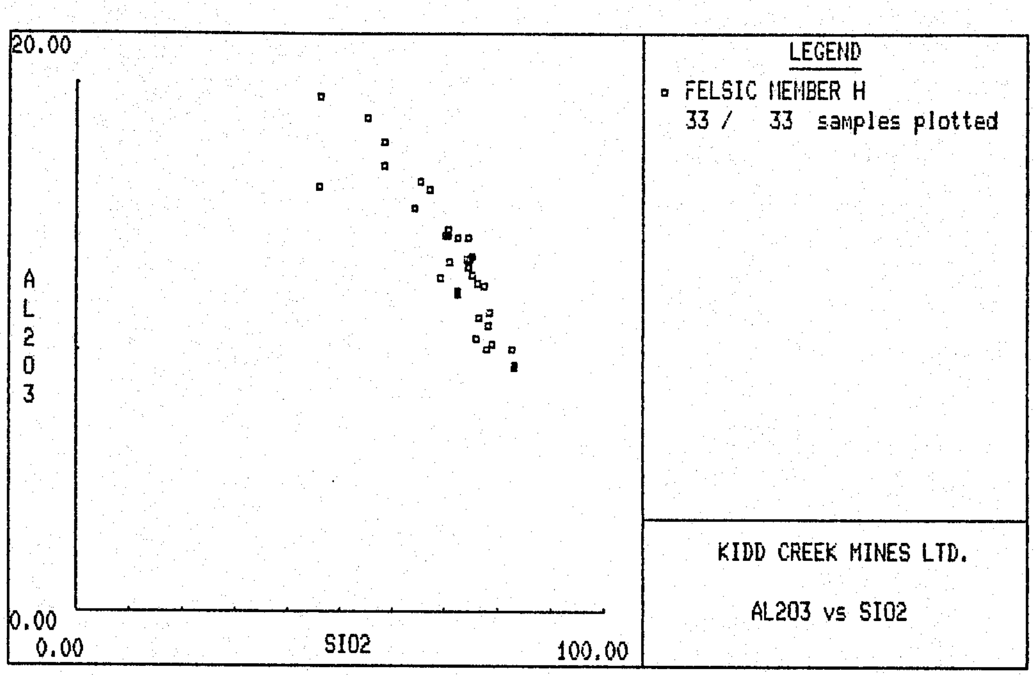

FIGURE 41g : Al2O3 vs SiO2 variation diagram; Felsic Member "H"

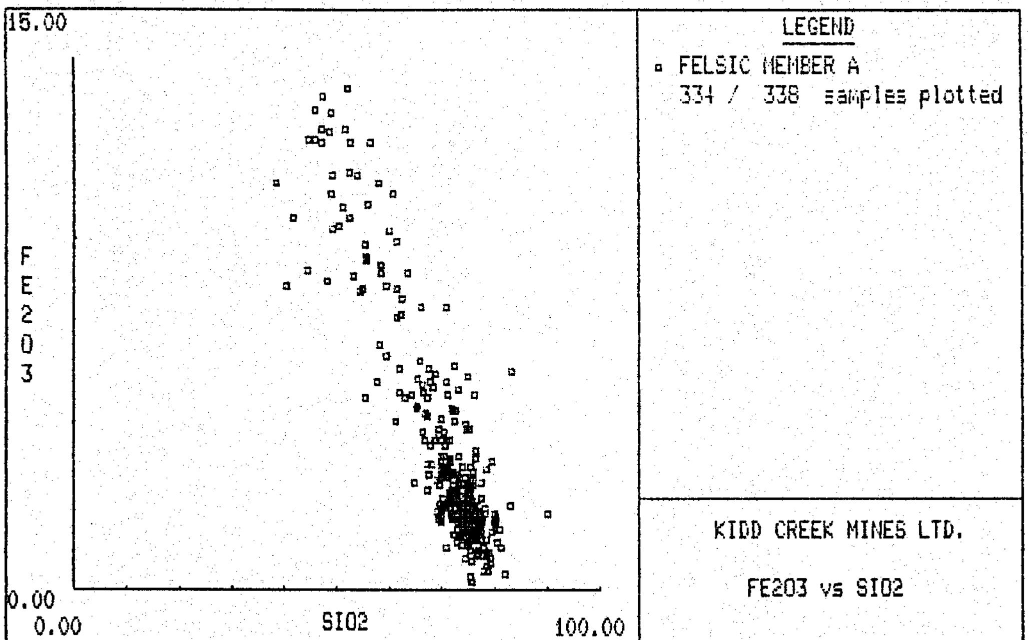

FIGURE 42a : Fe2O3 vs SiO2 variation diagram; Felsic Member "A"

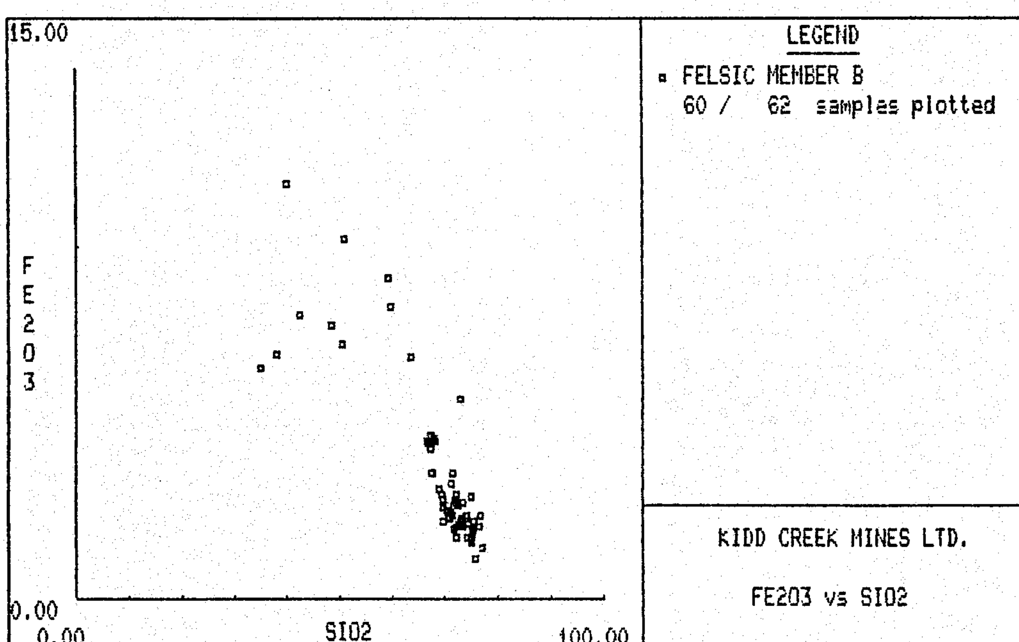

FIGURE 42b : Fe2O3 vs SiO2 variation diagram; Felsic Member "B"

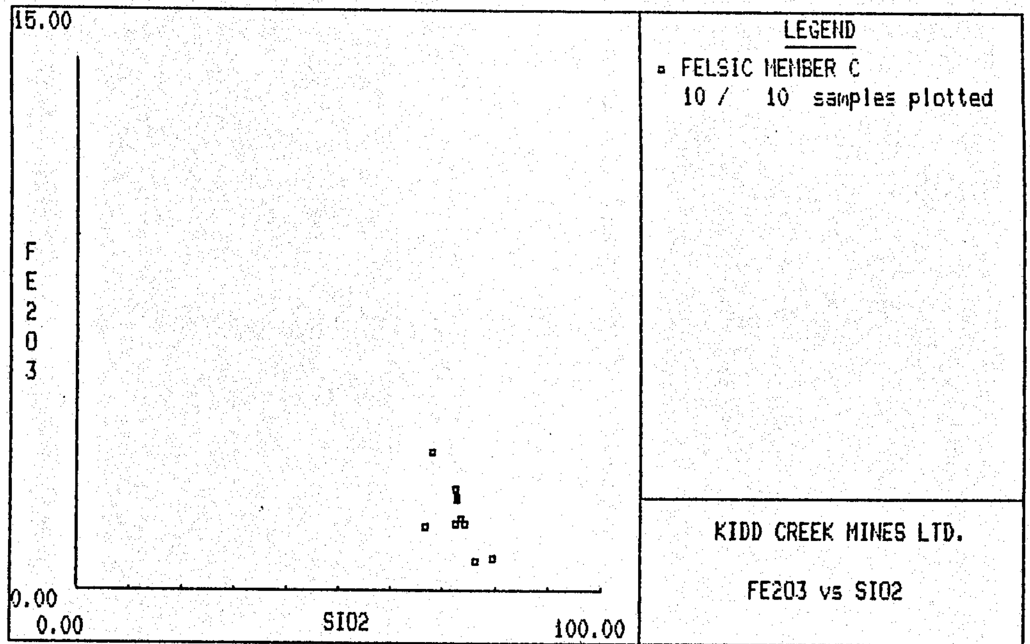

FIGURE 42c : Fe2O3 vs SiO2 variation diagram; Felsic Member "C"

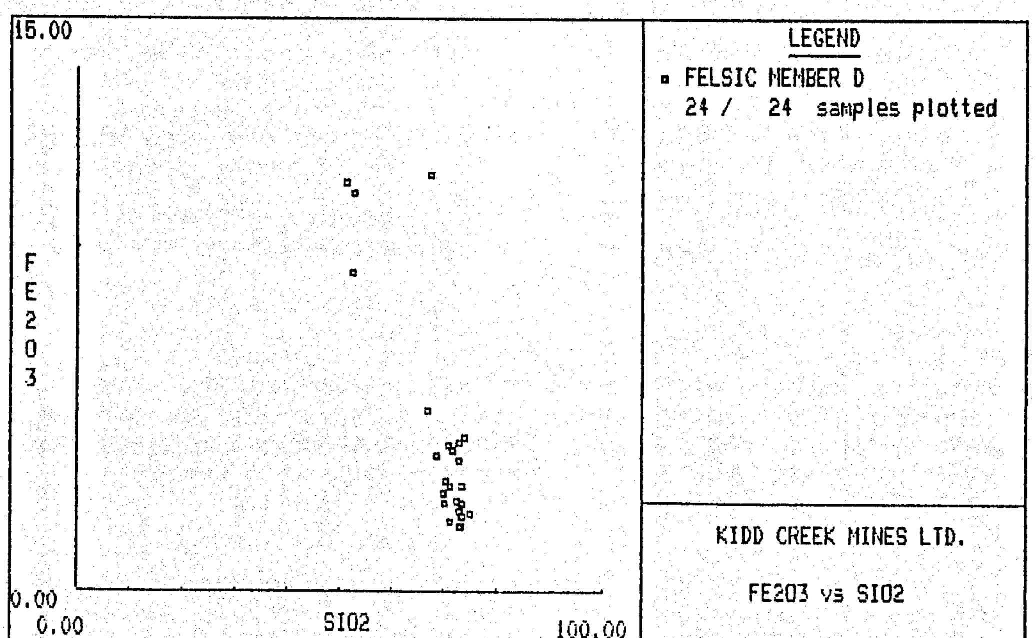

FIGURE 42d Fe2O3 vs SiO2 variation diagram; Felsic Member "D"

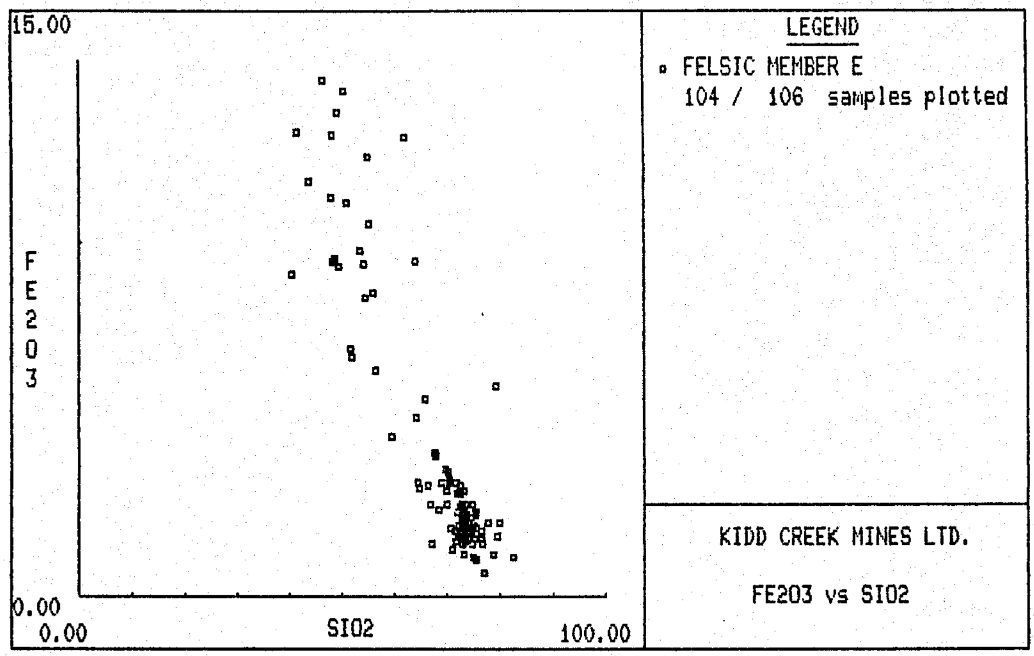

FIGURE 42e : Fe2O3 vs SiO2 variation diagram; Felsic Member "E"

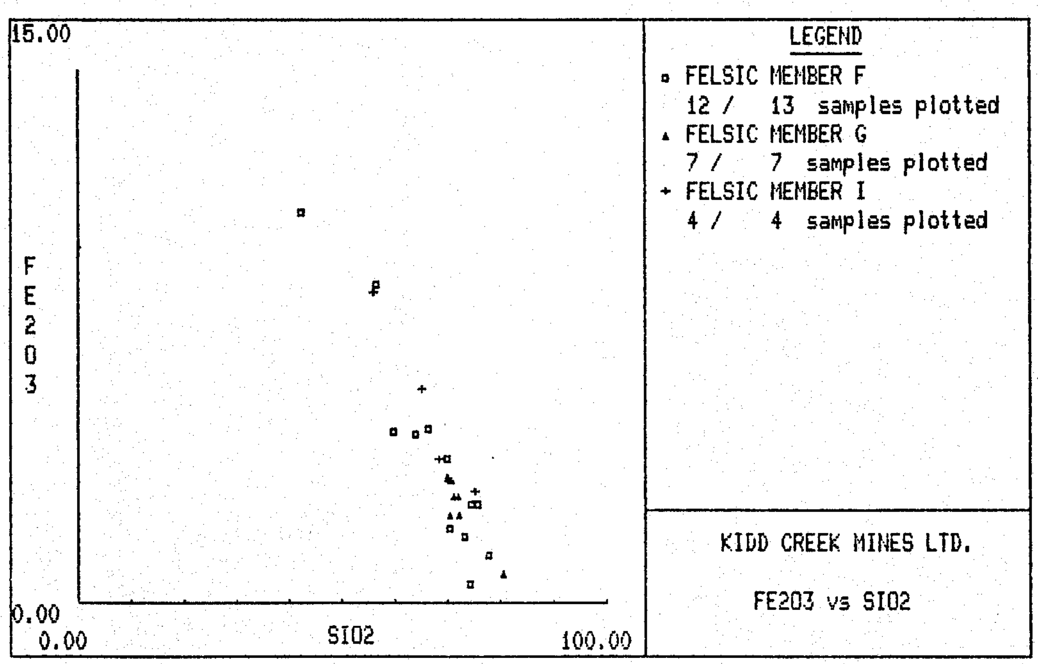

FIGURE 42f : Fe2O3 vs SiO2 variation diagram; Felsic Members "F", "G", and "I"

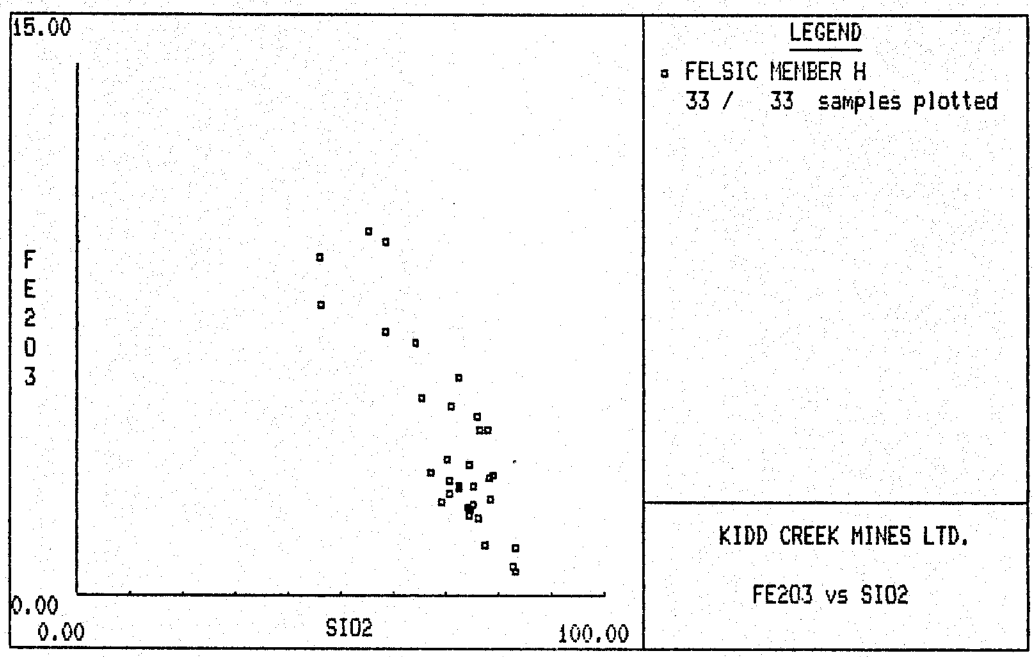

FIGURE 42g : Fe2O3 vs SiO2 variation diagram; Felsic Member "H"

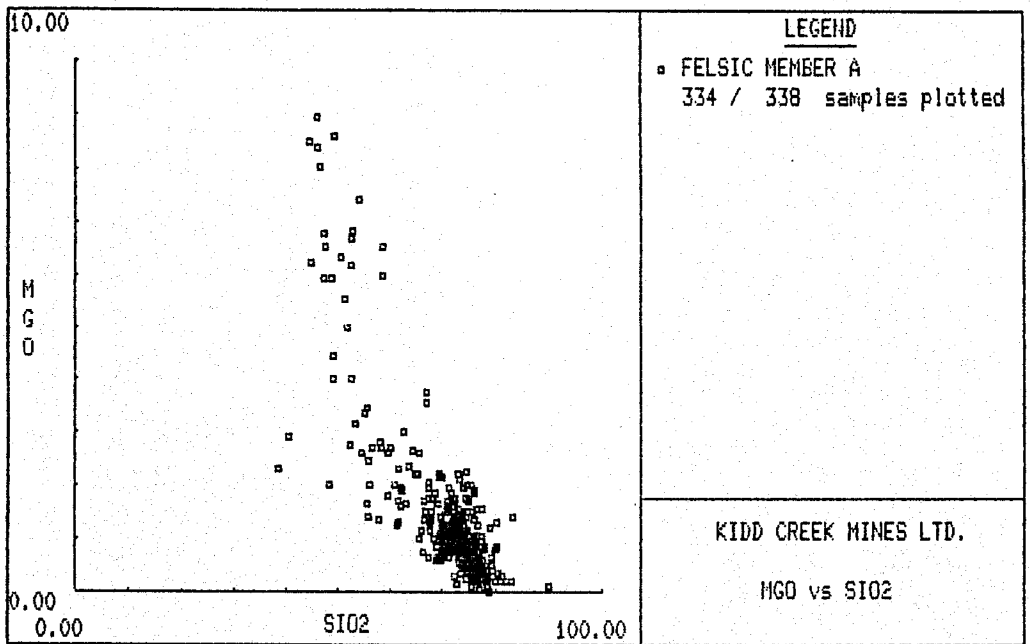

FIGURE 43a : MgO vs SiO2 variation diagram; Felsic Member "A"

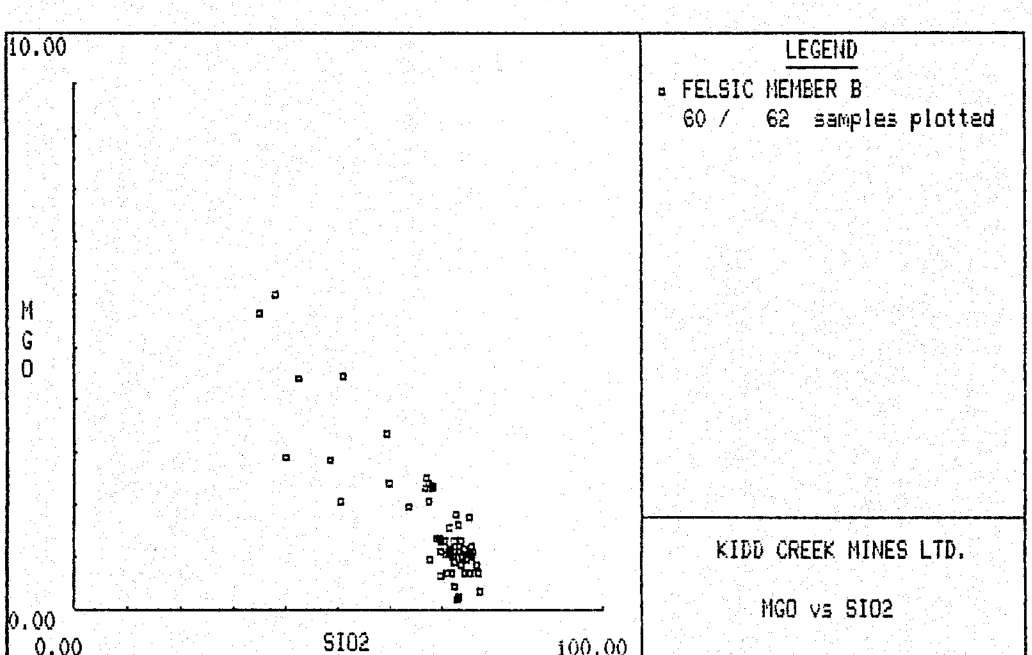

FIGURE 43b : MgO vs SiO2 variation diagram; Felsic Member "B"

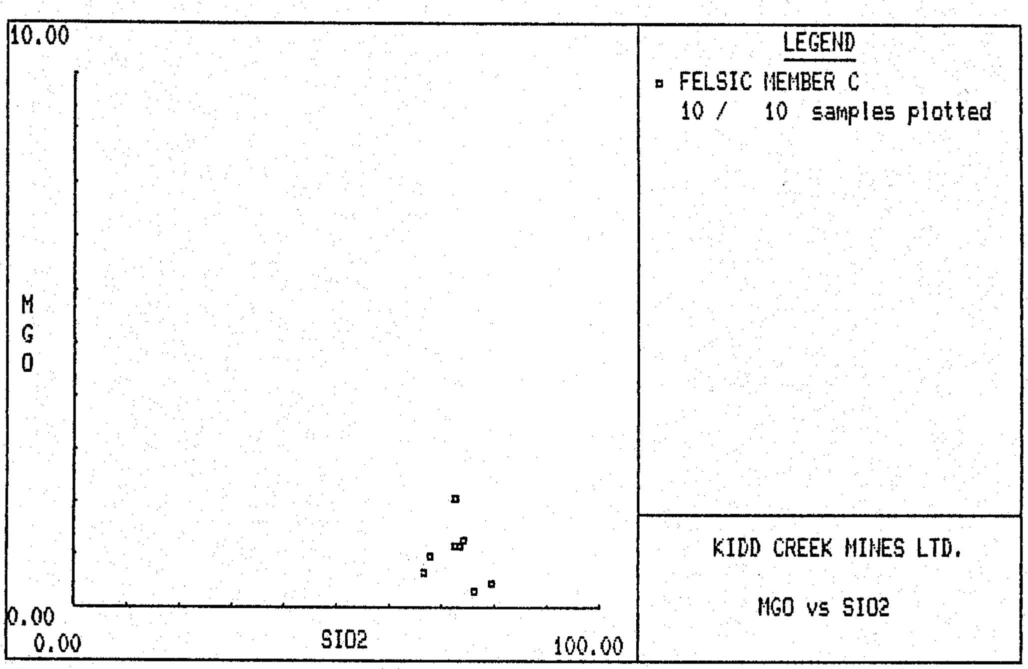

FIGURE 43c : MgO vs SiO2 variation diagram; Felsic Member "C"

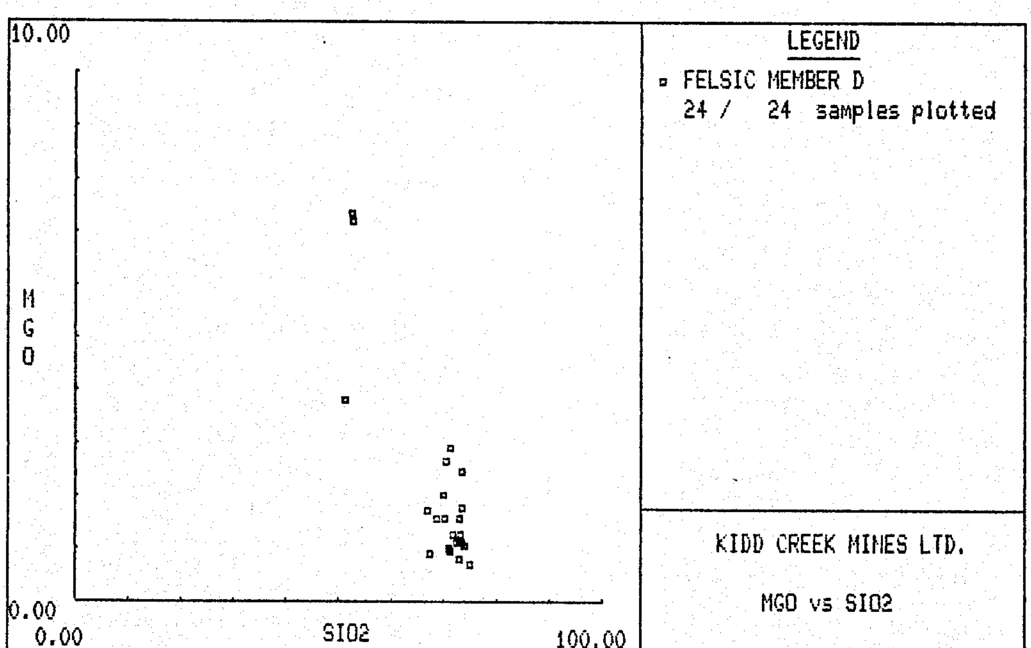

FIGURE 43d : MgO vs SiO2 variation diagram; Felsic Member "D"

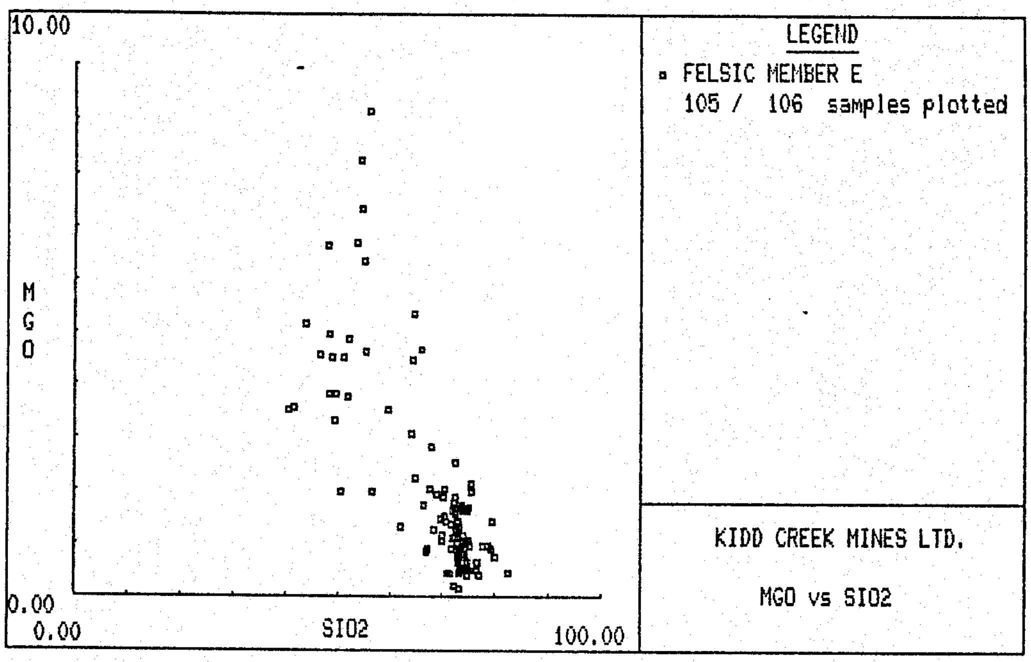

FIGURE 43e : MgO vs SiO2 variation diagram; Felsic Member "E"

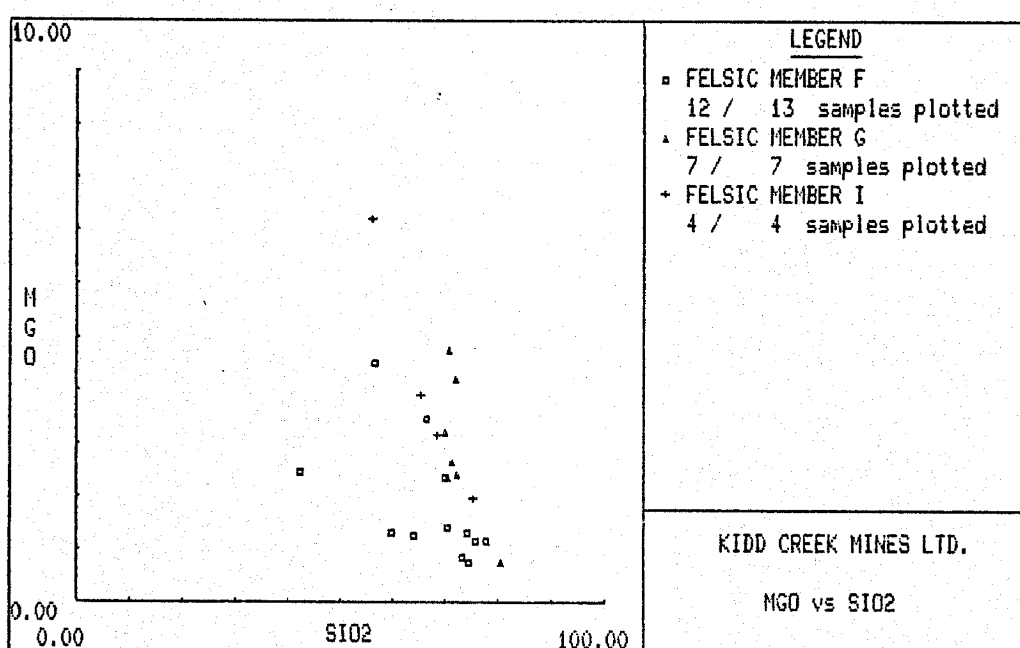

FIGURE 43f : MgO vs SiO2 variation diagram; Felsic Members "F", "G", and "I"

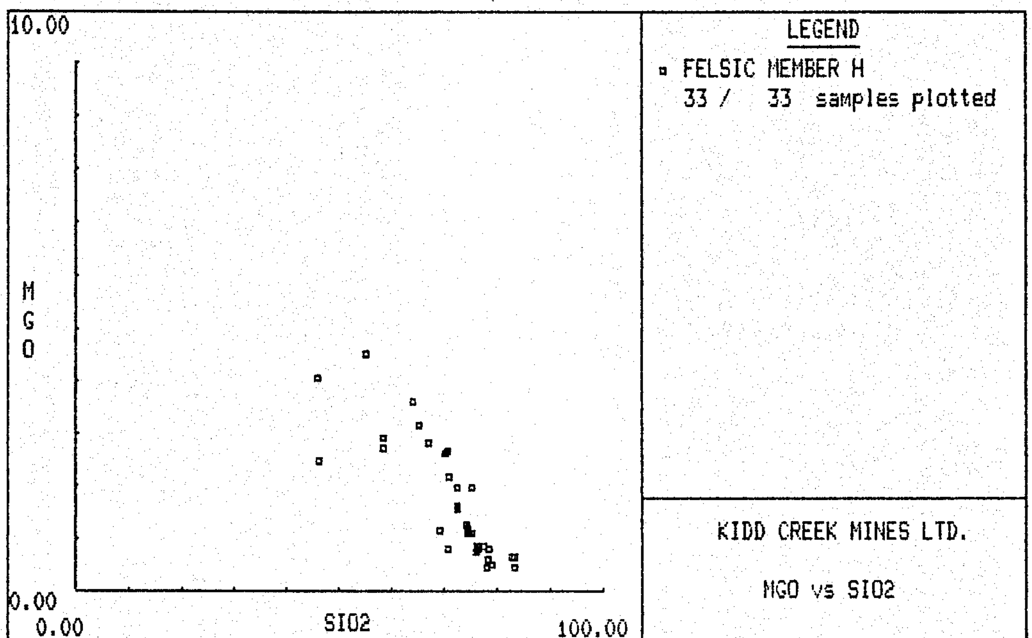

FIGURE 43g : MgO vs SiO2 variation diagram; Felsic Member "H"

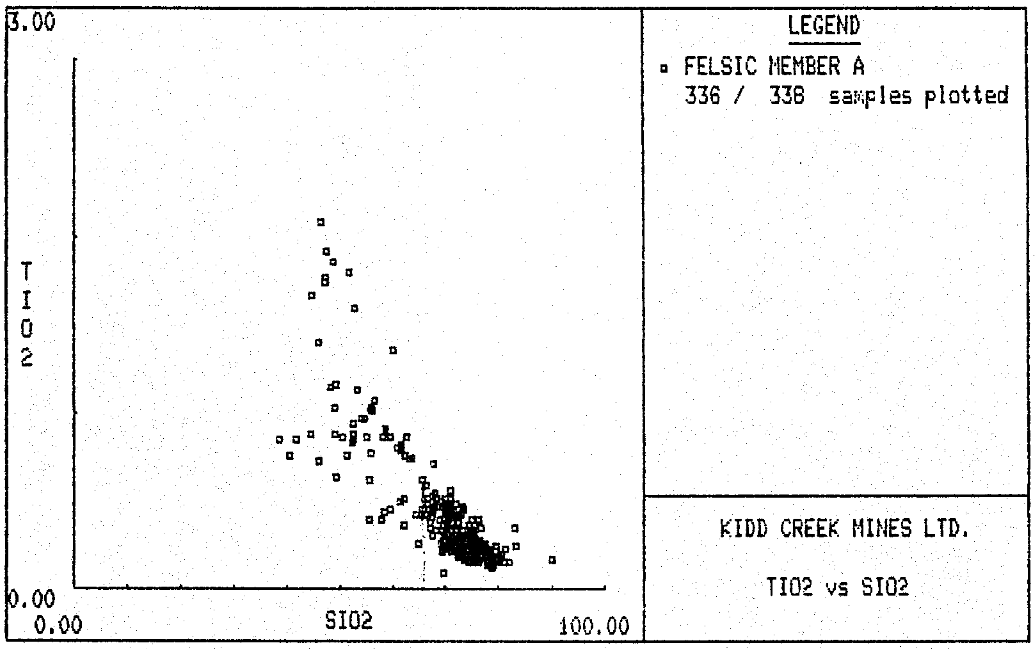

FIGURE 44a : TiO2 vs SiO2 variation diagram; Felsic Member "A"

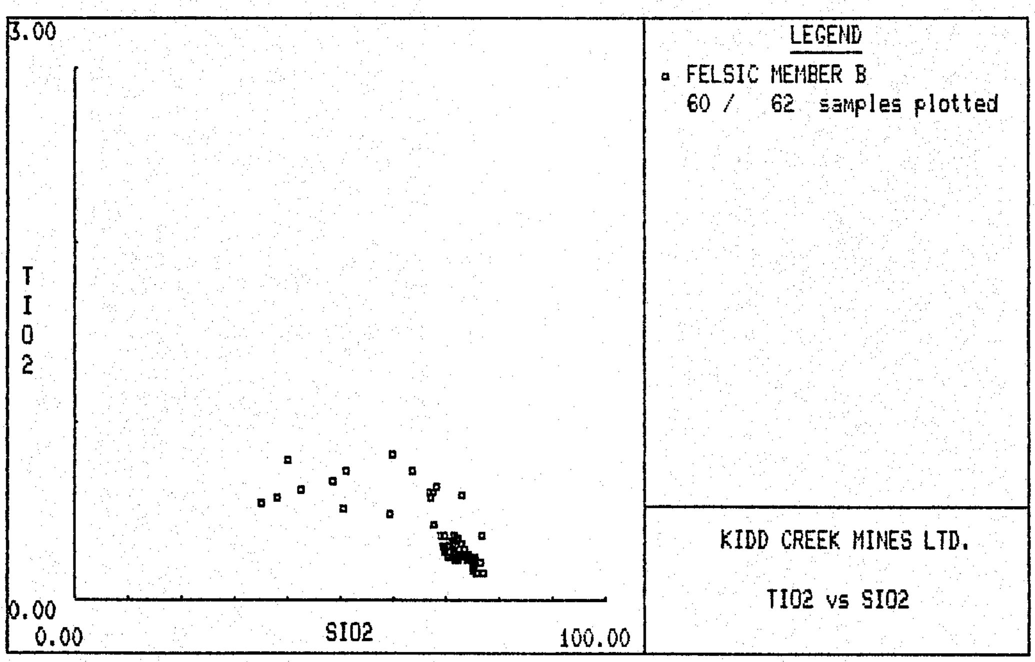

FIGURE 44b : TiO2 vs SiO2 variation diagram; Felsic Member "B"

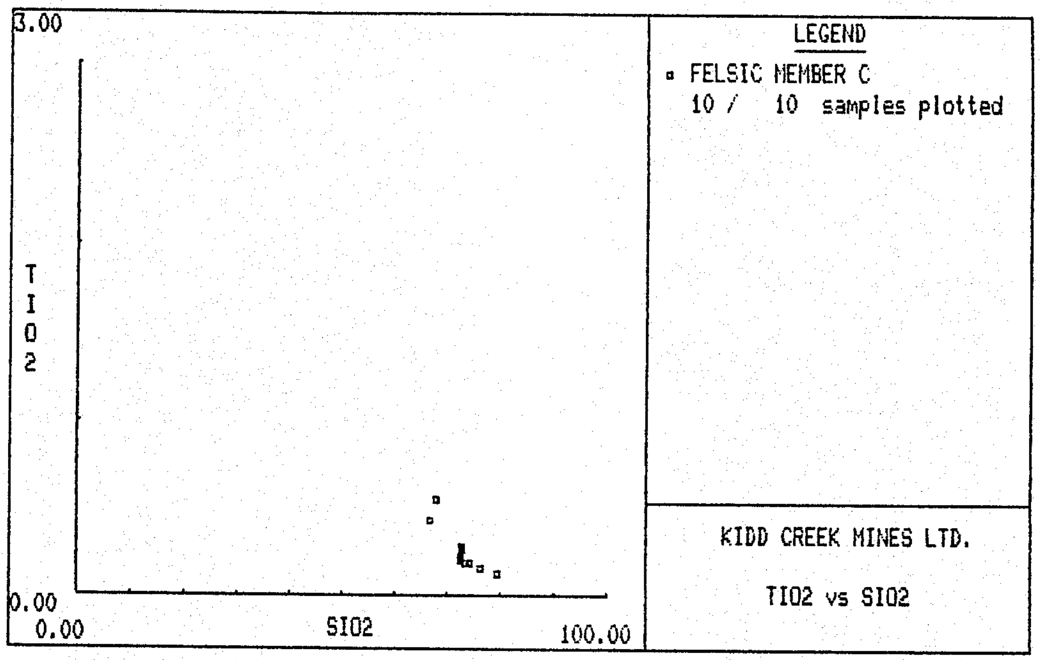

FIGURE 44c : TiO2 vs SiO2 variation diagram; Felsic Member "C"

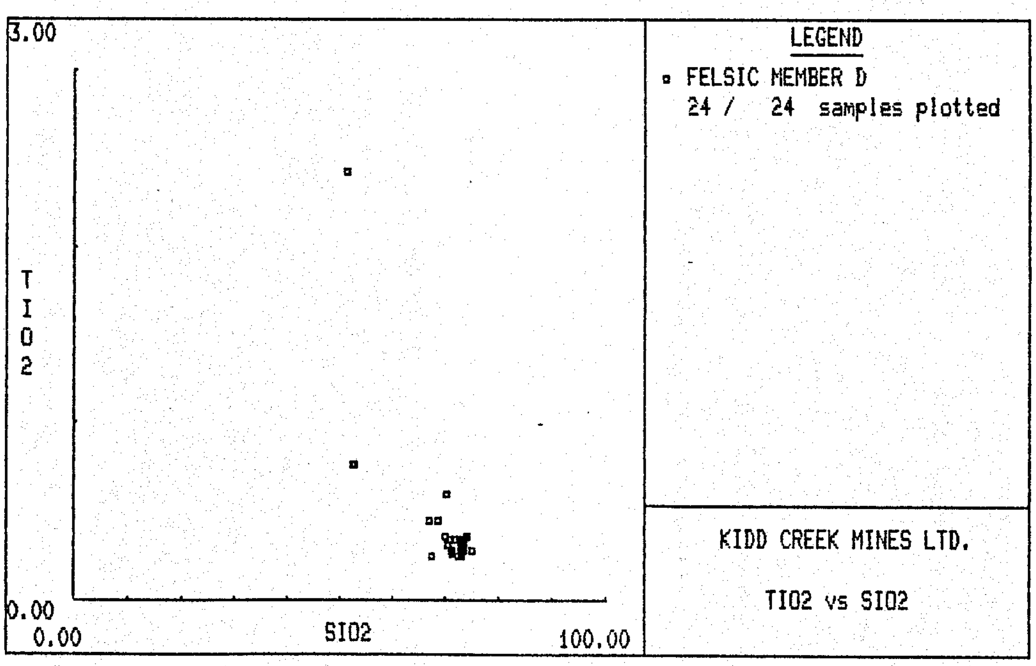

FIGURE 44d : TiO2 vs SiO2 variation diagram; Felsic Member "D"

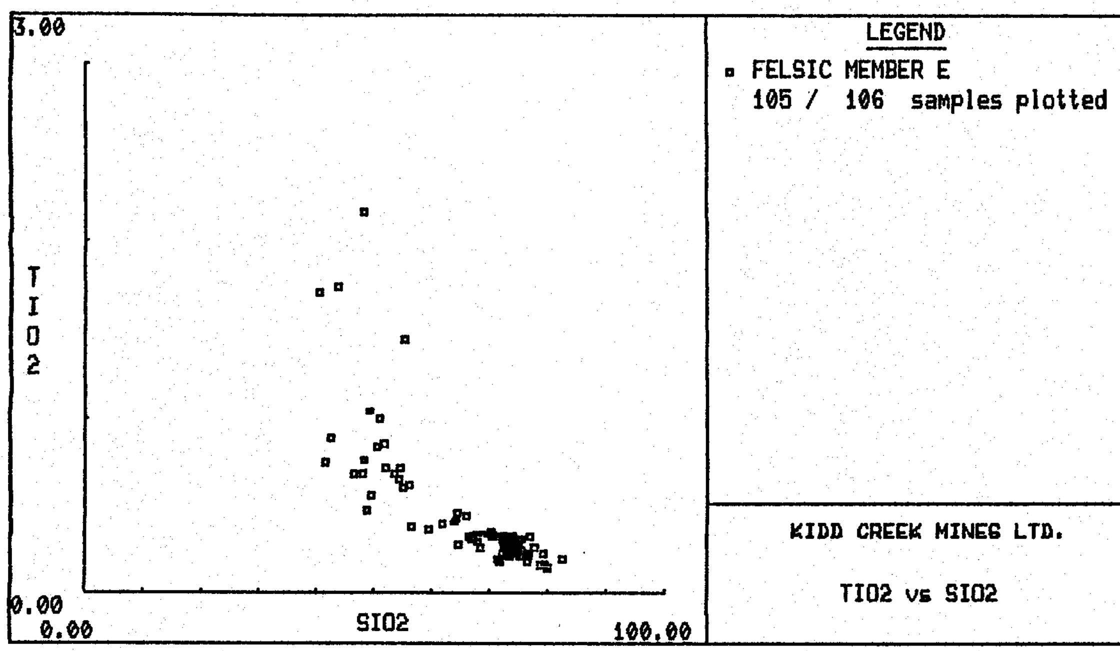

FIGURE 44e : TiO2 vs SiO2 variation diagram; Felsic Member "E"

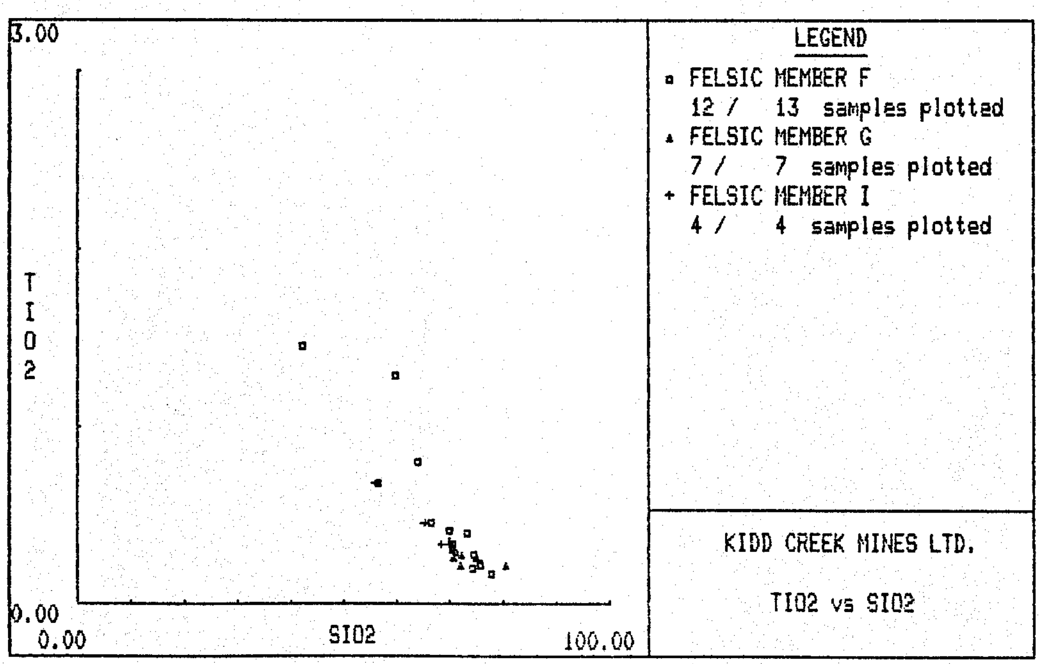

FIGURE 44f : TiO2 vs SiO2 variation diagram; Felsic Members "F", "G", and "I"

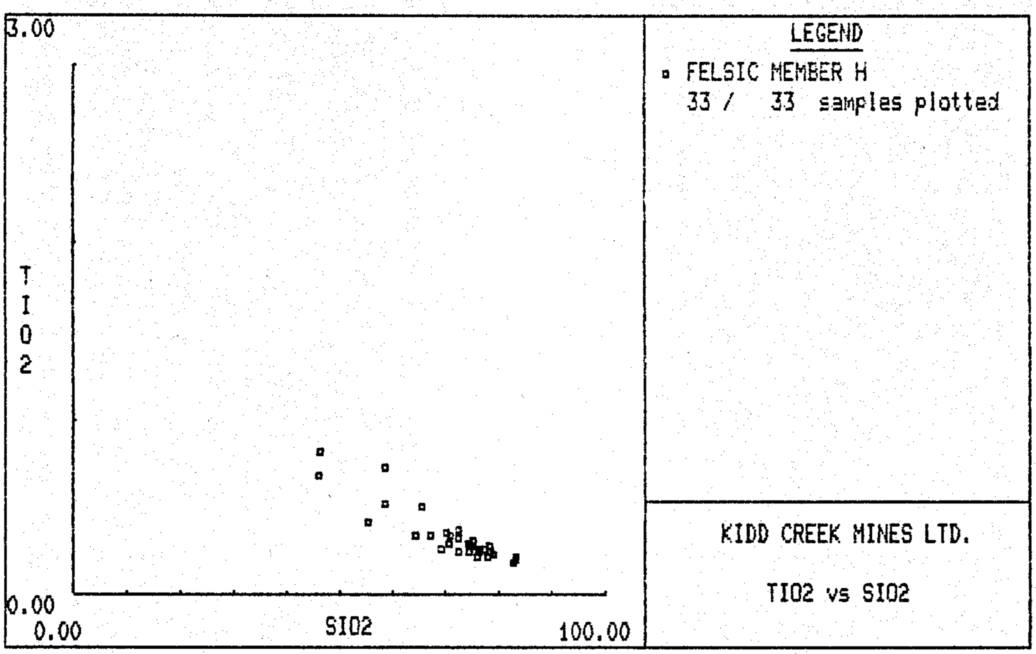

FIGURE 44g : TiO2 vs SiO2 variation diagram; Felsic Member "H"

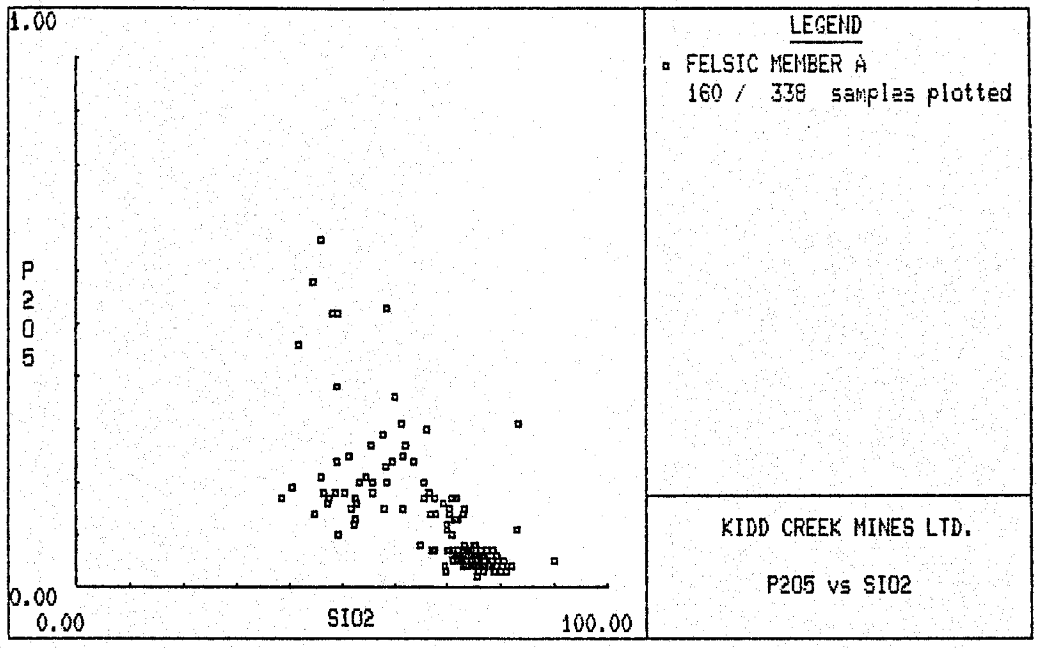

FIGURE 45a : P2O5 vs SiO2 variation diagram; Felsic Member "A"

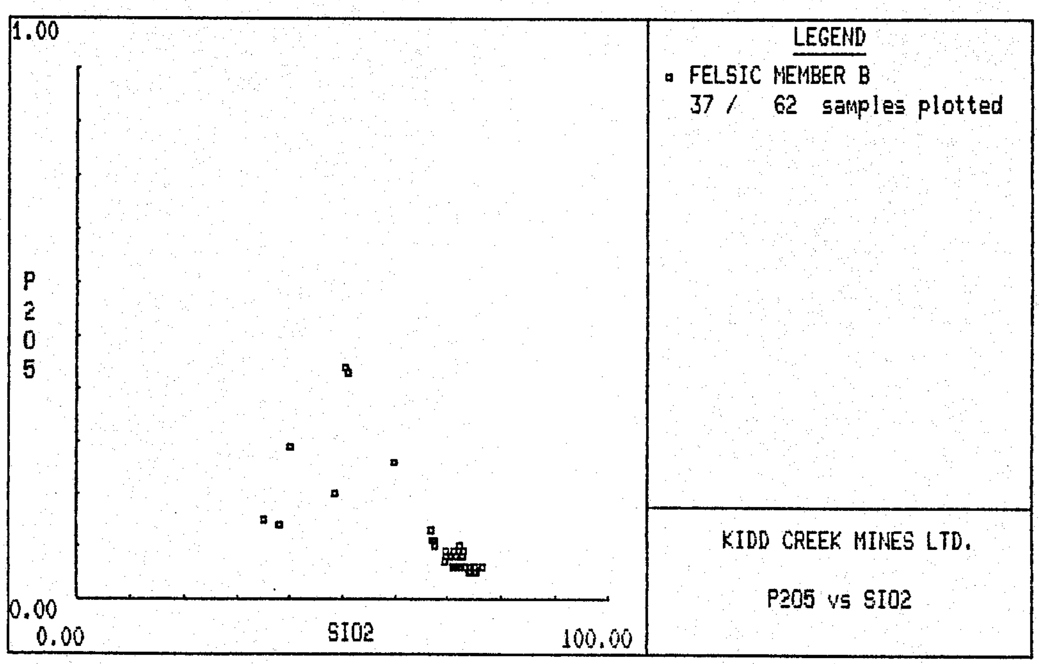

FIGURE 45b : P2O5 vs SiO2 variation diagram; Felsic Member "B"

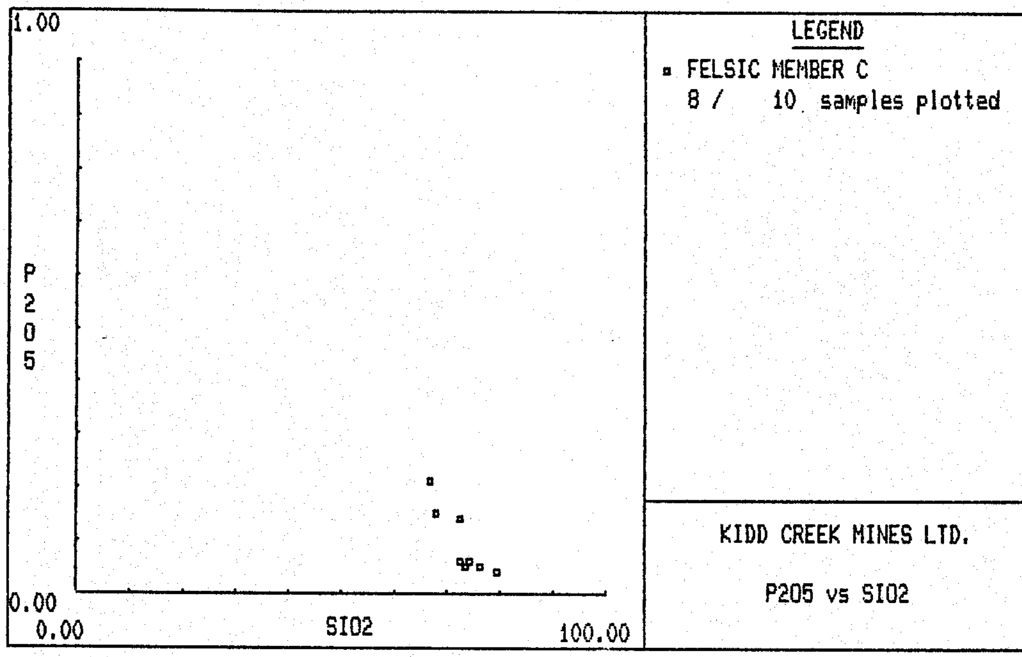

FIGURE 45c : P2O5 vs SiO2 variation diagram; Felsic Member "C"

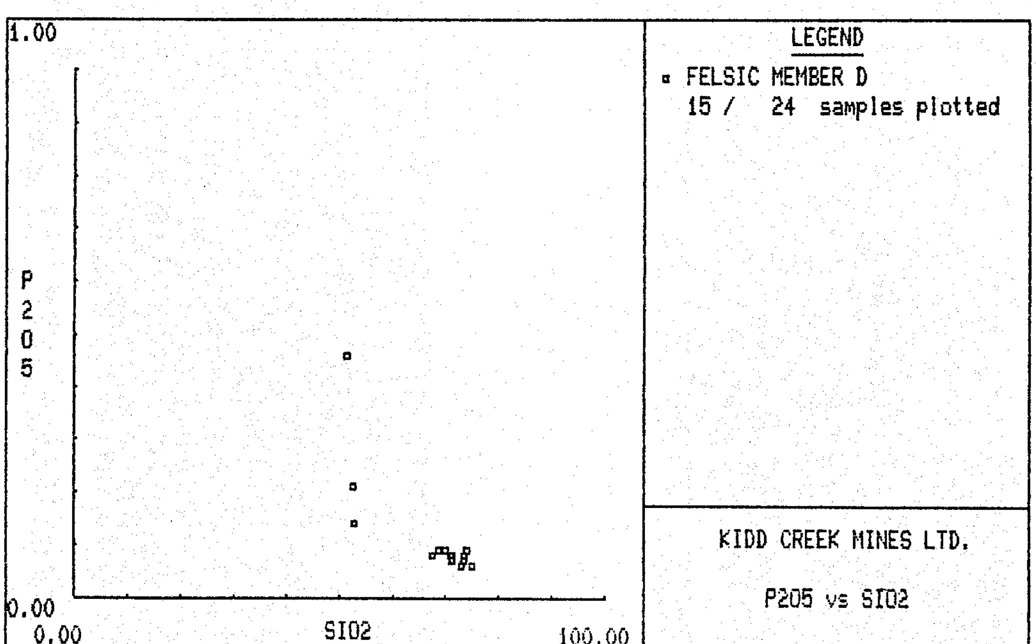

FIGURE 45d : P2O5 vs SiO2 variation diagram; Felsic Member "D"

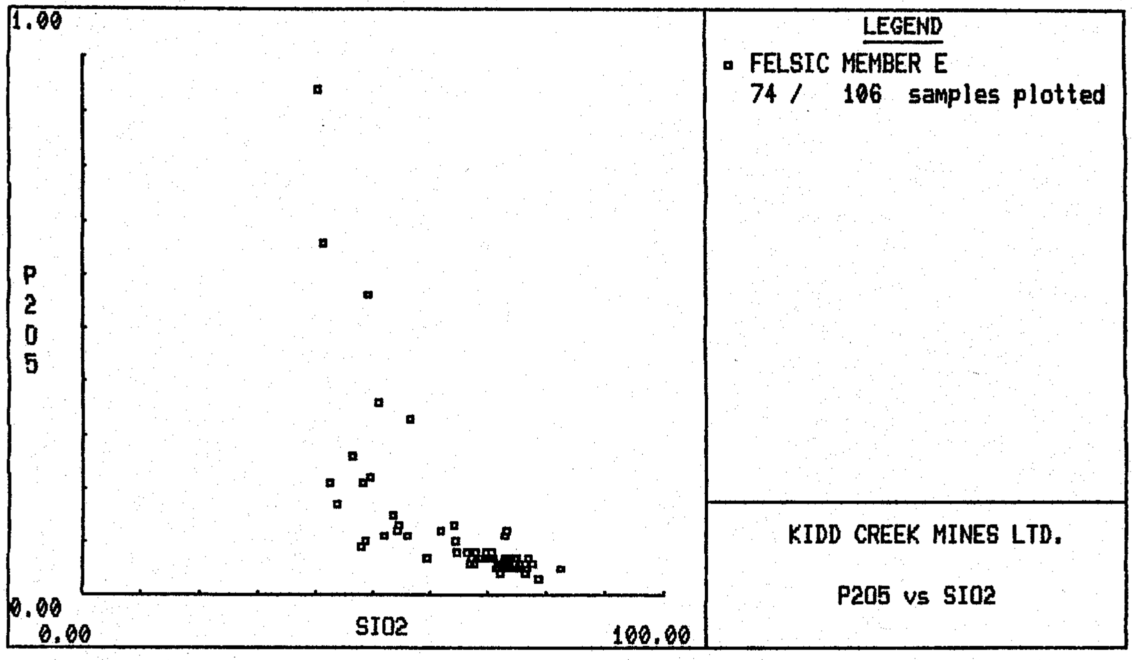

FIGURE 45e : P2O5 vs SiO2 variation diagram; Felsic Member "E"

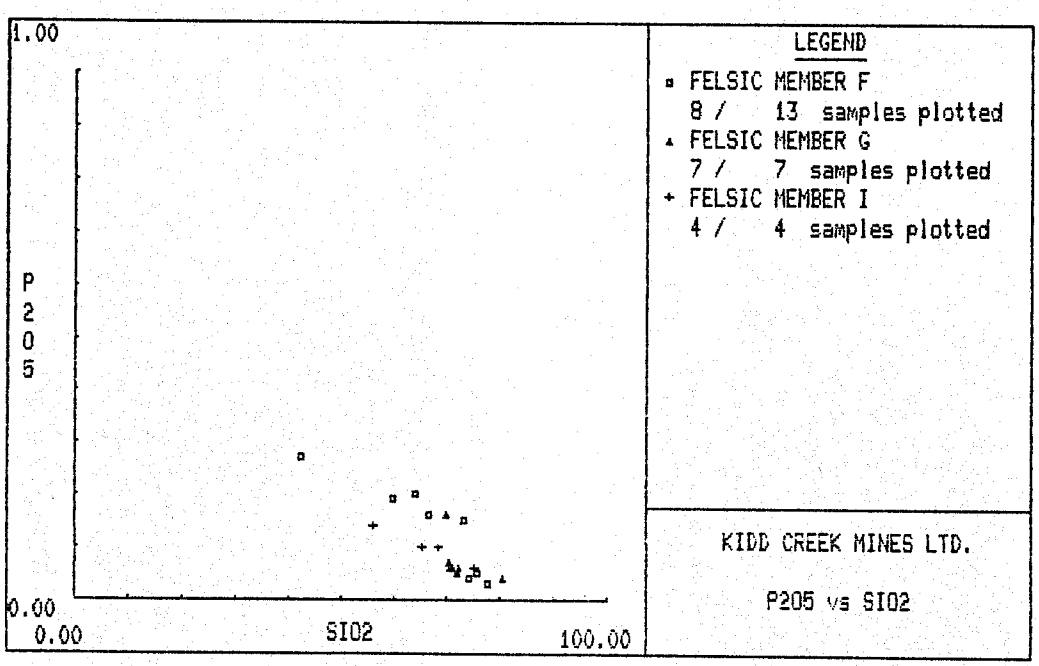

FIGURE 45f : P2O5 vs SiO2 variation diagram; Felsic Members "F", "G", and "I"

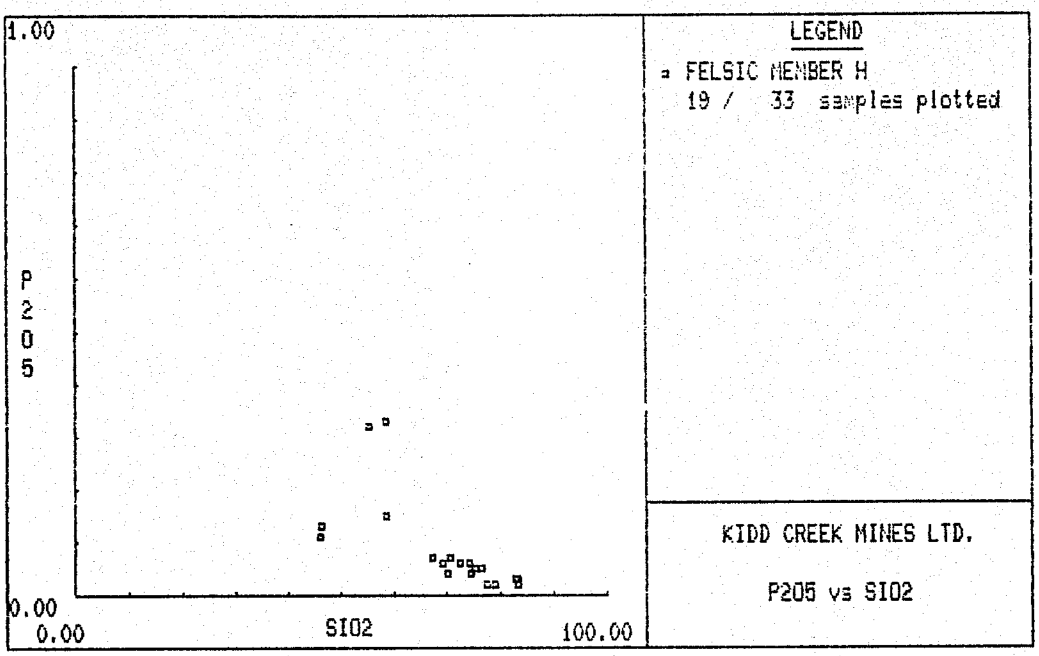

FIGURE 45g : P2O5 vs SiO2 variation diagram; Felsic Member "H"

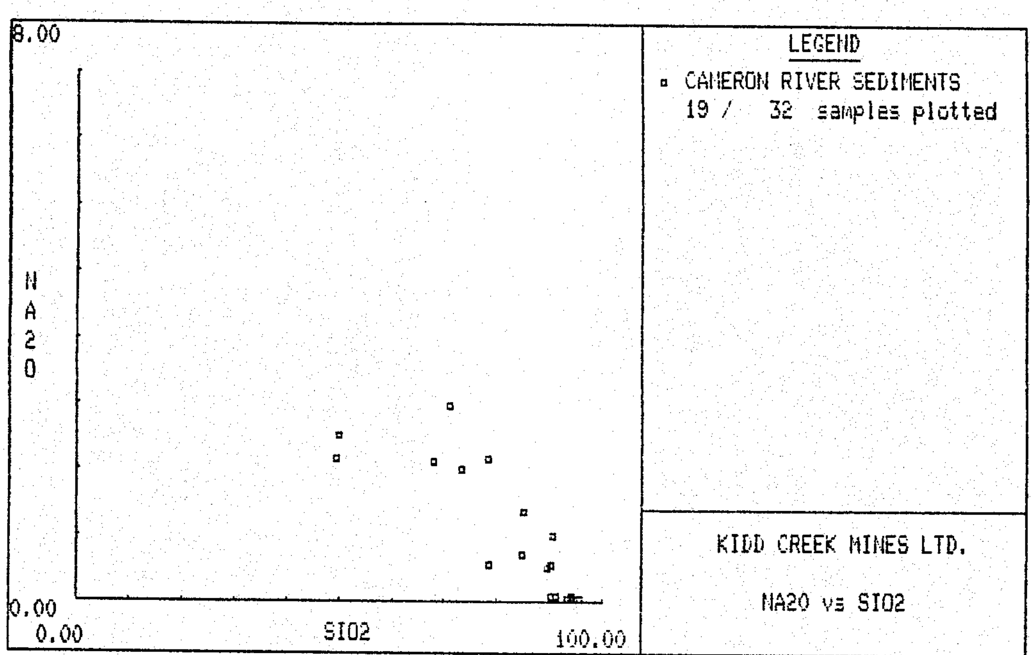

FIGURE 46 : Na2O vs SiO2 variation diagram; Cameron River Sediments

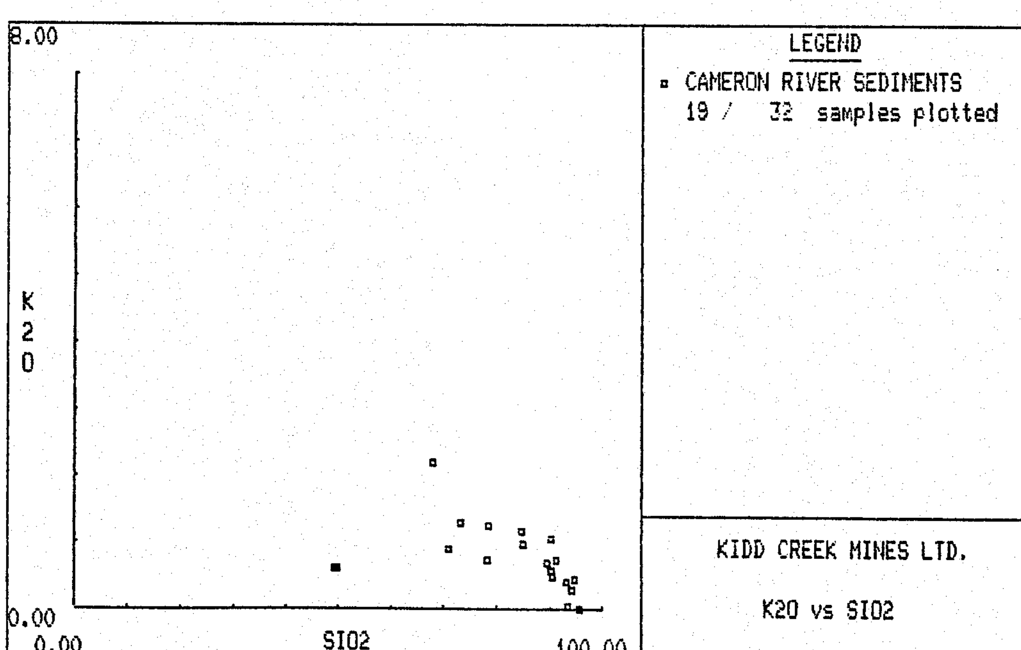

FIGURE 47 : K2O vs SiO2 variation diagram; Cameron River Sediments

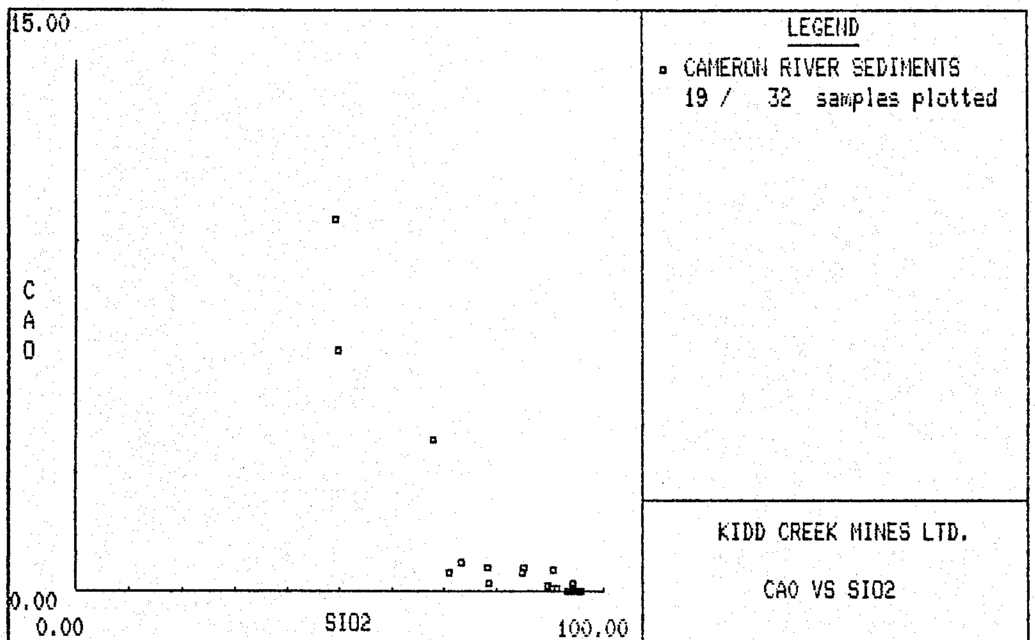

FIGURE 48 : Ca vs SiO2 variation diagram; Cameron River Sediments

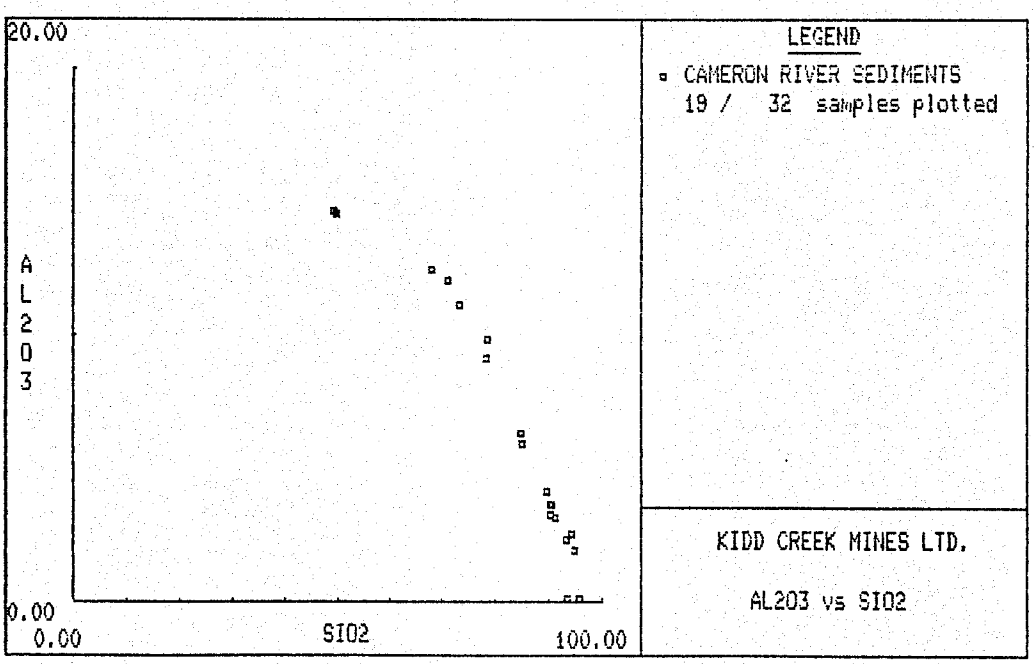

FIGURE 49 : Al2O3 vs SiO2 variation diagram; Cameron River Sediments

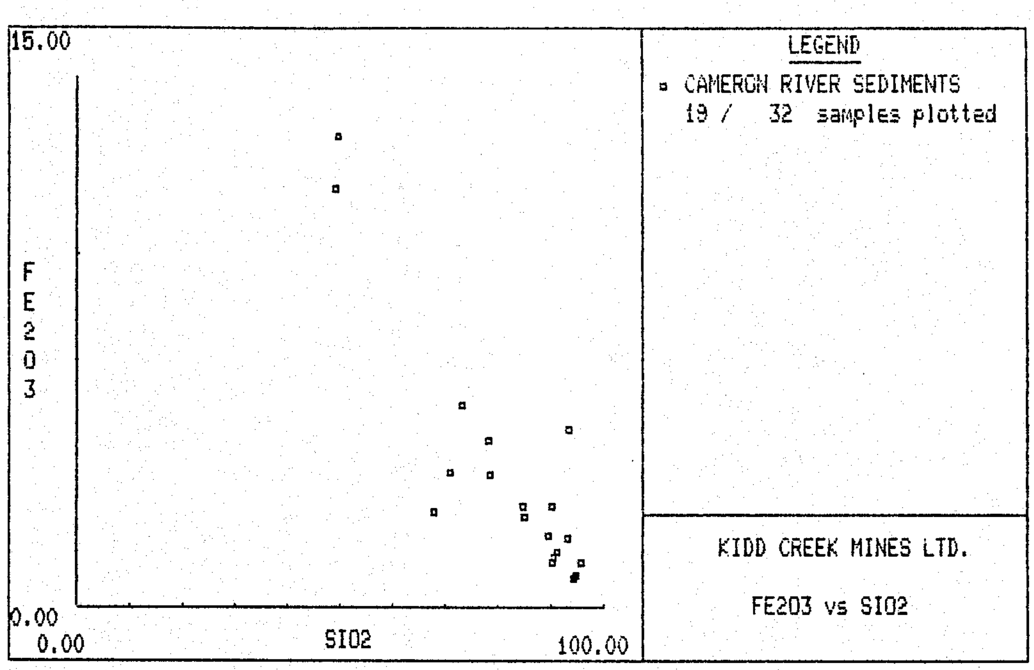

FIGURE 50 : Fe2O3 vs SiO2 variation diagram; Cameron River Sediments

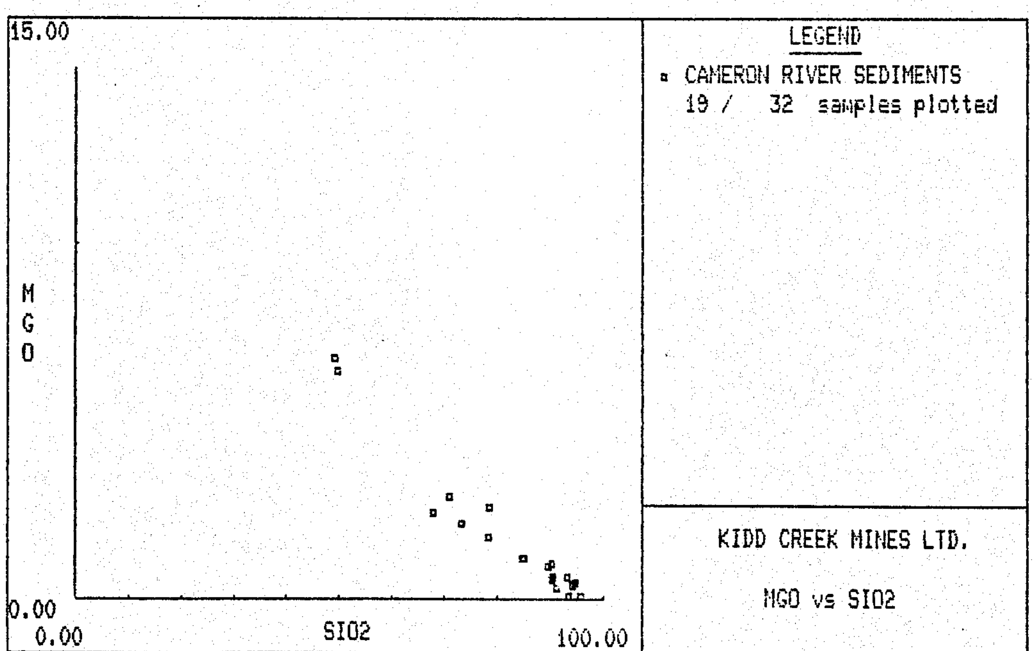

FIGURE 51 : MgO vs SiO2 variation diagram; Cameron River Sediments

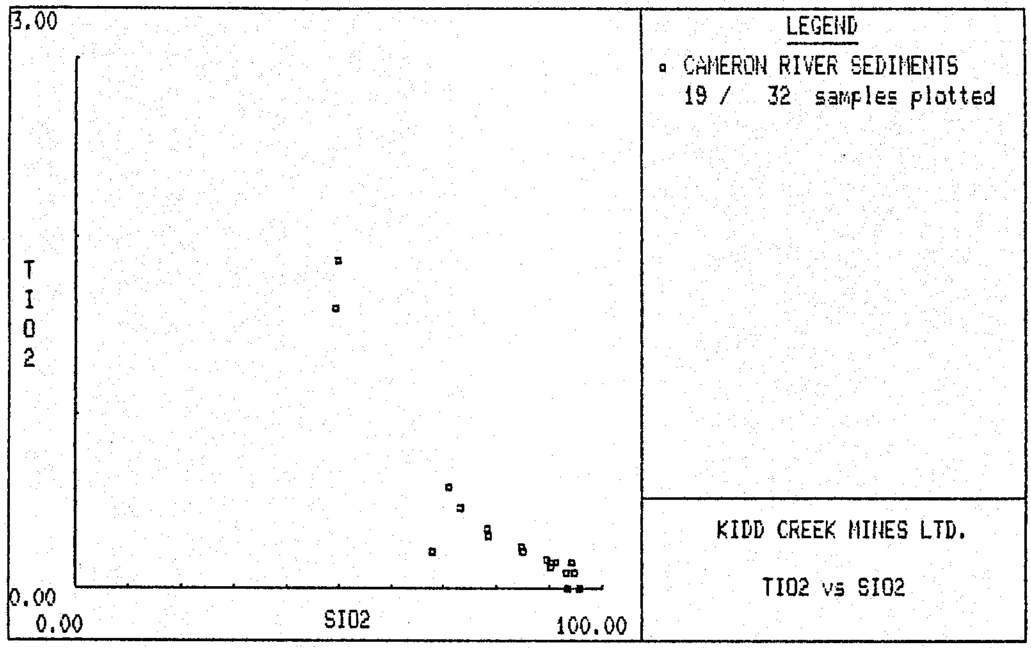

FIGURE 52 : TiO2 vs SiO2 variation diagram; Cameron River Sediments

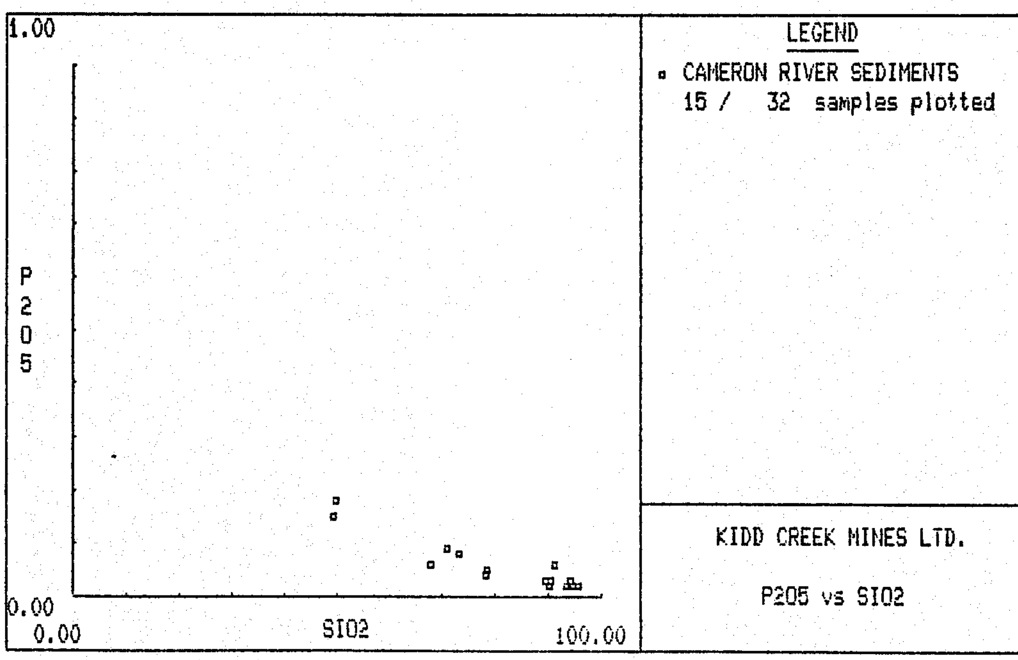

FIGURE 53 : P2O5 vs SiO2 variation diagram; Cameron River Sediments

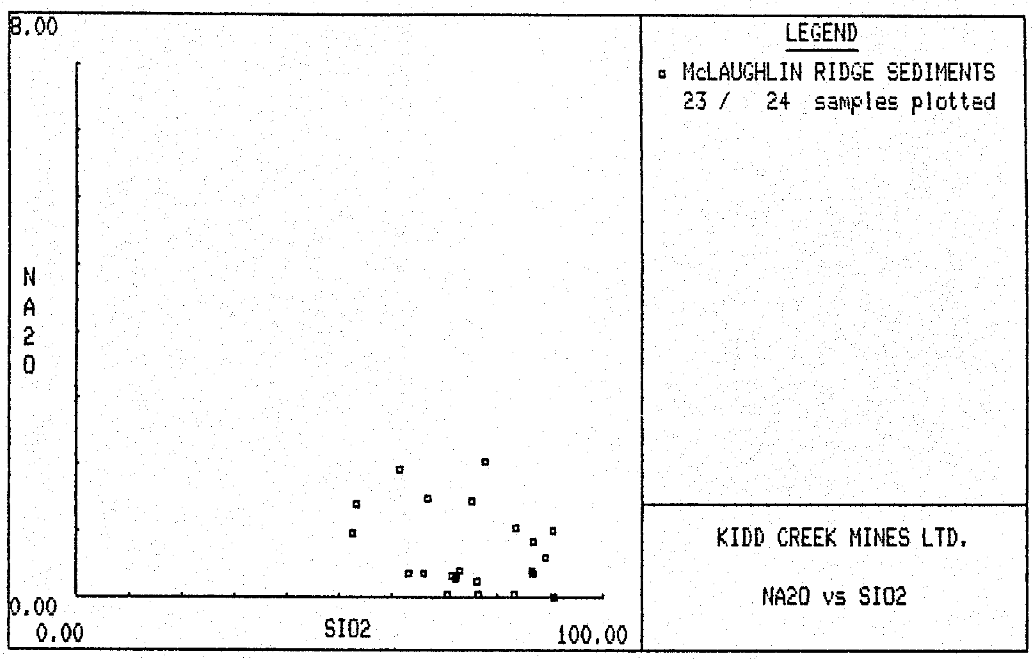

FIGURE 54 : Na2O vs SiO2 variation diagram; McLaughlin Ridge Sediments

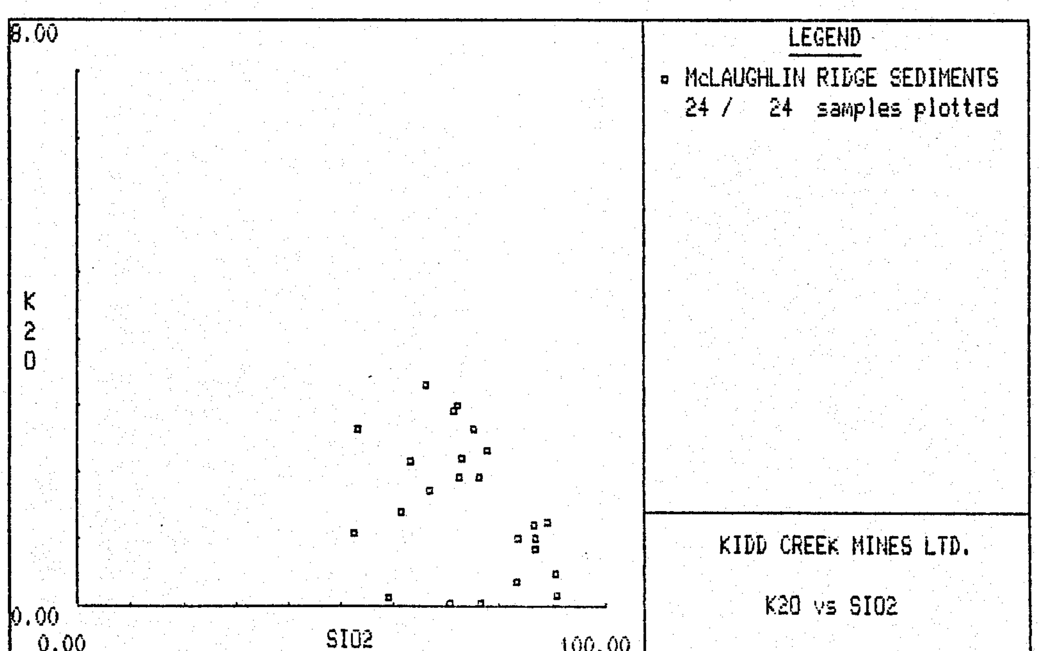

FIGURE 55 : K2O vs SiO2 variation diagram; McLaughlin Ridge Sediments

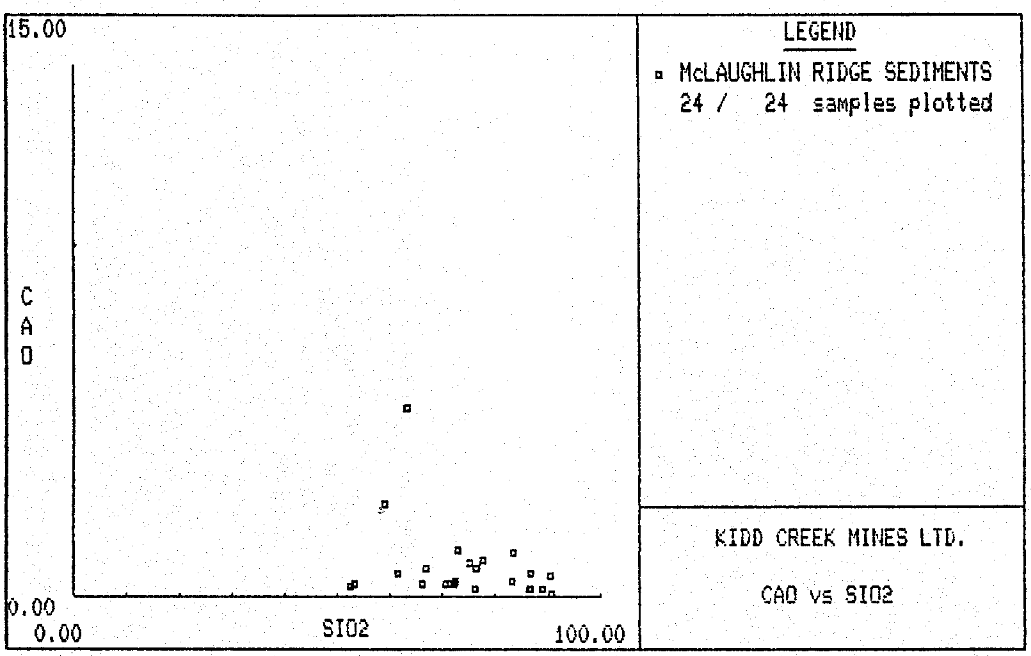

FIGURE 56 : CaO vs SiO2 variation diagram; McLaughlin Ridge Sediments

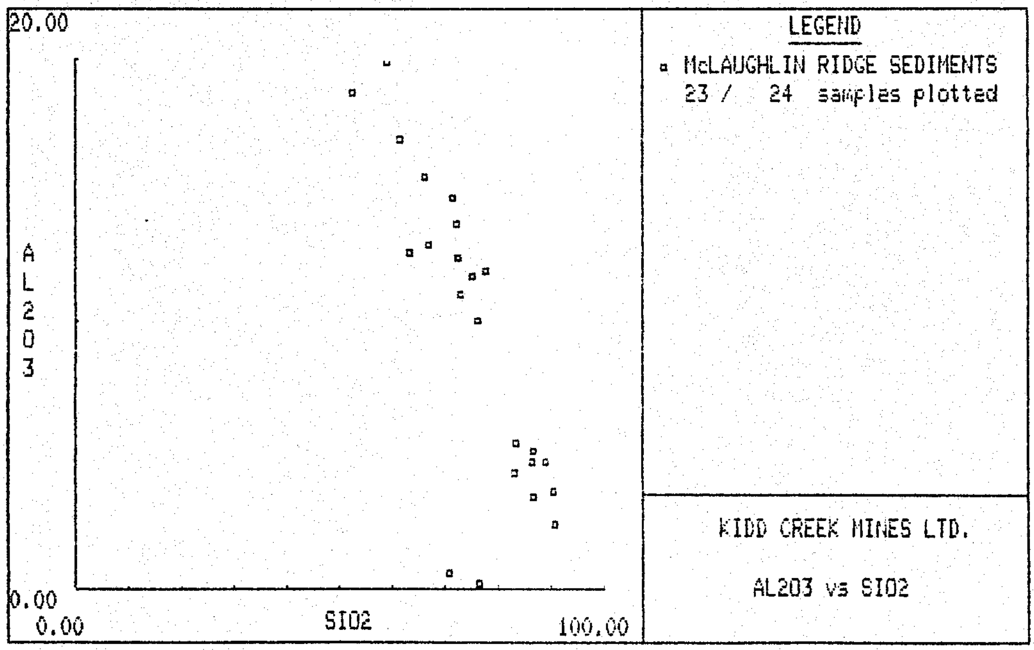

FIGURE 57 : Al2O3 vs SiO2 variation diagram; McLaughlin Ridge Formation

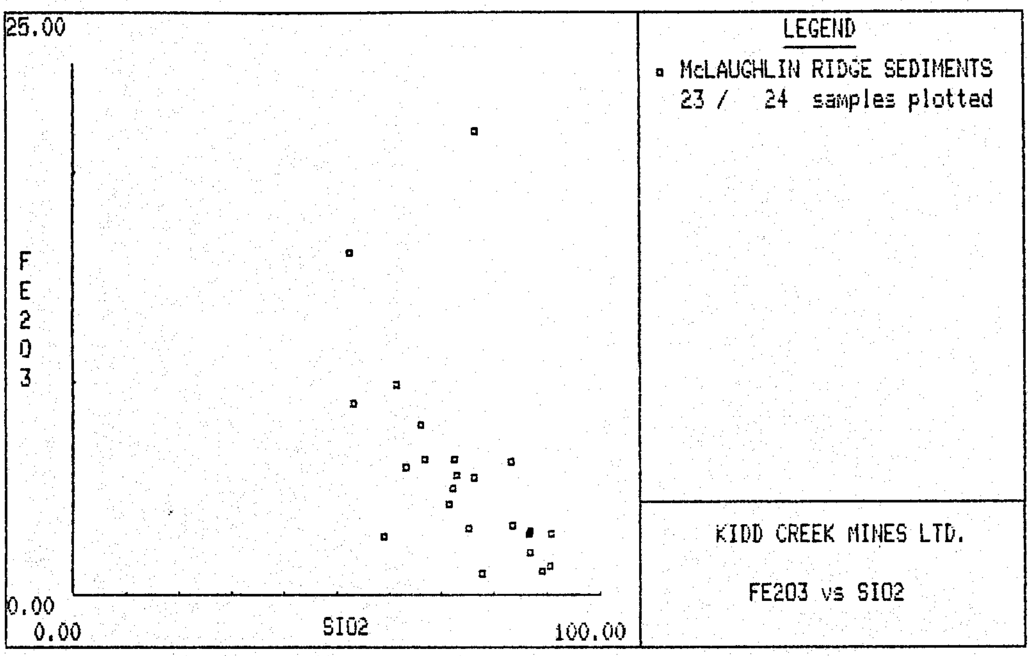

FIGURE 58 : Fe2O3 vs SiO2 variation diagram; McLaughlin Ridge Formation

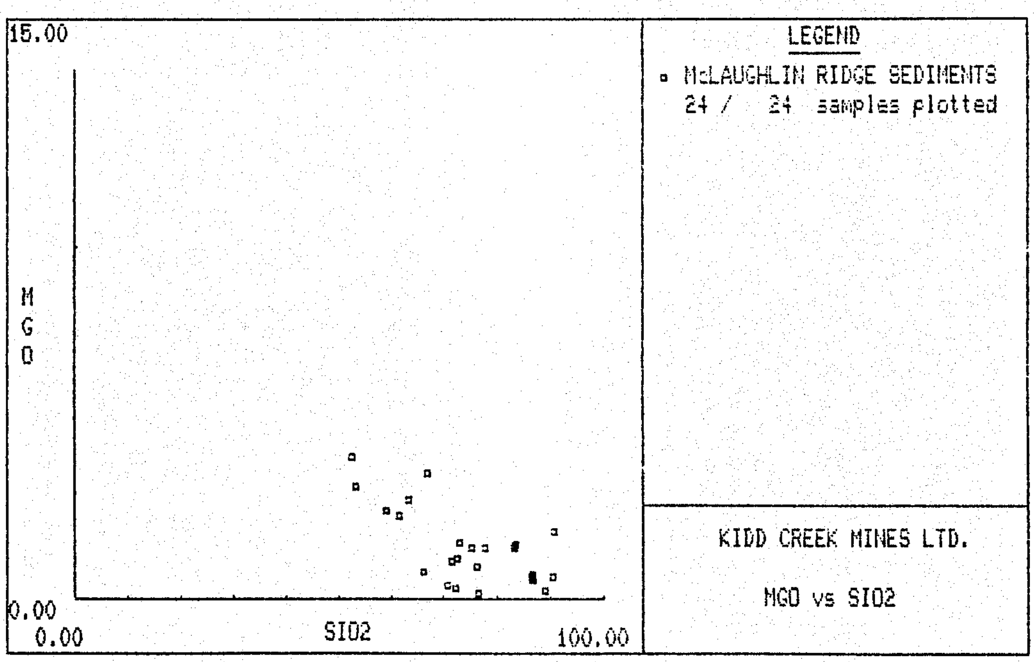

FIGURE 59 : MgO vs SiO2 variation diagram; McLaughlin Ridge Formation

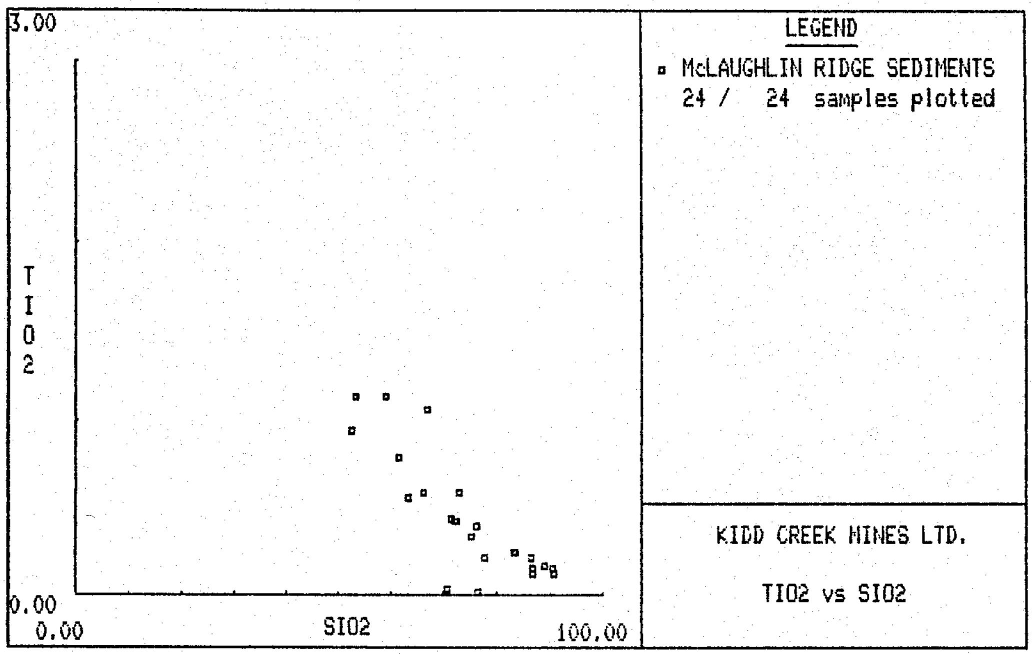

FIGURE 60 : TiO2 vs SiO2 variation diagram; McLaughlin Ridge Sediments

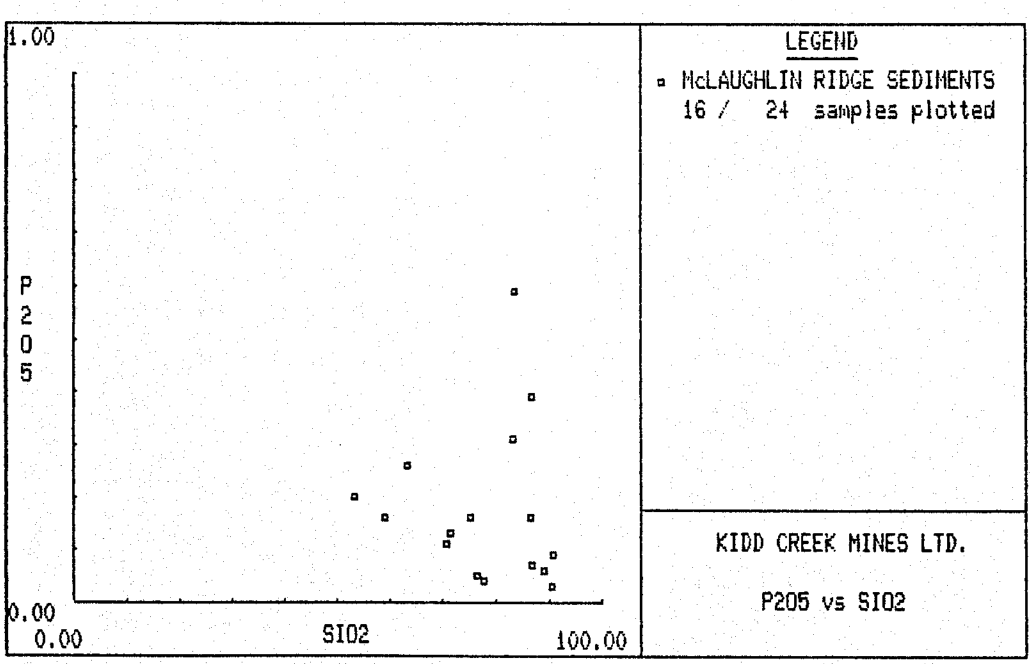

FIGURE 61 : P2O5 vs SiO2 variation diagram; McLaughlin Ridge Sediments

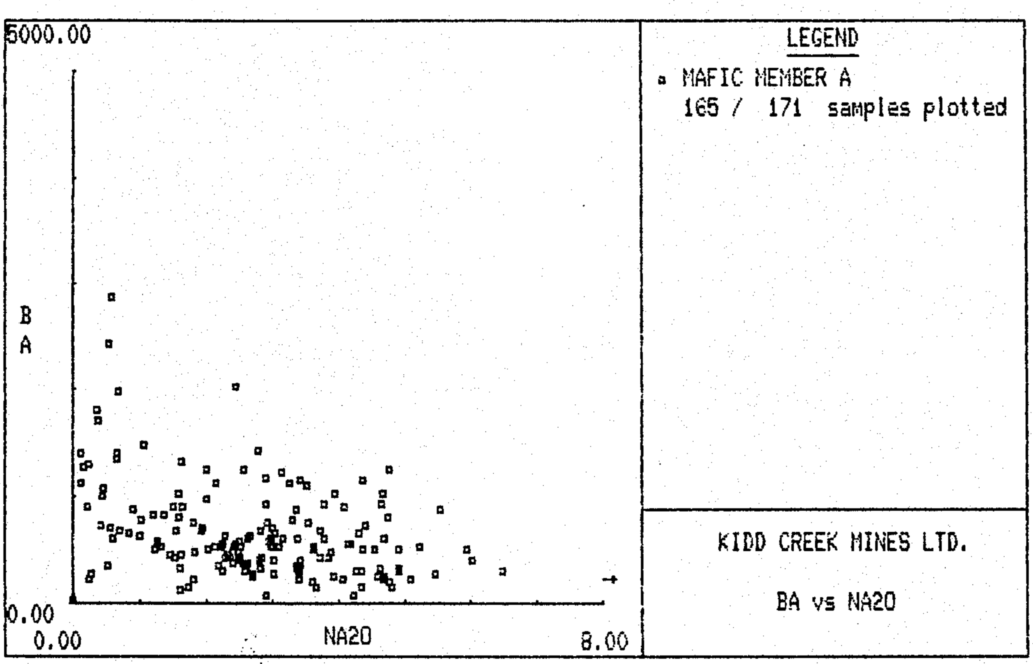

FIGURE 62a : Ba vs Na2O variation diagram; Mafic Member "A"

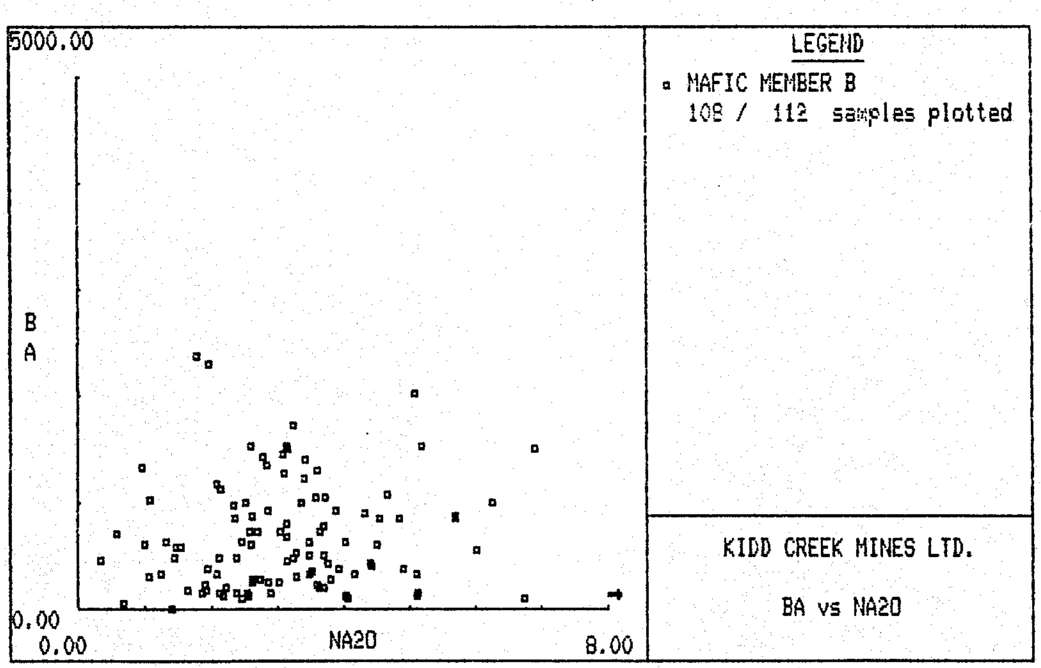

FIGURE 62b : Ba vs Na2O variation diagram; Mafic Member "B"

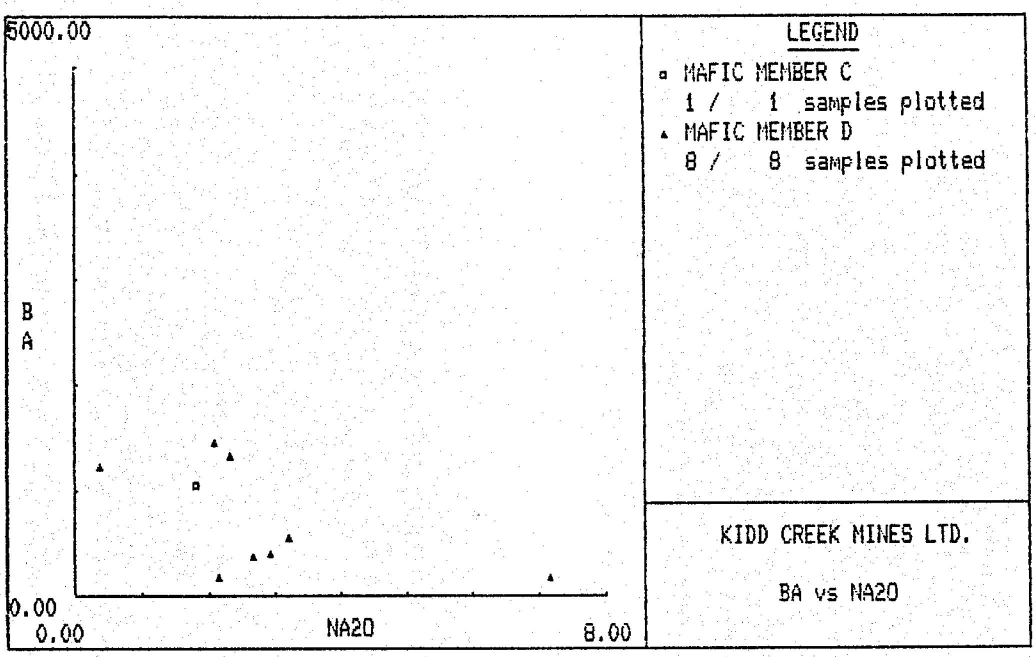

FIGURE 62c : Ba vs Na2O variation diagram; Mafic Members "C", and "D"

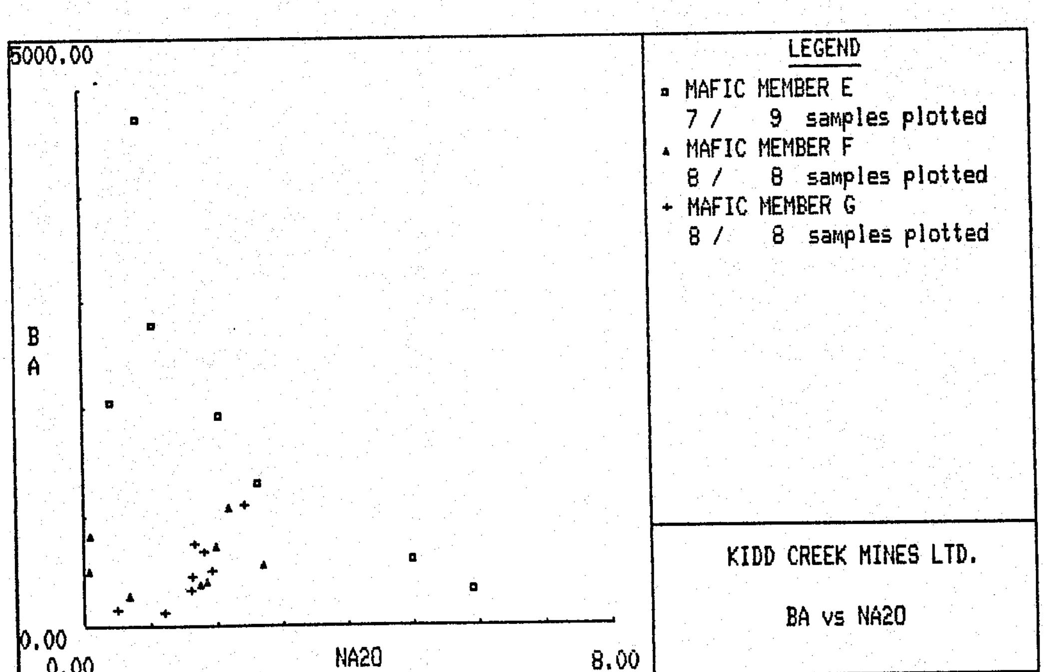

FIGURE 62d : Ba vs Na2O variation diagram; Mafic Members "E", "F", and "G"

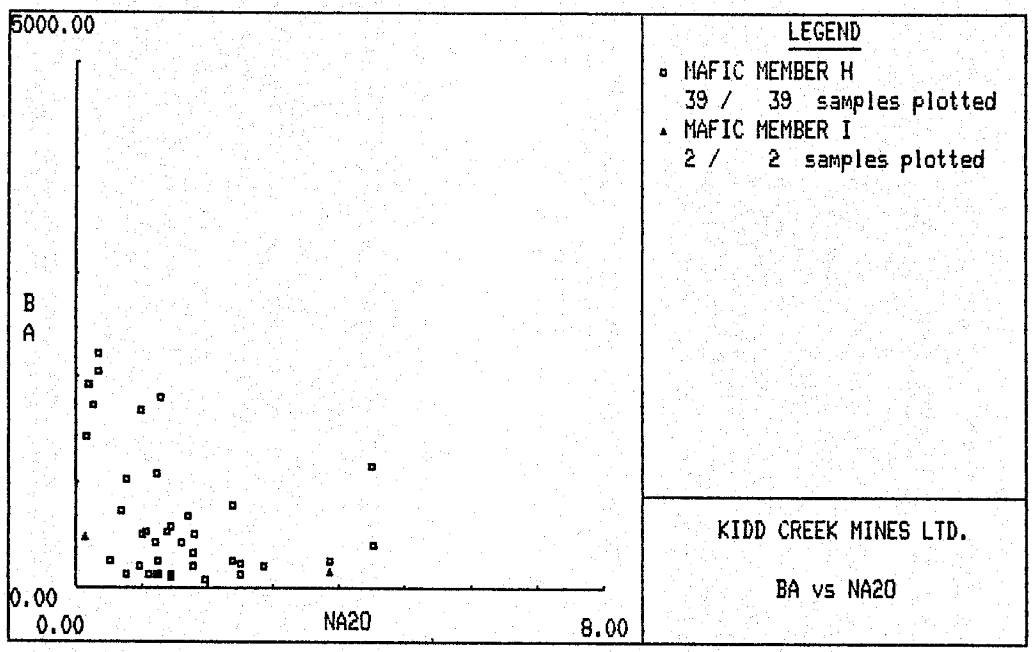

FIGURE 62e : Ba vs Na2O variation diagram; Mafic Members "H", and "I"

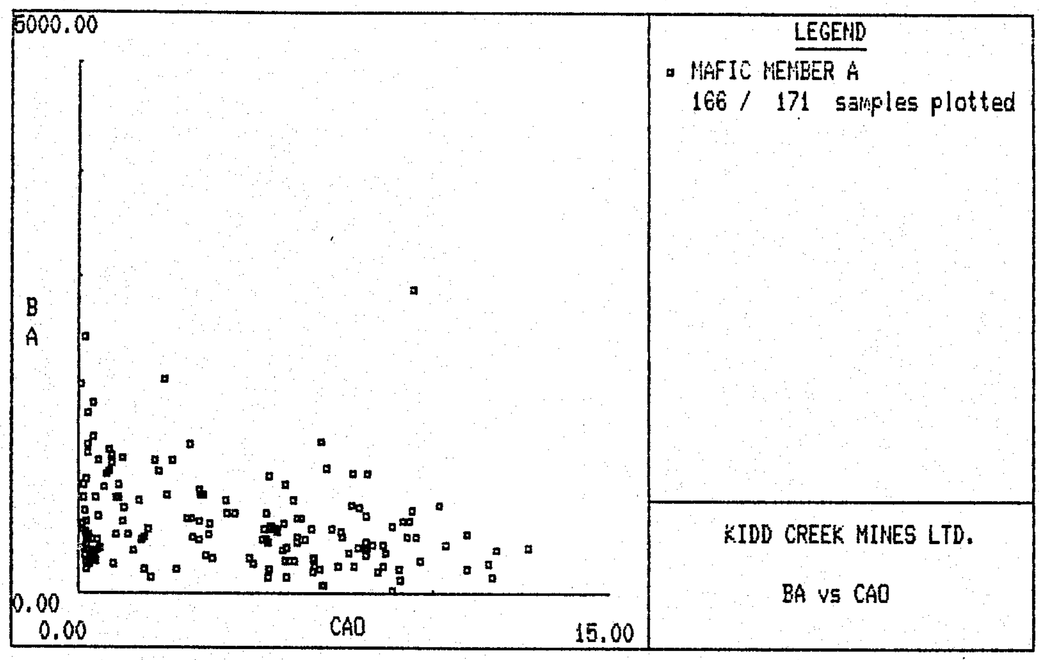

FIGURE 63a : Ba vs CaO variation diagram; Mafic Member "A"

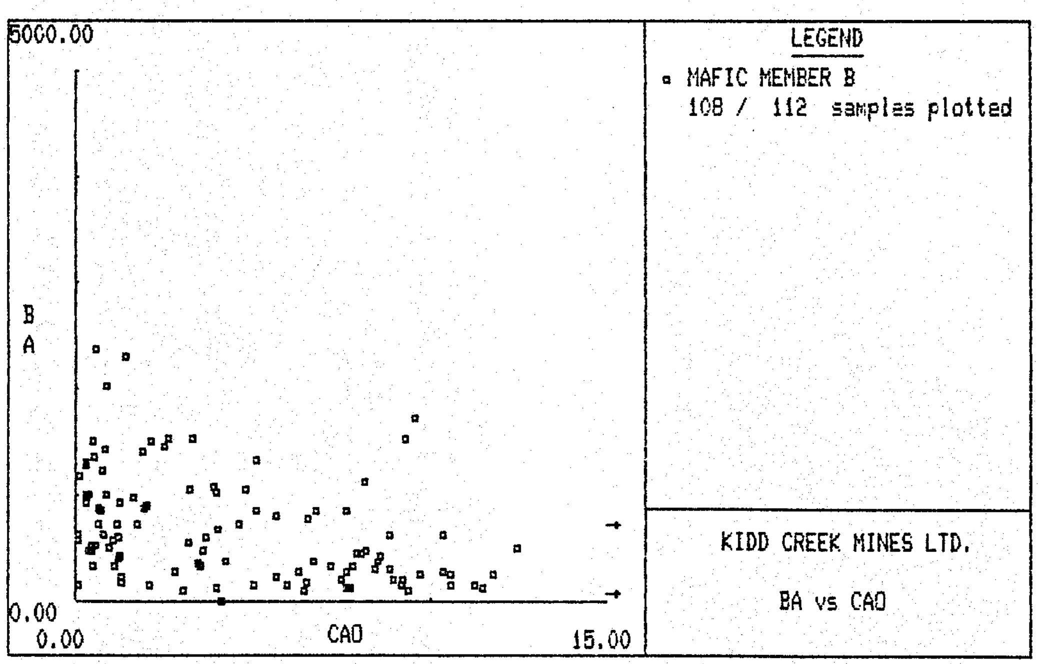

FIGURE 63b : Ba vs CaO variation diagram; Mafic Member "B"

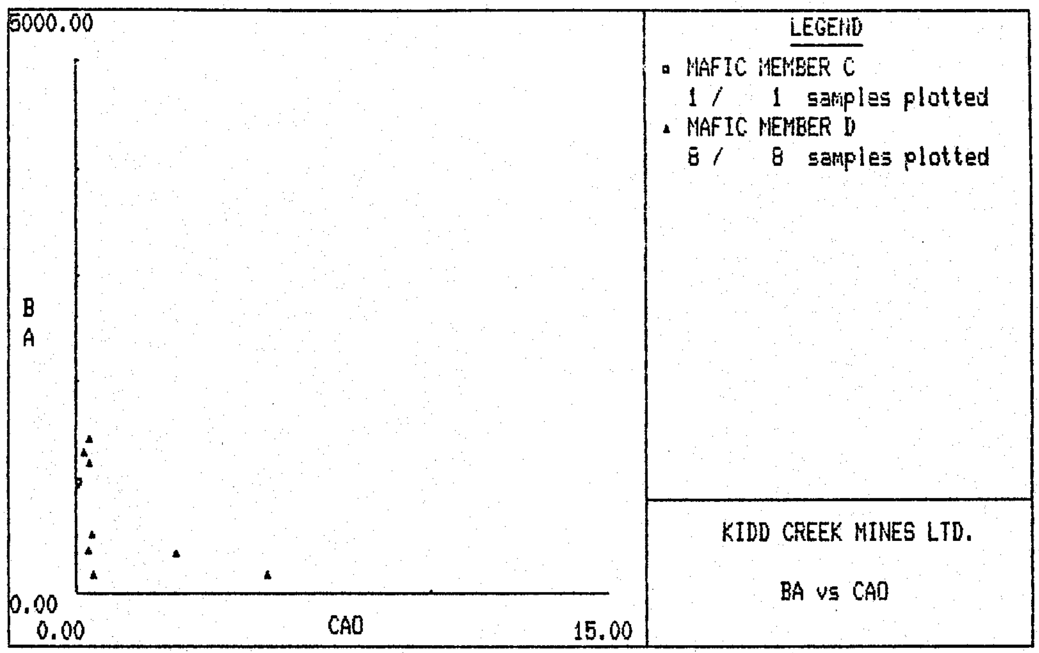

FIGURE 63c : Ba vs CaO variation diagram; Mafic Members "C", and "D"

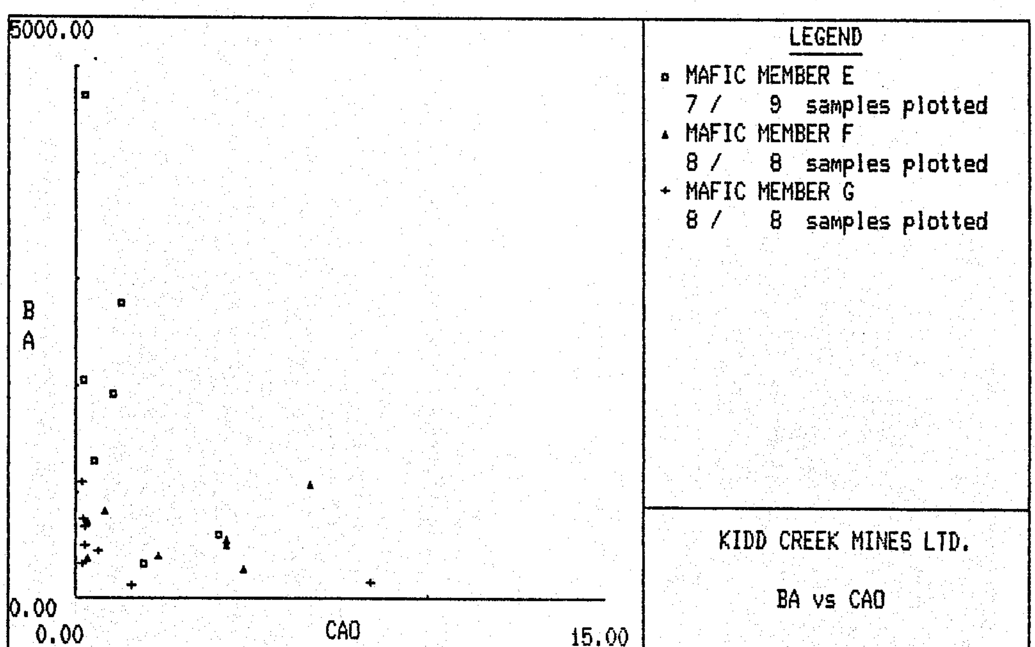

FIGURE 63d : Ba vs CaO variation diagram; Mafic Members "E", "F", and "G"

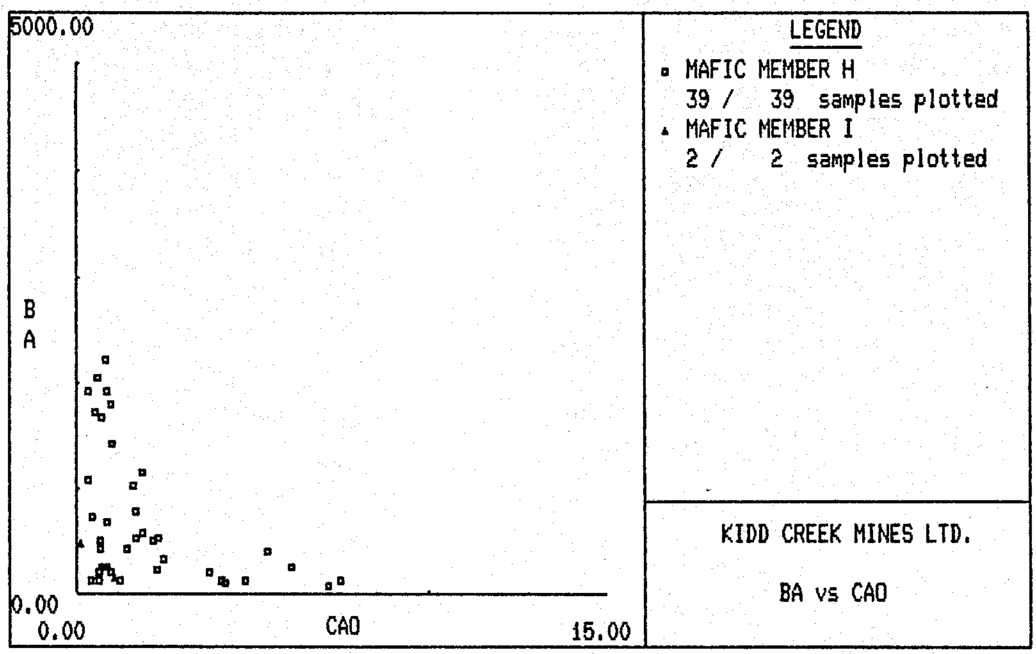

FIGURE 63e : Ba vs CaO variation diagram; Mafic Members "H", and "I"

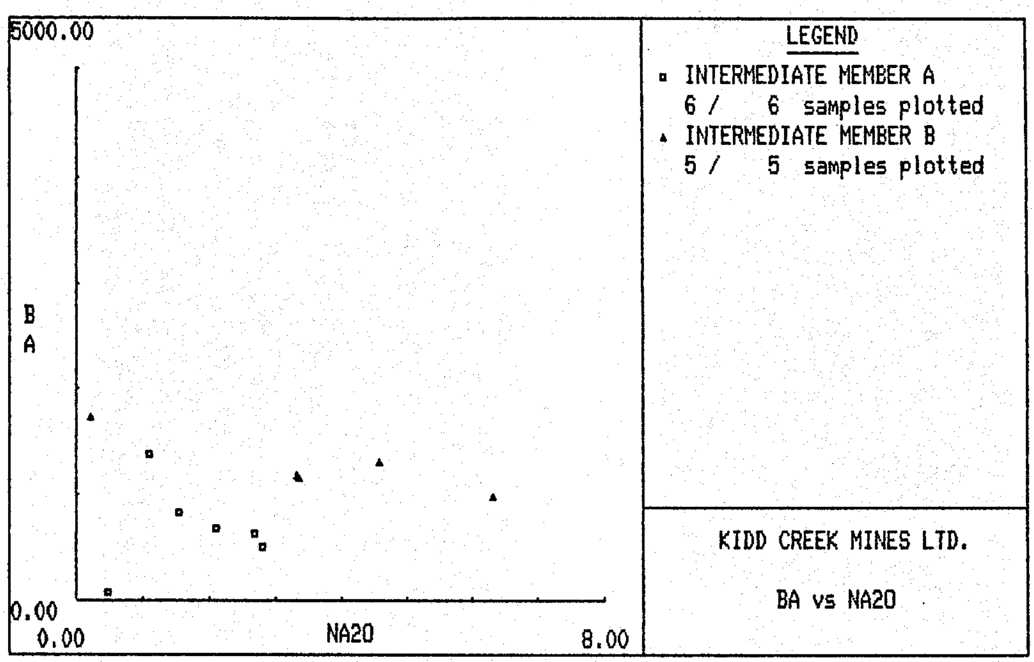

FIGURE 64a : Ba vs Na2O variation diagram; Intermediate Members "A", and "B"

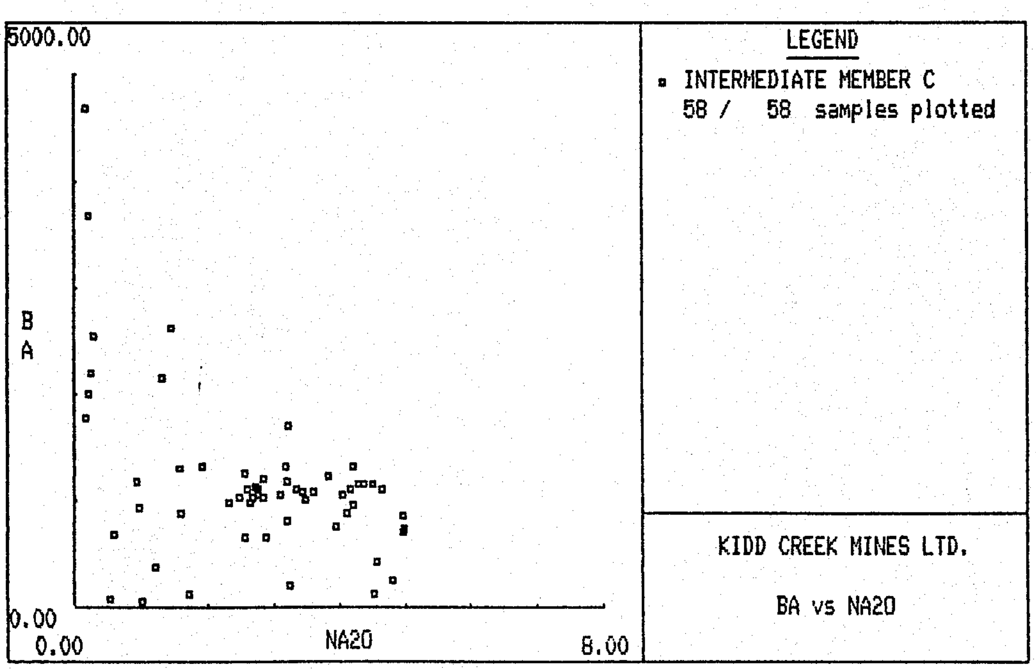

FIGURE 64b : Ba vs Na2O variation diagram; Intermediate Member "C"

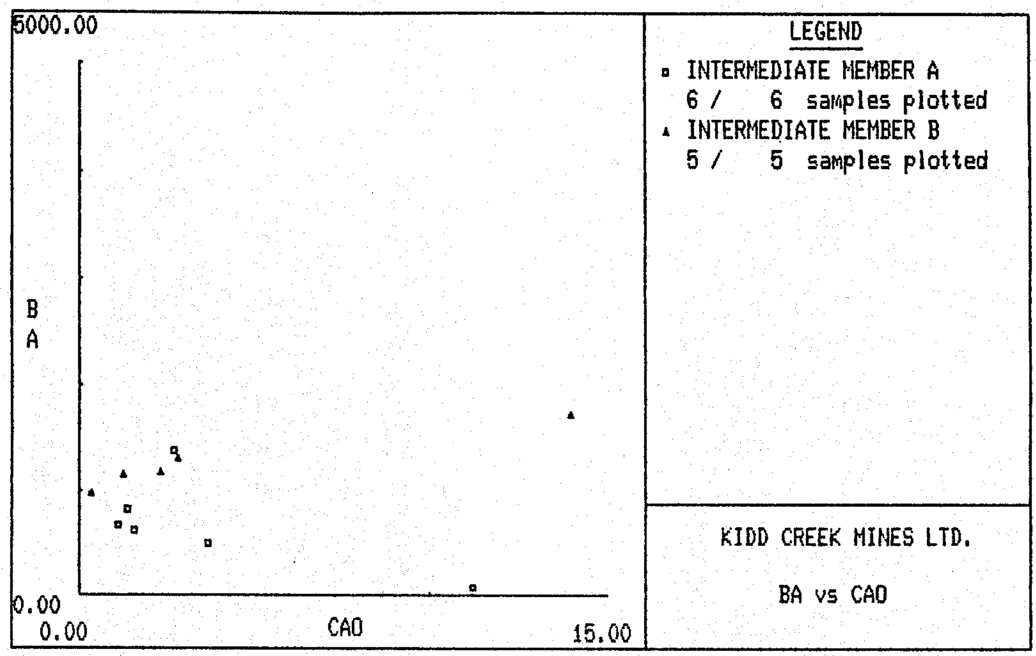

FIGURE 65a : Ba vs CaO variation diagram; Intermediate Members "A", and "B"

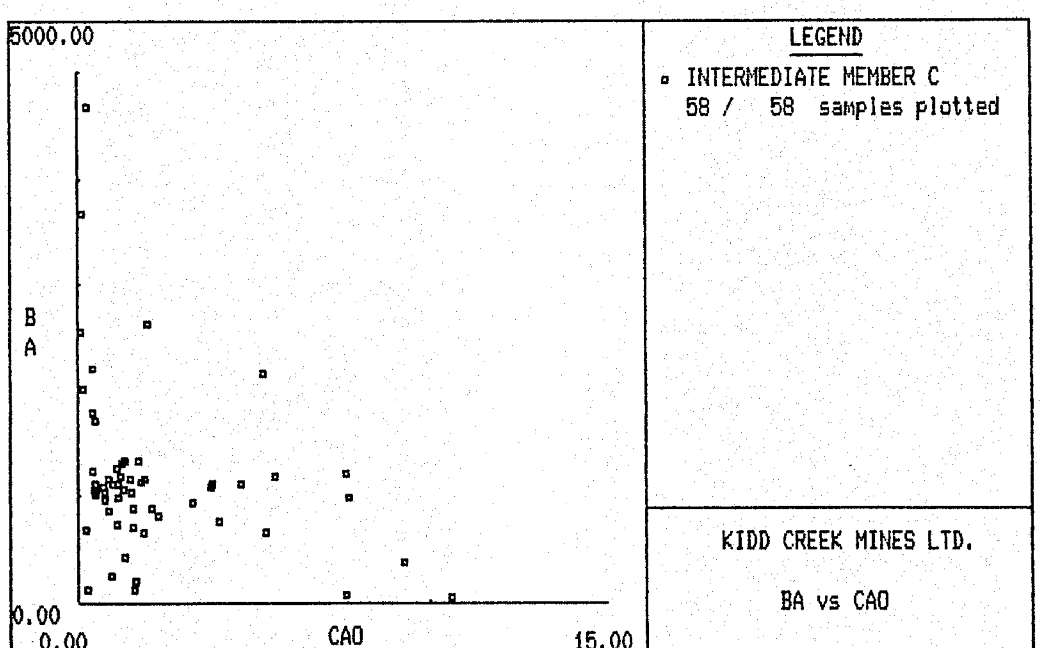

FIGURE 65b : Ba vs CaO variation diagram; Intermediate Member "C"

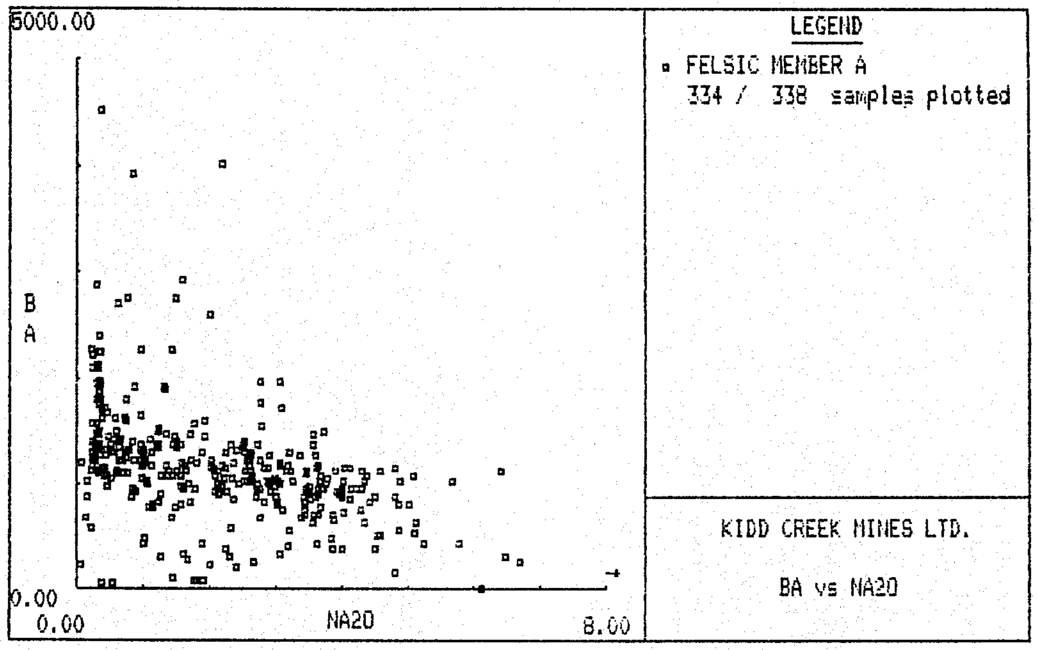

FIGURE 66a : Ba vs Na2O variation diagram; Felsic Member "A"

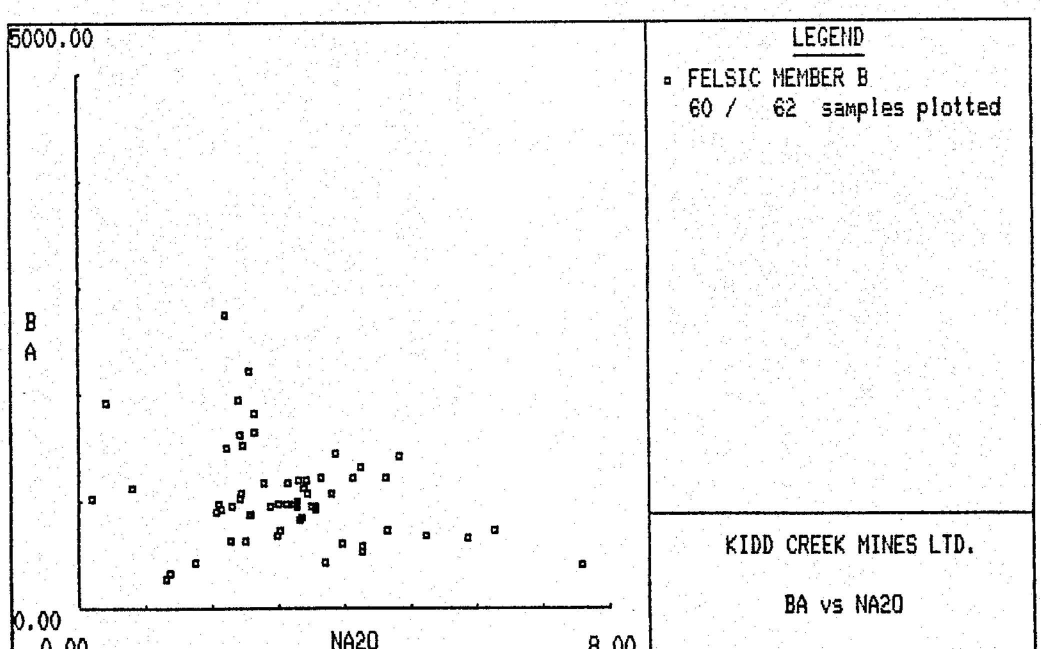

FIGURE 66b : Ba vs Na2O variation diagram; Felsic Member "B"

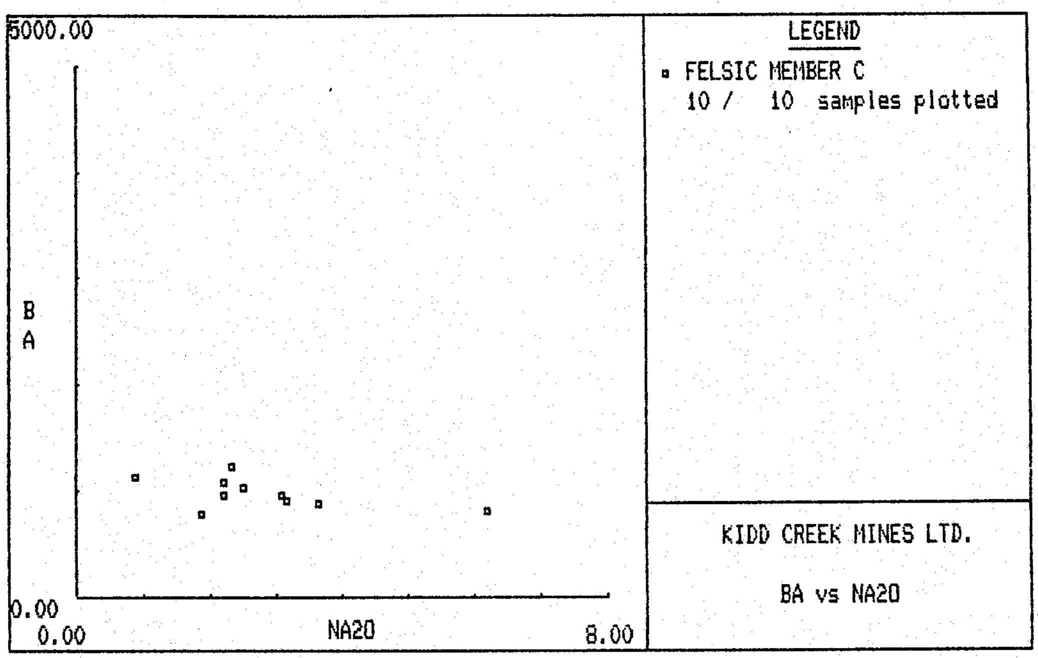

FIGURE 66c : Ba vs Na2O variation diagram; Felsic Member "C"

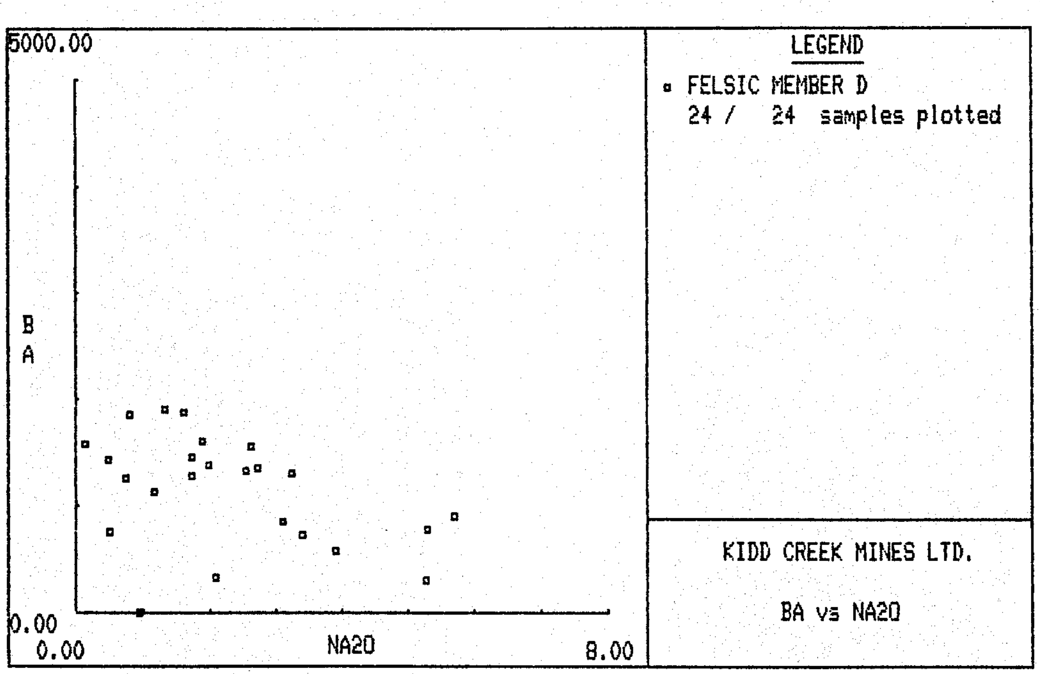

FIGURE 66d : Ba vs Na2O variation diagram; Felsic Member "D"

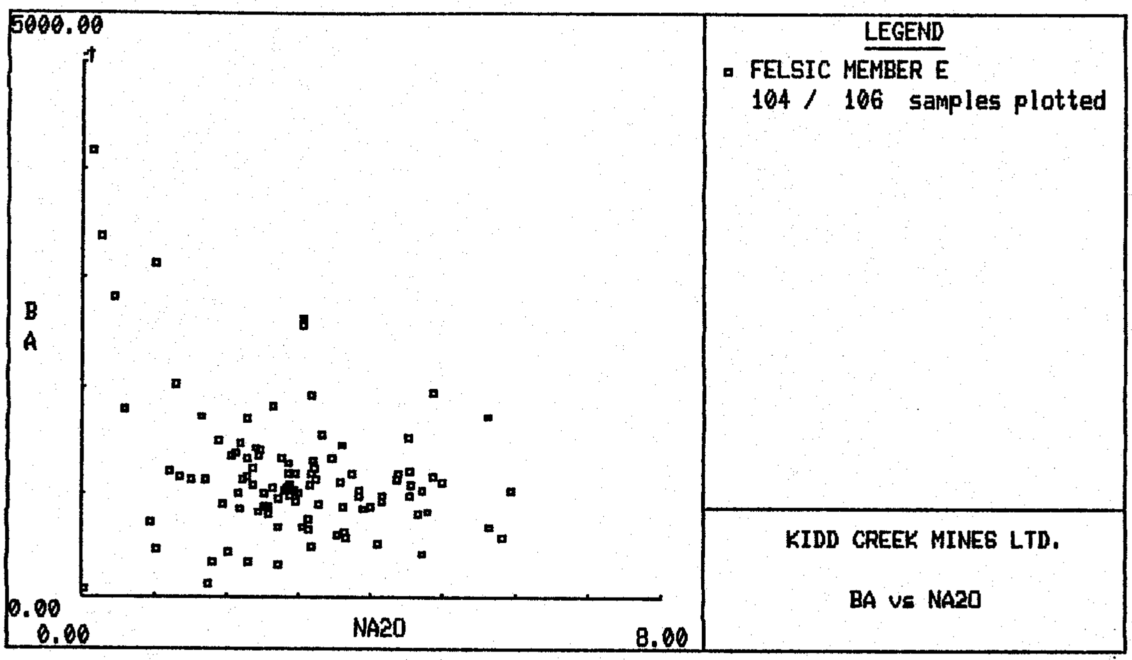

FIGURE 66e : Ba vs Na2O variation diagram; Felsic Member "E"

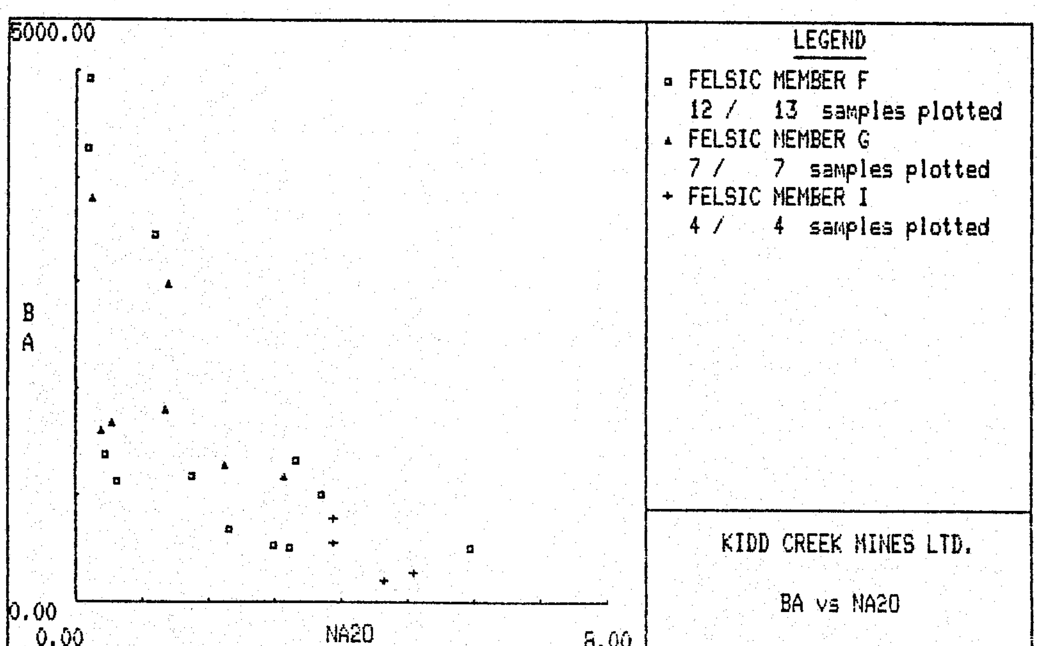

FIGURE 66f : Ba vs Na2O variation diagram; Felsic Members "F", "G", and "I"

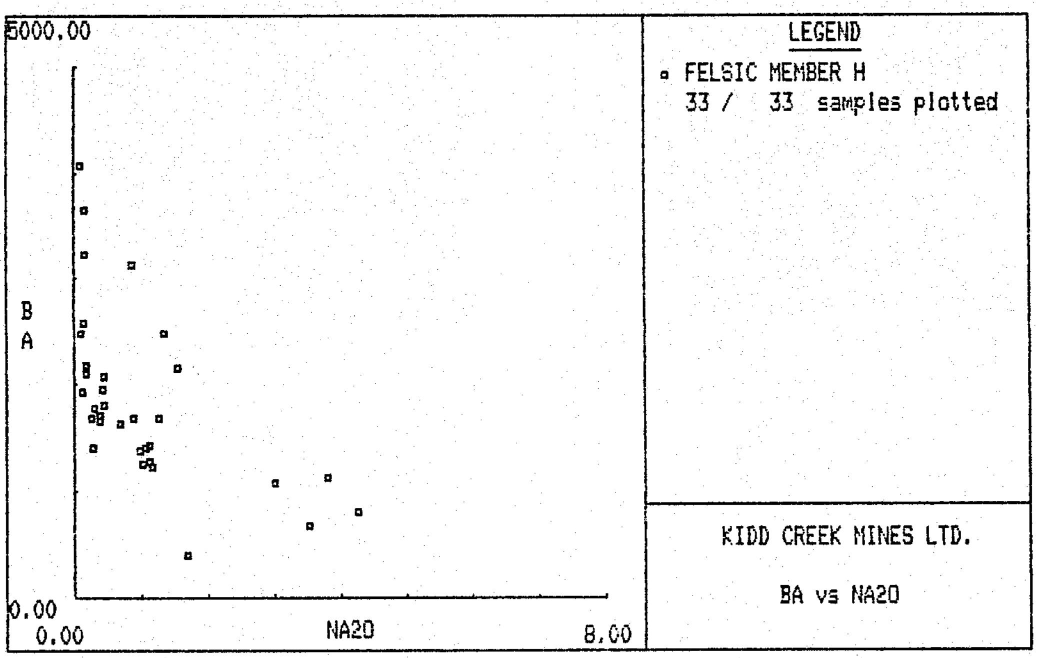

FIGURE 66g : Ba vs Na2O variation diagram; Felsic Member "H"

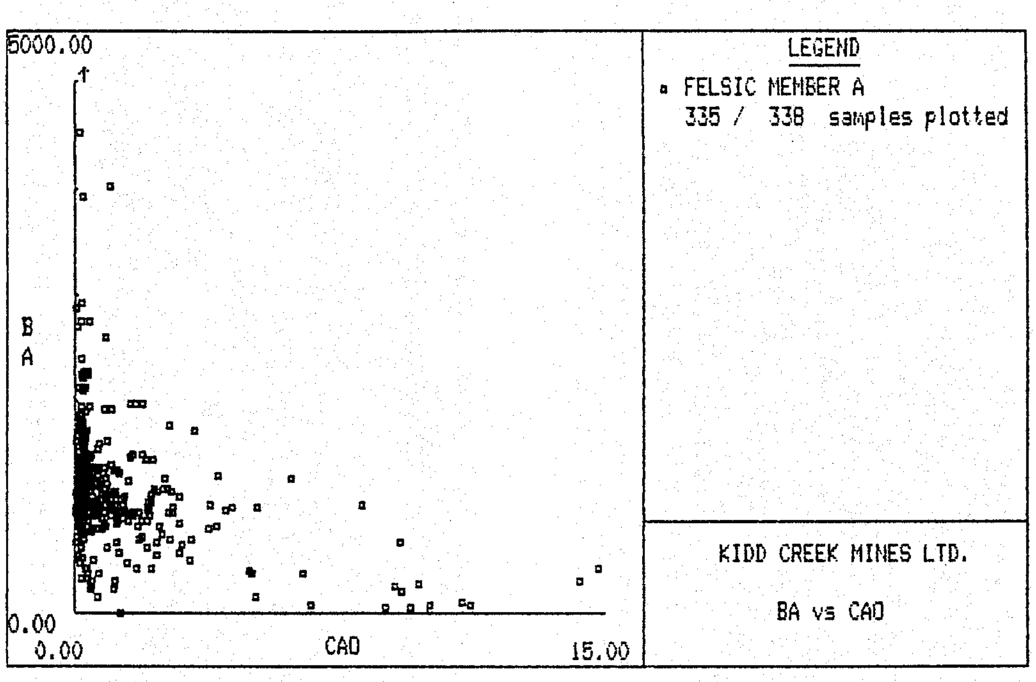

FIGURE 67a : Ba vs CaO variation diagram; Felsic Member "A"

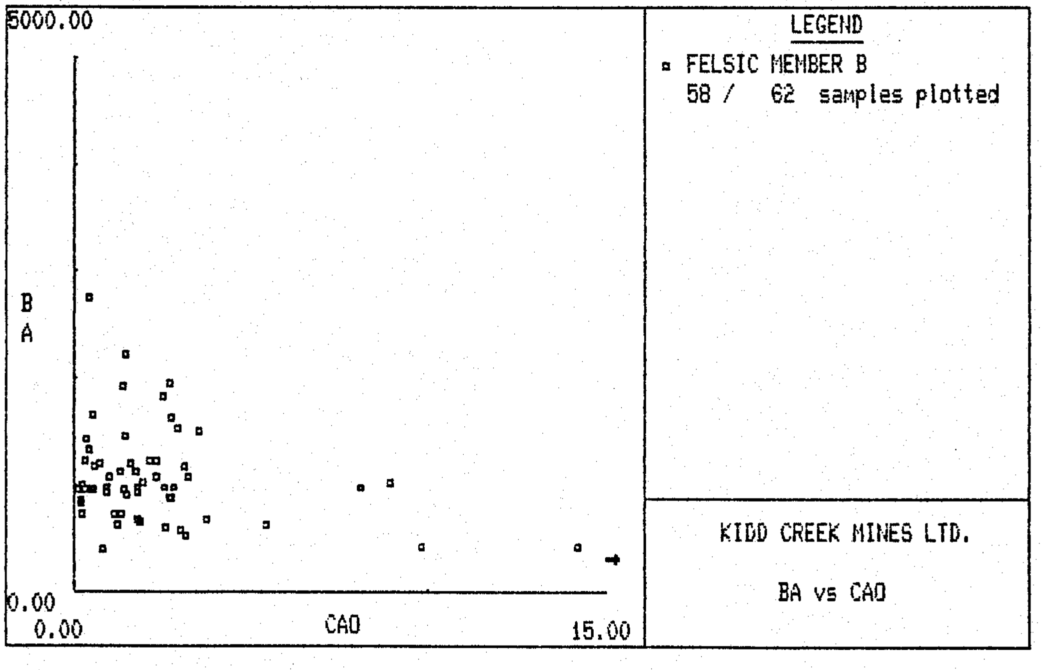

FIGURE 67b : Ba vs CaO variation diagram; Felsic Member "B"

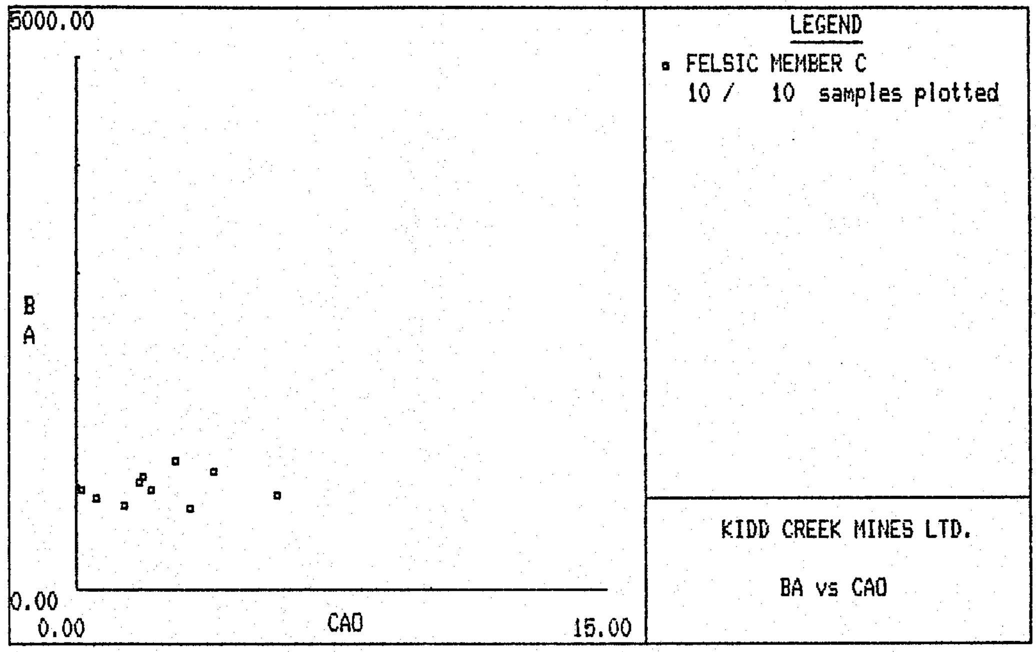

FIGURE 67c : Ba vs CaO variation diagram; Felsic Member "C"

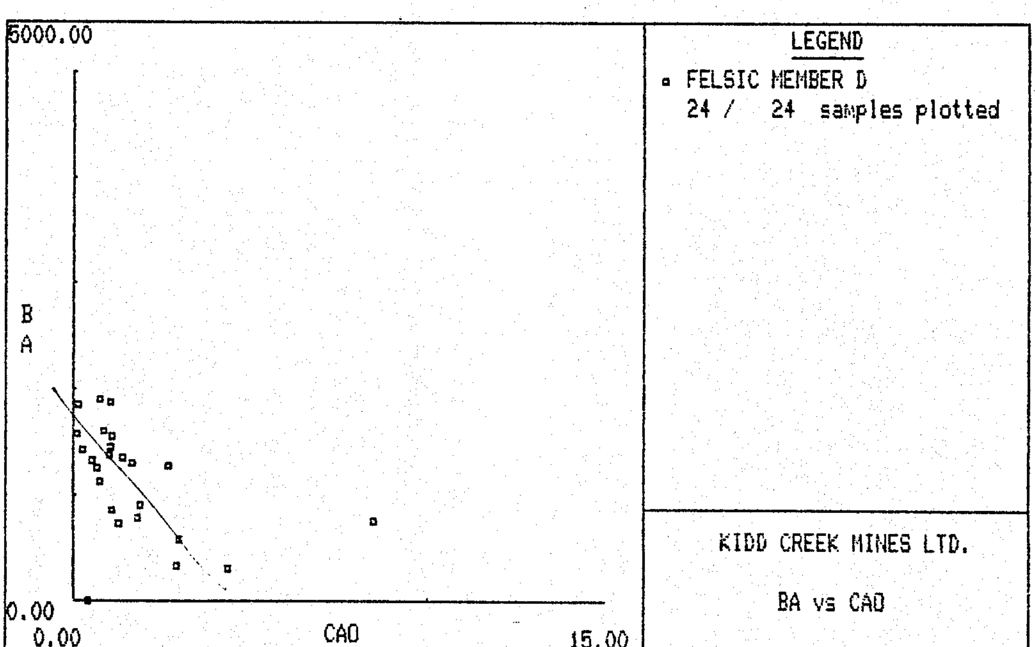

FIGURE 67d : Ba vs CaO variation diagram; Felsic Member "D"

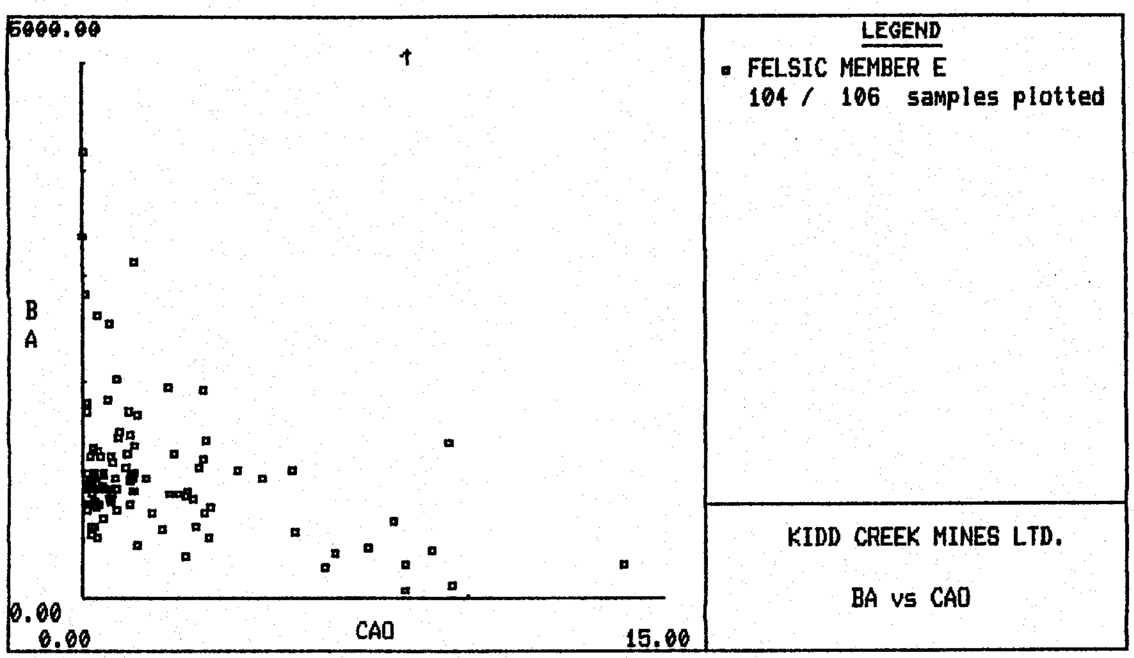

FIGURE 67e : Ba vs CaO variation diagram; Felsic Member "E"

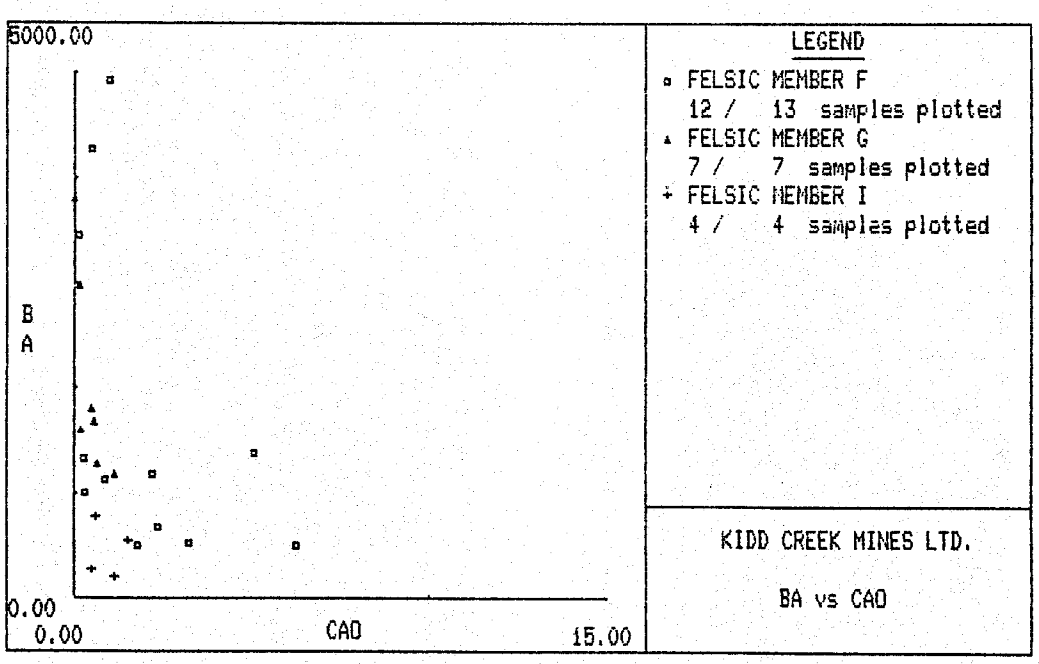

FIGURE 67f : Ba vs CaO variation diagram; Felsic Members "F", "G", and "I"

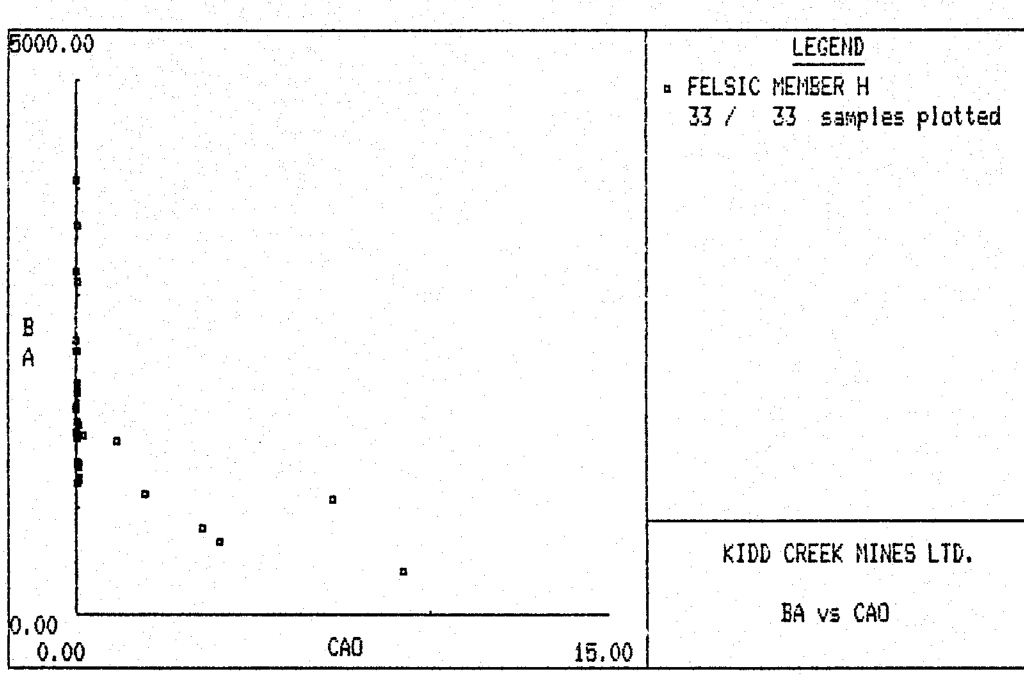

FIGURE 67g : Ba vs CaO variation diagram; Felsic Member "H"

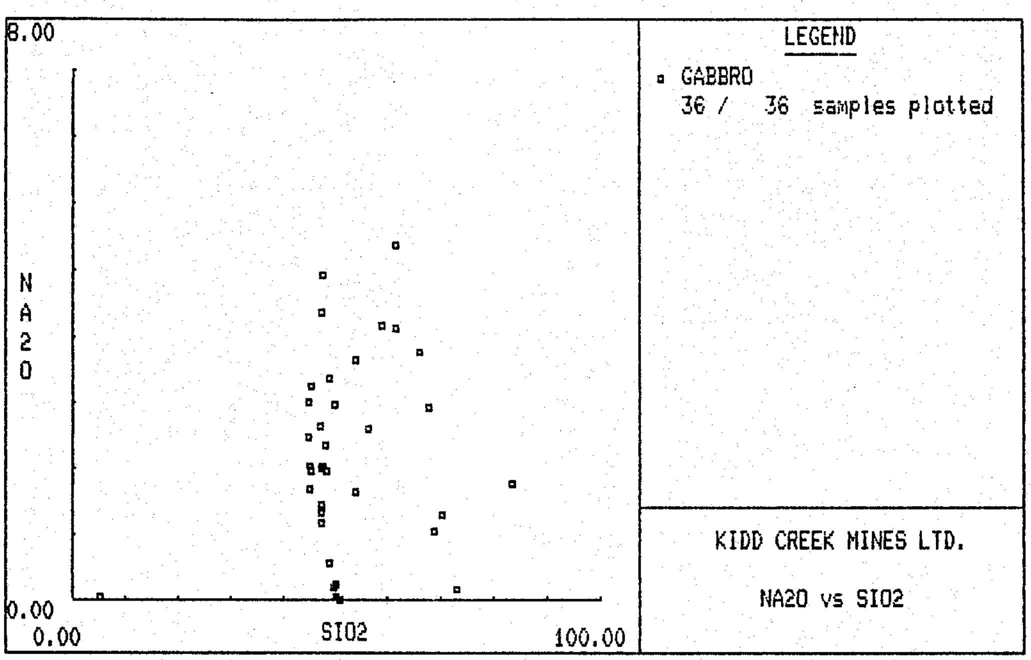

FIGURE 68 : Na2O vs SiO2 variation diagram; Karmutsen Fm.

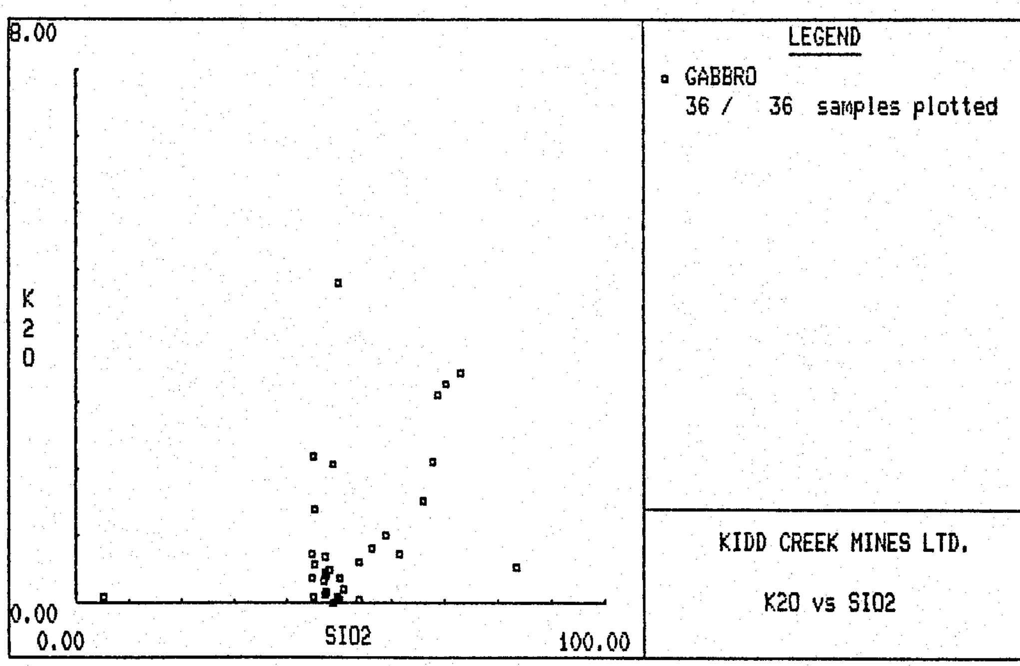

FIGURE 69 : K2O vs SiO2 variation diagram; Karmutsen Fm.

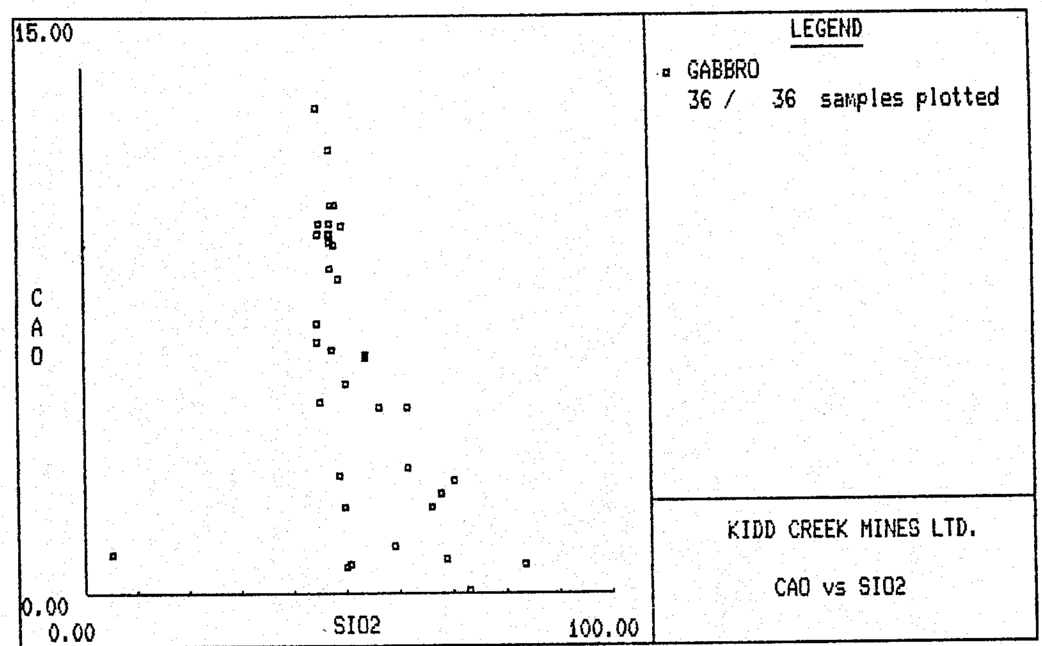

FIGURE 70 : CaO vs SiO2 variation diagram; Karmutsen Fm.

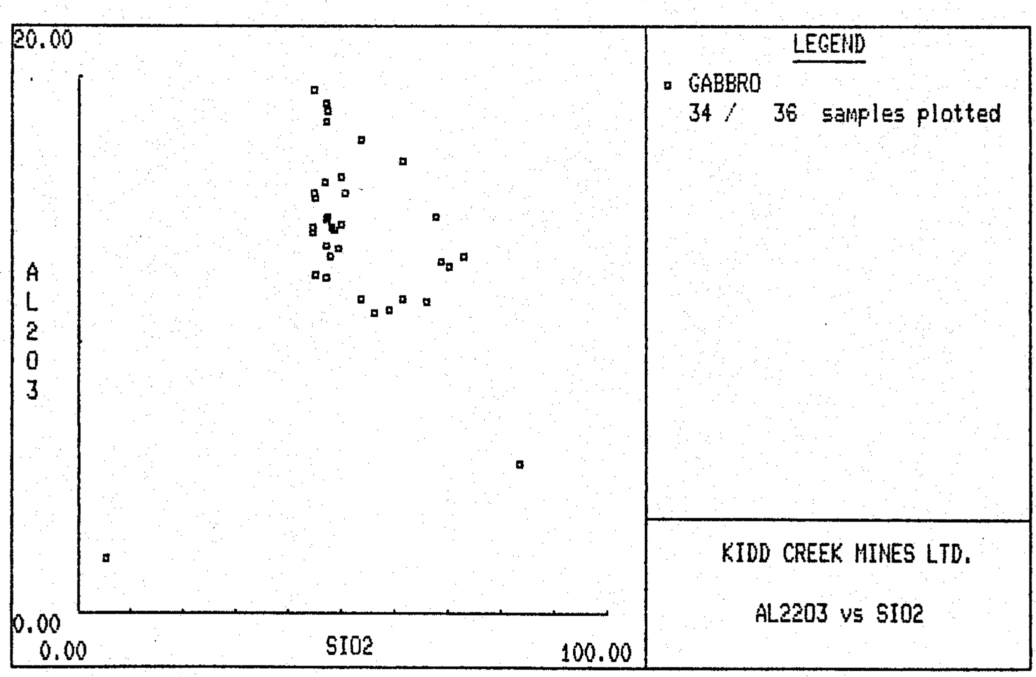

FIGURE 71 : Al2O3 vs SiO2 variation diagram; Karmutsen Fm.

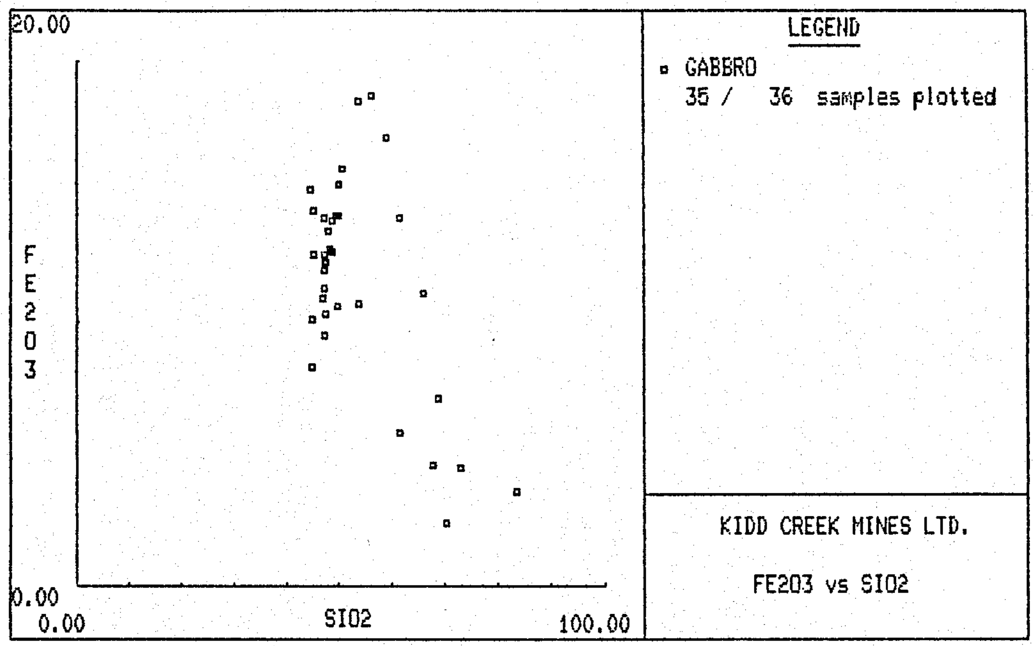

FIGURE 72 : Fe2O3 vs SiO2 variation diagram; Karmutsen Fm.

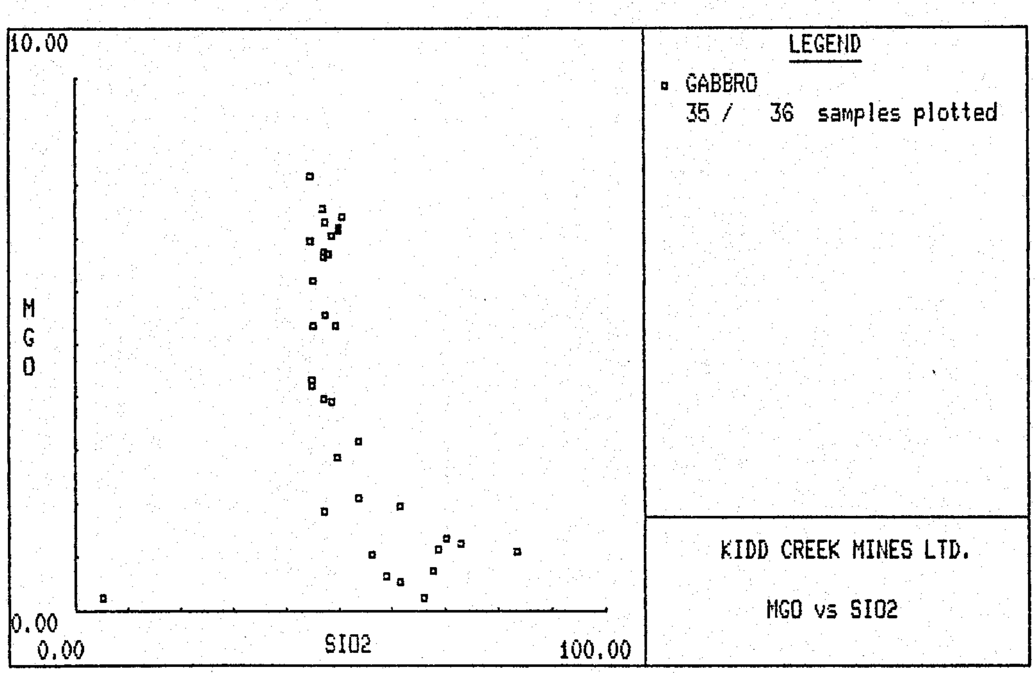

FIGURE 73 : MgO vs SiO2 variation diagram; Karmutsen Fm.

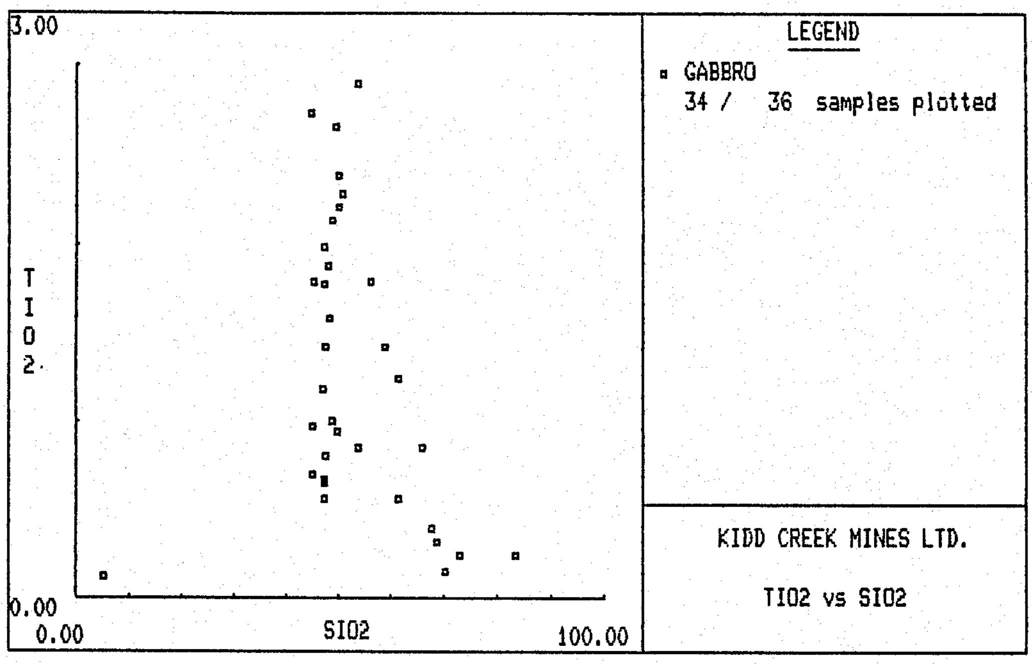

FIGURE 74 : TiO2 vs SiO2 variation diagram; Karmutsen Fm.

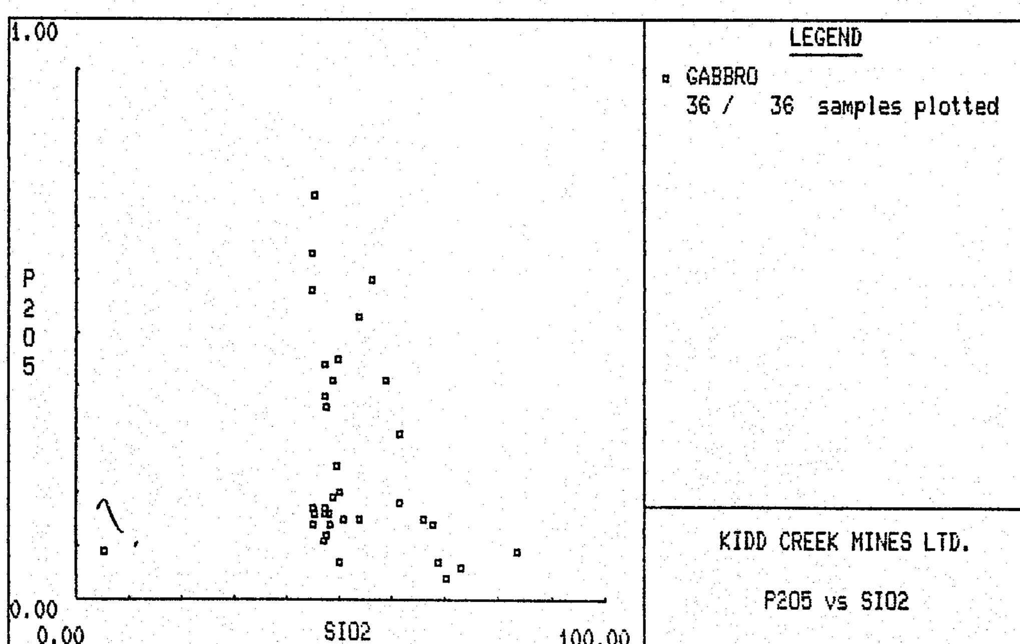

FIGURE 75 : P2O5 vs SiO2 variation diagram; Karmutsen Fm.

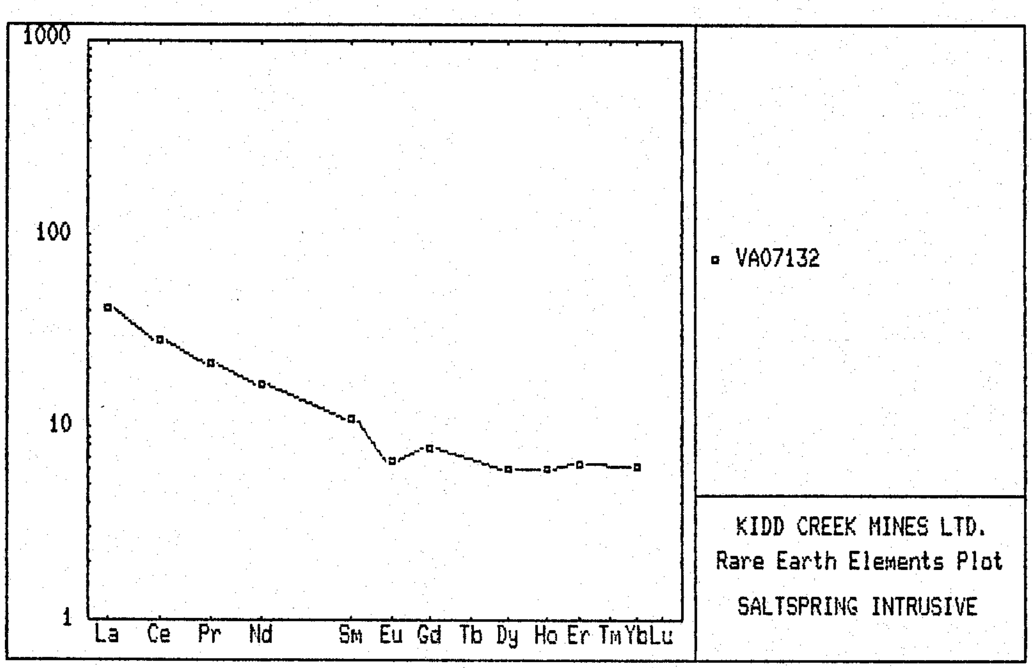

FIGURE 76 : Chondrite-normalized REE diagram; Saltspring Island Intrusion

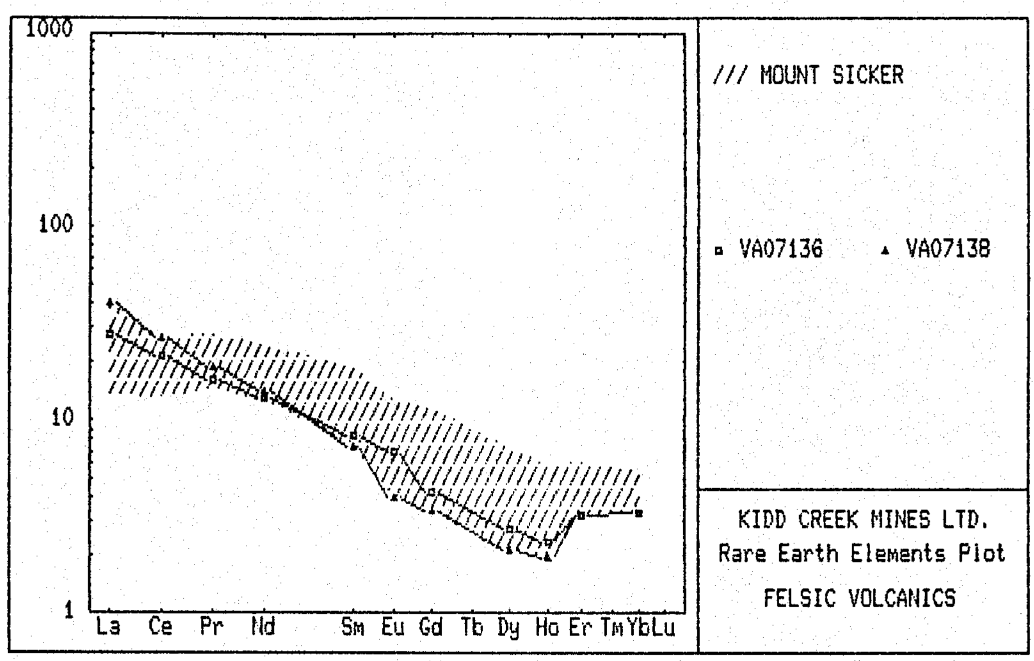

FIGURE 77a : Chondrite-normalized REE diagram; Mt. Sicker volcanics

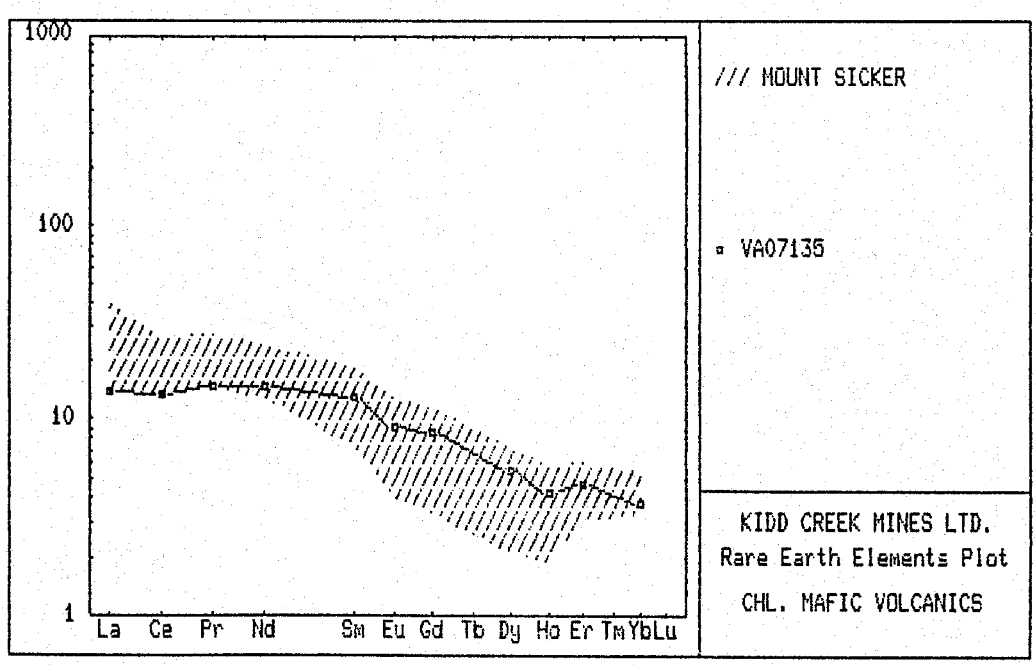

FIGURE 77b : Chondrite-normalized REE diagram; Mt. Sicker volcanics

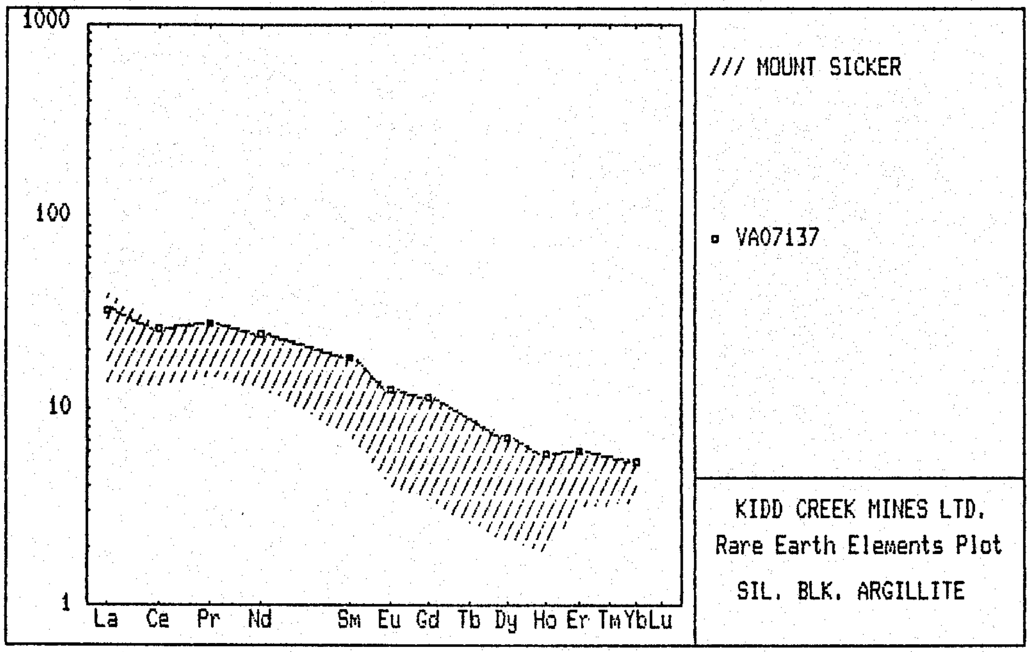

FIGURE 77c : Chondrite-normalized REE diagram; Mt. Sicker volcanics

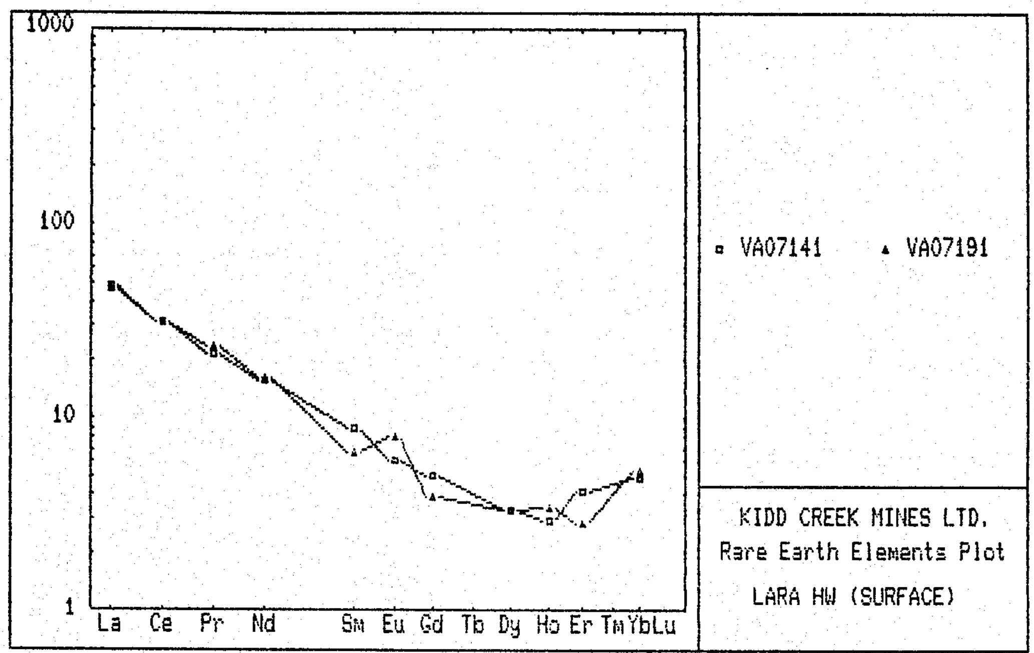

FIGURE 78a : Chondrite-normalized REE diagram; Lara claims

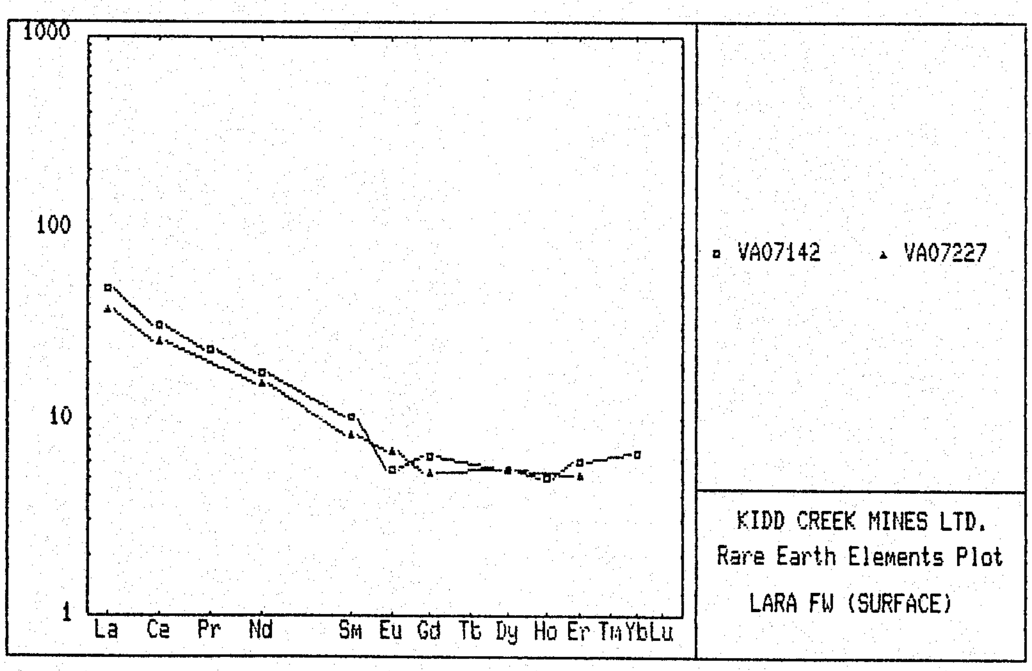

FIGURE 78b : Chondrite-normalized REE diagram; Lara claims

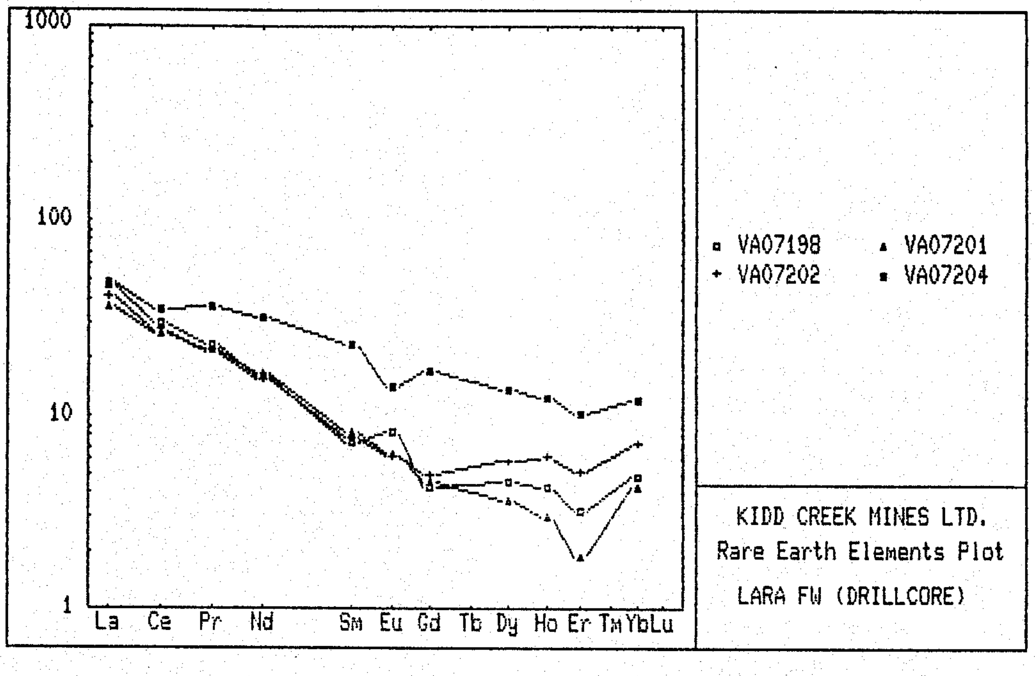

FIGURE 78c : Chondrite-normalized REE diagram; Lara claims

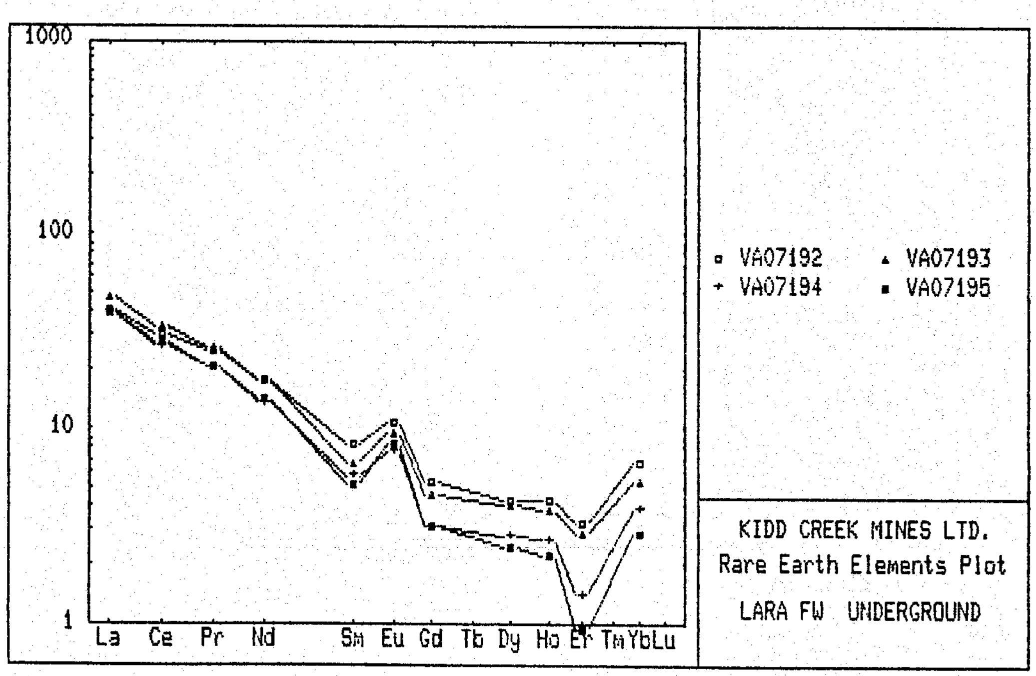

FIGURE 78d : Chondrite-normalized REE diagram; Lara claims

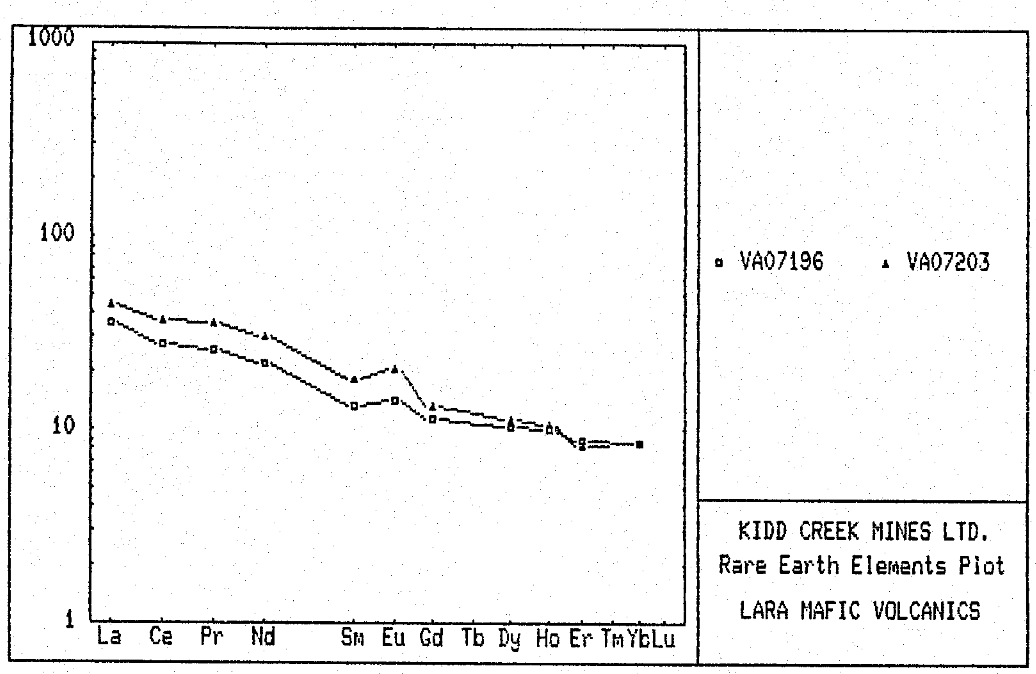

FIGURE 78e : Chondrite-normalized REE diagram; Lara claims

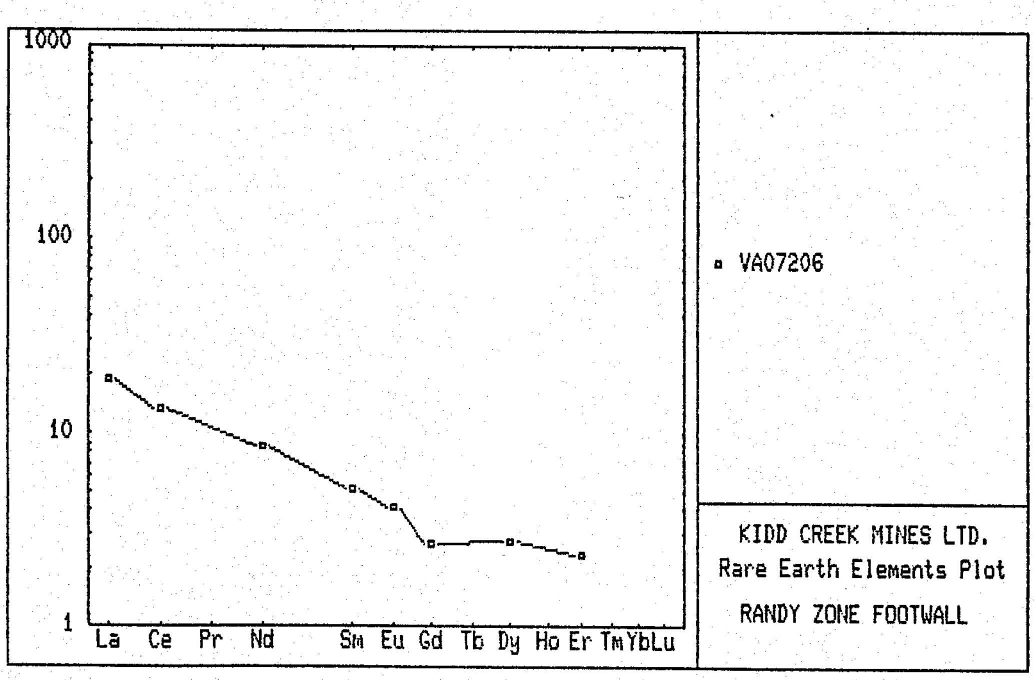

FIGURE 78f : Chondrite-normalized REE diagram; Lara claims

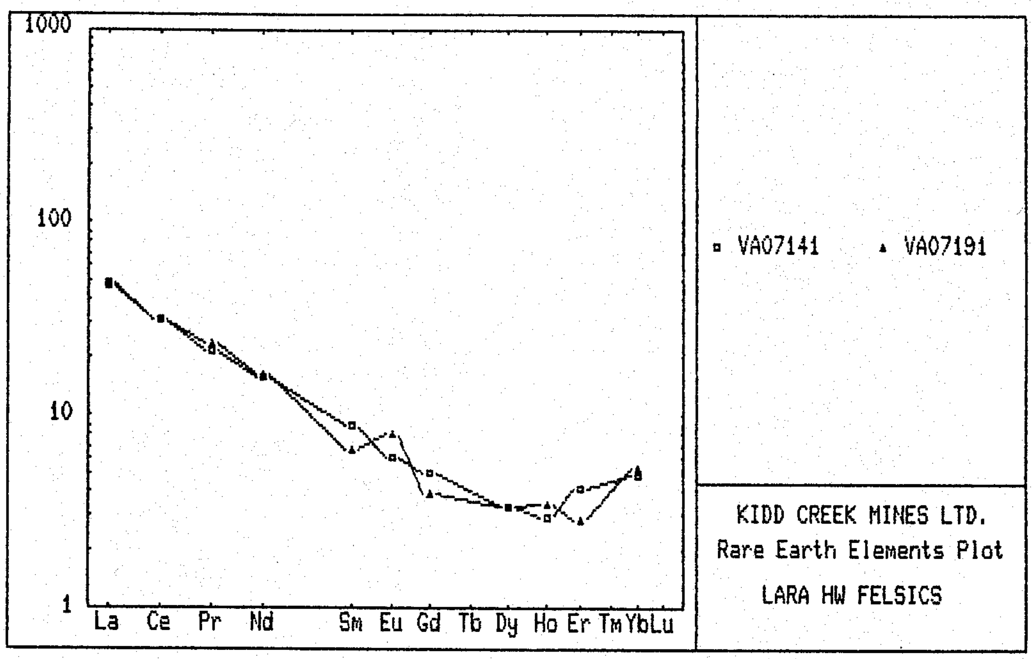

FIGURE 78g : Chondrite-normalized REE diagram; Lara claims

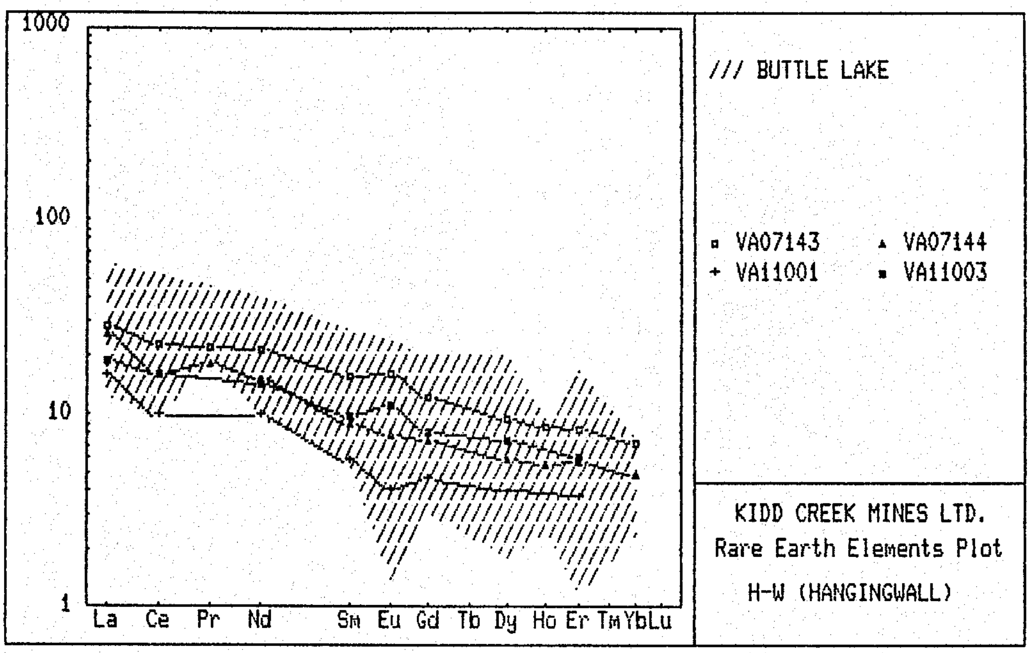

FIGURE 79a : Chondrite-normalized REE diagram; Buttle Lake

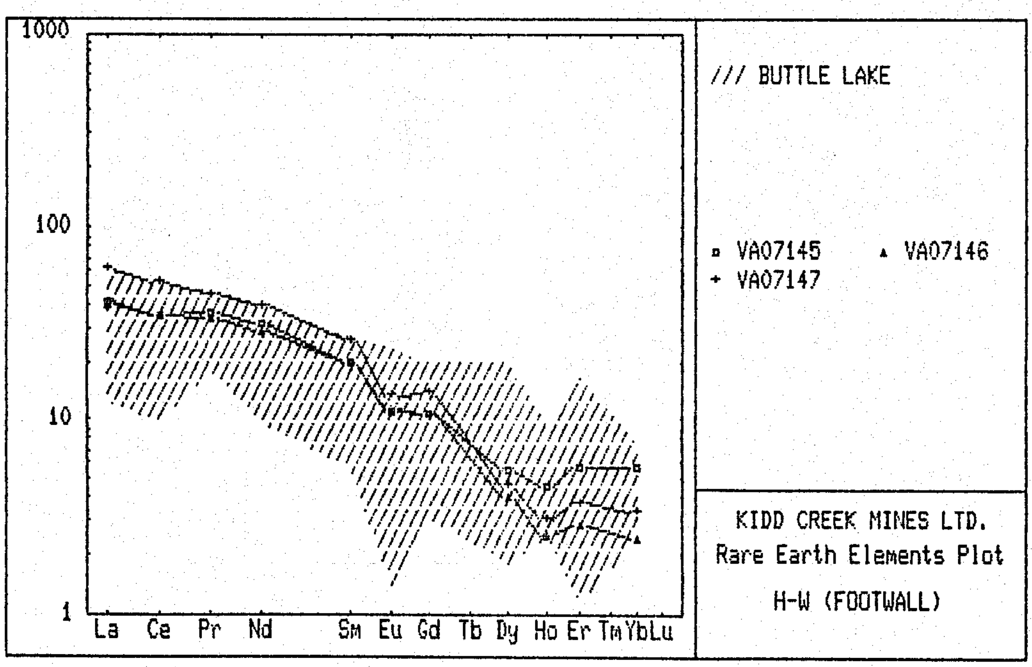

FIGURE 79b : Chondrite-normalized REE diagram; Buttle Lake

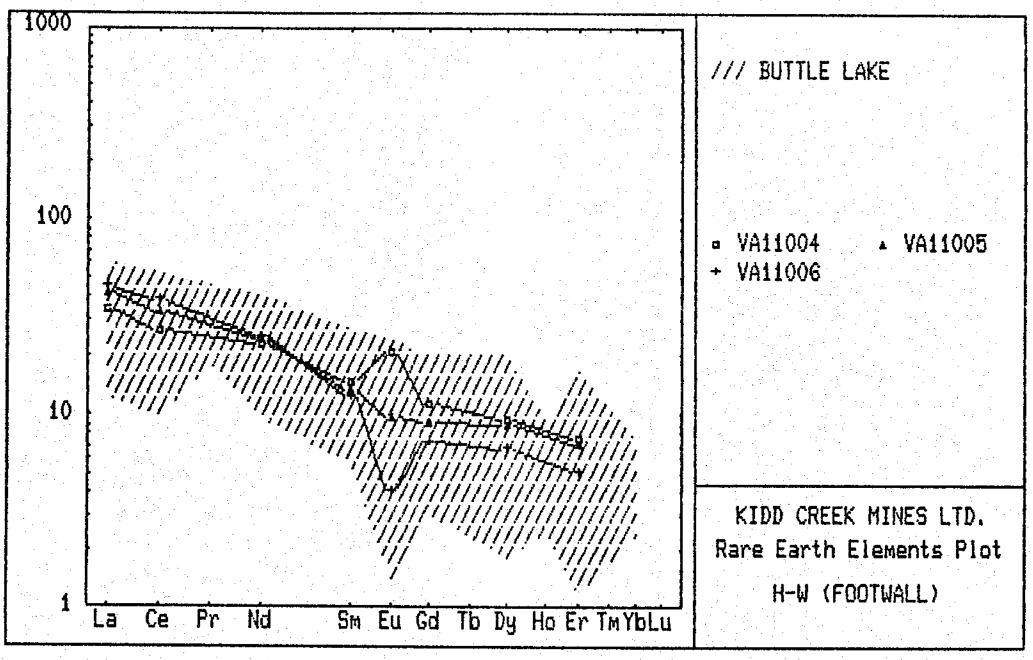

FIGURE 79c : Chondrite-normalized REE diagram; Buttle Lake

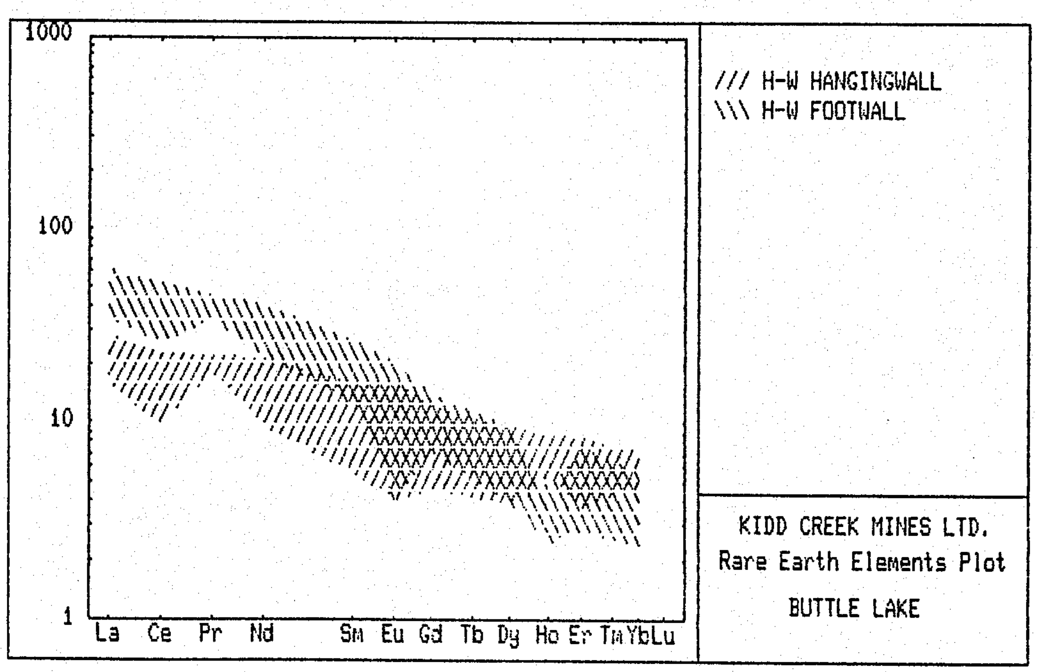

FIGURE 79d : Chondrite-normalized REE diagram; Buttle Lake

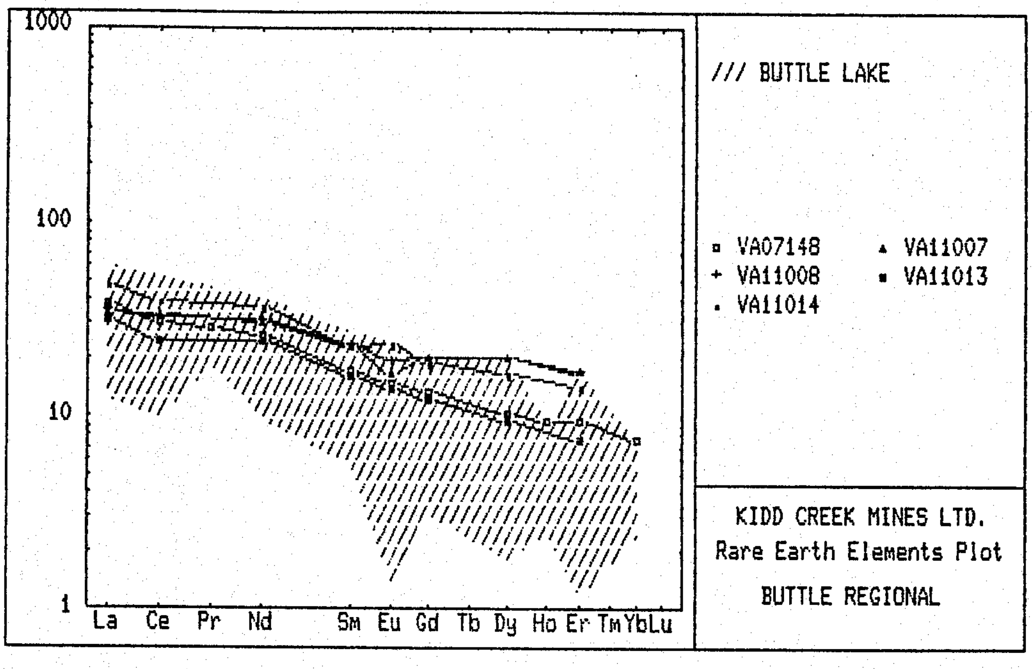

FIGURE 79e : Chondrite-normalized REE diagram; Buttle Lake

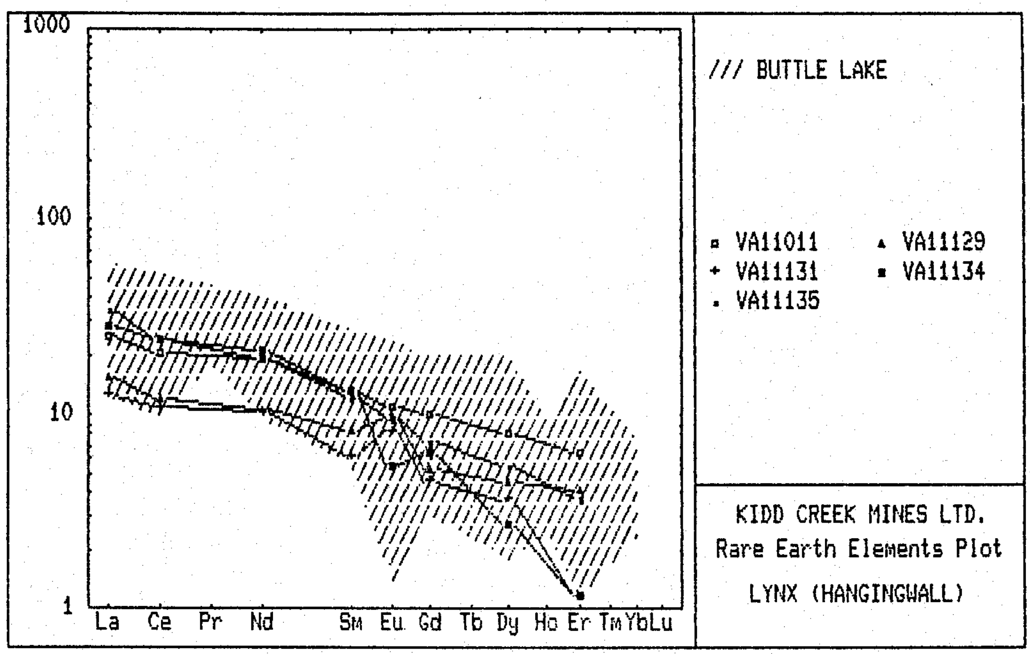

FIGURE 79f : Chondrite-normalized REE diagram; Buttle Lake

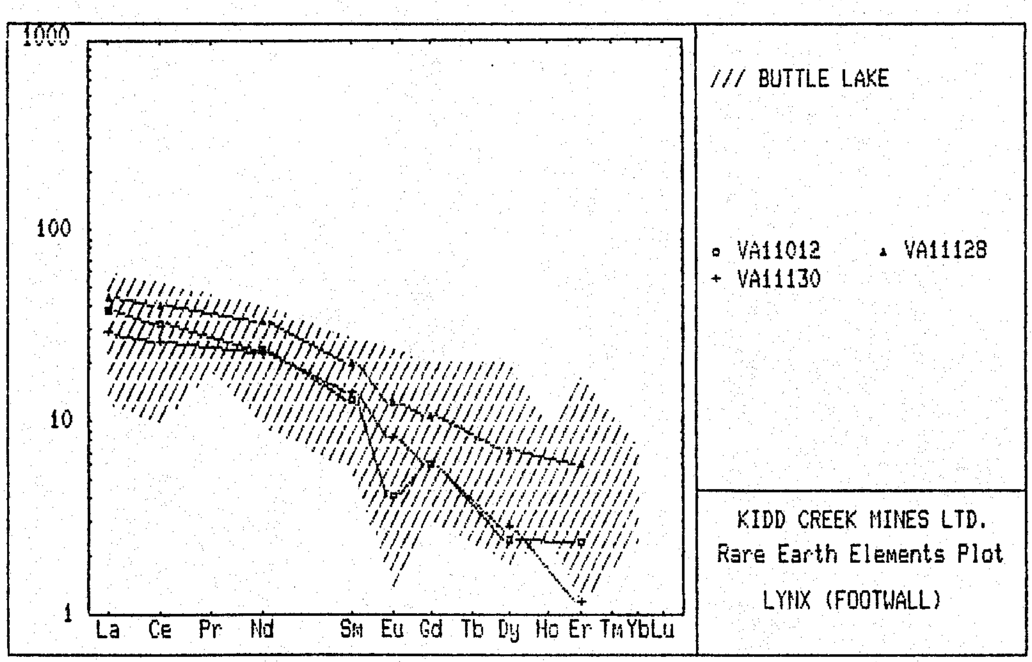

FIGURE 79g : Chondrite-normalized REE diagram; Buttle Lake

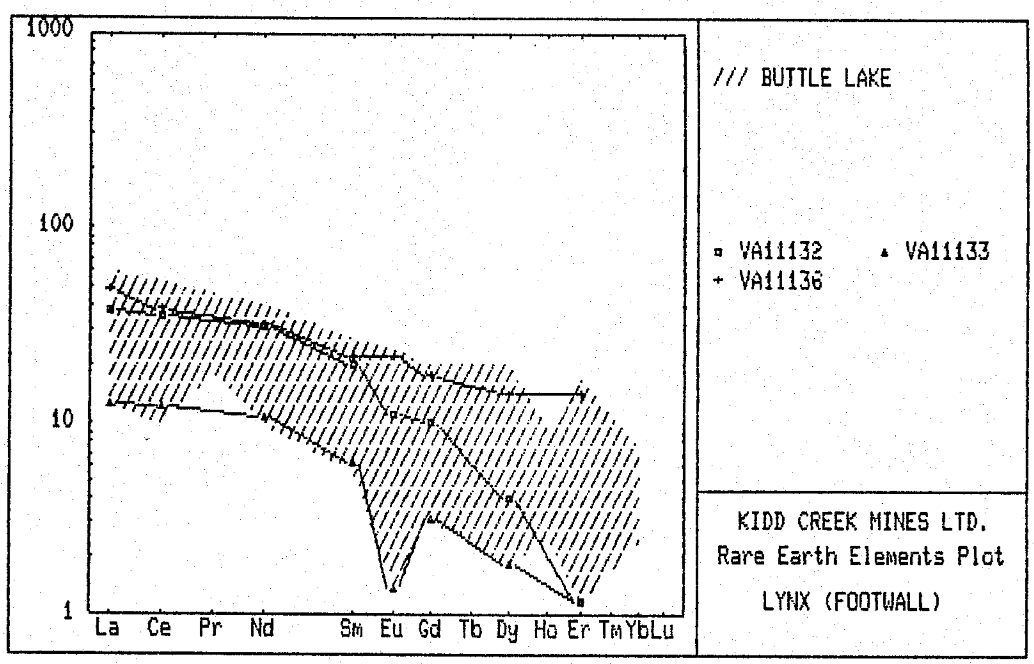

FIGURE 79h : Chondrite-normalized REE diagram; Buttle Lake

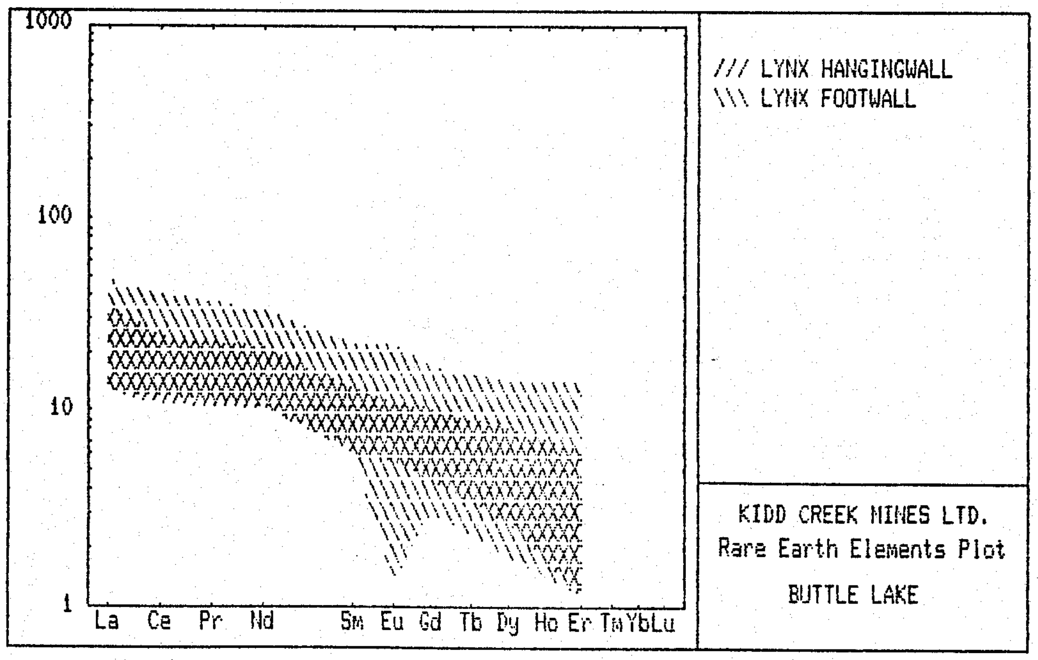

FIGURE 79i : Chondrite-normalized REE diagram; Buttle Lake

LEGEND

MAJOR ROCK UNITS

11	Nanaimo Sediments
10	Late Mafic Intrusions
9	Felsic Intrusive Rocks
8	Intermediate Intrusive Rocks
7	Mafic Intrusive Rocks
6	Ultramafic Intrusive Rocks
5	Sedimentary Rocks
4	Felsic Volcanic Rocks
3	Intermediate Volcanic Rocks
2	Mafic Volcanic Rocks
1	Ultramafic Volcanic Rocks

ROCK UNIT LETTER QUALIFIERS

The second letter indicates the type of rock; if omitted a dash should be inserted if a third letter is used.

a	Tuff	k	Wacke
b	Lapilli Tuff	l	Conglomerate
c	Tuff Breccia	m	Chert
d	Massive Flow	n	Iron Formation
e	Pillowed Flow	o	Limestone
f	Flow Breccia	p	Exhalite/Sulphides
g	Pillow Breccia	q	Tuffaceous Sediments
h	Intrusive	r	Fine Grained
i	Argillite	s	Medium Grained
j	Siltstone	t	Coarse Grained
		u	Chlorite Schist

The third and fourth letters are placed in alphabetical order, they are optional and further define the rock.

a	Quartz Phyric	j	Melanocratic
b	Feldspar Phyric	k	Bedded
c	Quartz-Felspar Phyric	l	Chloritic
d	Mafic Phyric	m	Graphitic
e	Mafic-Feldspar Phyric	n	Calcareous
f	Amygdaloidal	o	Argillaceous
g	Spherulitic	p	Siliceous/Cherty
h	Variolitic	q	Sheared
i	Leucocratic	r	Massive
		s	Lithic

SYMBOLS

- Small bedrock outcrop
- Area of bedrock outcrop
- Bedding, top unknown; (inclined, vertical)
- Bedding, top(arrow); (inclined, overturned)
- Schistosity; (inclined, vertical)
- Shear zone, fault; (inclined, vertical)
- Geological boundary, observed
- Geological boundary, position interpreted
- Geological boundary, fault contact
- Drag fold with plunge (S-fold, Z-fold)
- Mineral/stretch lineation
- Anticline, syncline with plunge
- Mineral occurrence
- Adit
- A A' Location of cross-section
- Base metal mineralized zone

ABBREVIATIONS

py	pyrite
po	pyrrhotite
sph	sphalerite
jsp	jasper
cpy	chalcopyrite
mt	magnetite
ep	epidotized
carb	carbonatized
sil	silicified
ser	sericitized
chl	chloritized
hem	hematitized
Fe-carb	iron carbonate alteration
QV	quartz vein
mag	magnetic
mag'c	magnetic

SHEET INDEX

EE DW DE CW CE BW BE AW AE

The McElhanney Group Ltd.
1166 Alberni Street, Vancouver B.C., Canada

Compiled from aerial photography taken in May 1987 at an approximate scale of 1:30 000

SCALE 1:5000 | CONTOUR INTERVAL 20 metres
DATE COMPILED June 1987 | SHEET NUMBER AE

FALCONBRIDGE LIMITED
CHEMAINUS JOINT VENTURE
GEOLOGY

100 0 100 200 300 metres

Work by: MGM | Date: Dec 88 | Proj No: 116 | **Figure 3i**


HOLYOAK 1
NUGGET 1
BRENT 1
MILDRED L 96G
NONESUCH L 66G
NUGGET 2
Sharon (py, cpy)
F1
F
SCRUB
LEGEND
MAJOR ROCK UNITS
11 Nanaimo Sediments
10 Late Mafic Intrusions
9 Felsic Intrusive Rocks
8 Intermediate Intrusive Rocks
7 Mafic Intrusive Rocks
6 Ultramafic Intrusive Rocks
5 Sedimentary Rocks
4 Felsic Volcanic Rocks
3 Intermediate Volcanic Rocks
2 Mafic Volcanic Rocks
1 Ultramafic Volcanic Rocks
ROCK UNIT LETTER QUALIFIERS
The second letter indicates the type of rock; if omitted a dash should be inserted if a third letter is used.
a Tuff
b Lapilli Tuff
c Tuff Breccia
d Massive Flow
e Pillowed Flow
f Flow Breccia
g Pillow Breccia
h Intrusive
i Argillite
j Siltstone
k Wacke
l Conglomerate
m Chert
n Iron Formation
o Limestone
p Exhalite/Sulphides
q Tuffaceous Sediments
r Fine Grained
s Medium Grained
t Coarse Grained
u Chlorite Schist
The third and fourth letters are placed in alphabetical order; they are optional and further define the rock.
a Quartz Phyric
b Feldspar Phyric
c Quartz-Felspar Phyric
d Mafic Phyric
e Mafic-Feldspar Phyric
f Amygdaloidal
g Spherulitic
h Variolitic
i Leucocratic
j Melanocratic
k Bedded
l Chloritic
m Graphitic
n Calcareous
o Argillaceous
p Siliceous/Cherty
q Sheared
r Massive
s Lithic
SYMBOLS
Small bedrock outcrop
Area of bedrock outcrop
Bedding, top unknown; (inclined, vertical)
Bedding, top(arrow); (inclined, overturned)
Schistosity; (inclined, vertical)
Shear zone, fault; (inclined, vertical)
Geological boundary, observed
Geological boundary, position interpreted
Geological boundary, fault contact
Drag fold with plunge (S-fold, Z-fold)
Mineral/stretch lineation
Anticline, syncline with plunge
Mineral occurrence
Adit
Location of cross-section
Base metal mineralized zone
ABBREVIATIONS
py pyrite
po pyrrhotite
sph sphalerite
jsp jasper
cpy chalcopyrite
mt magnetite
ep epidotized
carb carbonatized
sil silicified
ser sericitized
chl chloritized
hem hematitized
Fe-carb iron carbonate alteration
QV quartz vein
mag magnetic
mag'c magnetic
SHEET INDEX
EE DW DE CW CE BW BE AW AE
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FALCONBRIDGE LIMITED
CHEMAINUS JOINT VENTURE
GEOLOGY
100 0 100 200 300 metres
Work by: MGM
Date: Dec 88
Proj No: 116
Figure 3h

LEGEND

MAJOR ROCK UNITS

11	Nanaimo Sediments
10	Late Mafic Intrusions
9	Felsic Intrusive Rocks
8	Intermediate Intrusive Rocks
7	Mafic Intrusive Rocks
6	Ultramafic Intrusive Rocks
5	Sedimentary Rocks
4	Felsic Volcanic Rocks
3	Intermediate Volcanic Rocks
2	Mafic Volcanic Rocks
1	Ultramafic Volcanic Rocks

ROCK UNIT LETTER QUALIFIERS

The second letter indicates the type of rock; if omitted a dash should be inserted if a third letter is used.

a	Tuff	k	Wacke
b	Lapilli Tuff	l	Conglomerate
c	Tuff Breccia	m	Chert
d	Massive Flow	n	Iron Formation
e	Pillowed Flow	o	Limestone
f	Flow Breccia	p	Exhalite/Sulphides
g	Pillow Breccia	q	Tuffaceous Sediments
h	Intrusive	r	Fine Grained
i	Argillite	s	Medium Grained
j	Siltstone	t	Coarse Grained
		u	Chlorite Schist

The third and fourth letters are placed in alphabetical order; they are optional and further define the rock.

a	Quartz Phyric	j	Melanocratic
b	Feldspar Phyric	k	Bedded
c	Quartz-Felspar Phyric	l	Chloritic
d	Mafic Phyric	m	Graphitic
e	Mafic-Feldspar Phyric	n	Calcareous
f	Amygdaloidal	o	Argillaceous
g	Spherulitic	p	Siliceous/Cherty
h	Variolitic	q	Sheared
i	Leucocratic	r	Massive
		s	Lithic

SYMBOLS

Small bedrock outcrop
Area of bedrock outcrop
Bedding, top unknown; (inclined, vertical)
Bedding, top(arrow); (inclined, overturned)
Schistosity; (inclined, vertical)
Shear zone, fault; (inclined, vertical)
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Geological boundary, position interpreted
Geological boundary, fault contact
Drag fold with plunge (S-fold, Z-fold)
Mineral/stretch lineation
Anticline, syncline with plunge
Mineral occurrence
Adit
A A' Location of cross-section
Base metal mineralized zone

ABBREVIATIONS

py	pyrite
po	pyrrhotite
sph	sphalerite
jsp	jasper
cpy	chalcopyrite
mt	magnetite
ep	epidotized
carb	carbonatized
sil	silicified
ser	sericitized
chl	chloritized
hem	hematitized
Fe-carb	iron carbonate alteration
QV	quartz vein
mag	magnetic
mag'c	magnetic

N

SHEET INDEX

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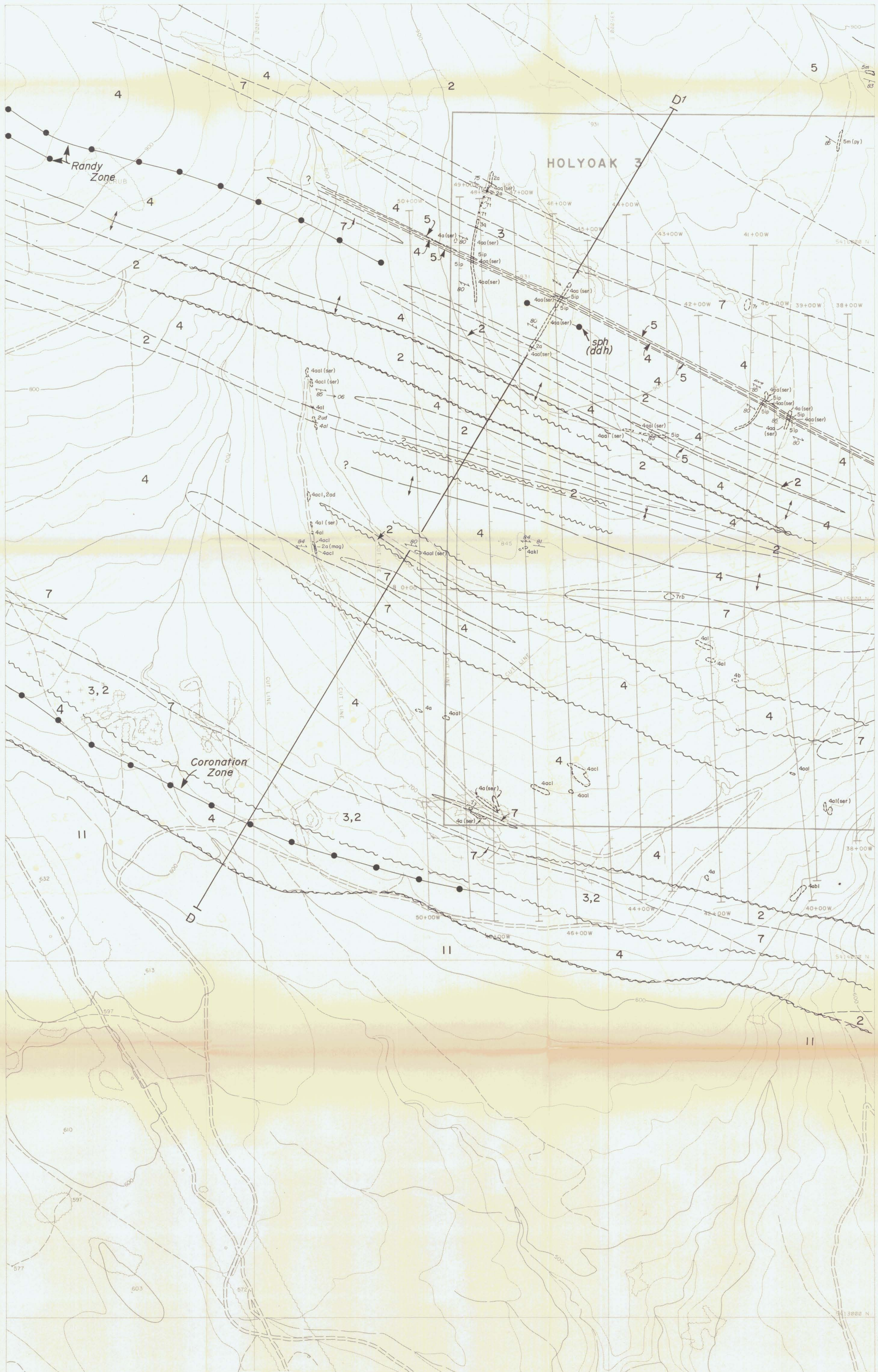
DATE COMPILED June 1987 | SHEET NUMBER BE

FALCONBRIDGE LIMITED
CHEMAINUS JOINT VENTURE
GEOLOGY

100 0 100 200 300 metres

Work by: MGM | Date: Dec 88 | Proj No: 116 | **Figure 3g**



LEGEND

MAJOR ROCK UNITS

- 11 Nanaimo Sediments
- 10 Late Mafic Intrusions
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- 8 Intermediate Intrusive Rocks
- 7 Mafic Intrusive Rocks
- 6 Ultramafic Intrusive Rocks
- 5 Sedimentary Rocks
- 4 Felsic Volcanic Rocks
- 3 Intermediate Volcanic Rocks
- 2 Mafic Volcanic Rocks
- 1 Ultramafic Volcanic Rocks

ROCK UNIT LETTER QUALIFIERS

The second letter indicates the type of rock; if omitted a dash should be inserted if a third letter is used.

a	Tuff	k	Wacke
b	Lapilli Tuff	l	Conglomerate
c	Tuff Breccia	m	Chert
d	Massive Flow	n	Iron Formation
e	Pillowed Flow	o	Limestone
f	Flow Breccia	p	Exhalite/Sulphides
g	Pillow Breccia	q	Tuffaceous Sediments
h	Intrusive	r	Fine Grained
i	Argillite	s	Medium Grained
j	Siltstone	t	Coarse Grained
		u	Chlorite Schist

The third and fourth letters are placed in alphabetical order; they are optional and further define the rock.

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f	Amygdaloidal	o	Argillaceous
g	Spherulitic	p	Siliceous/Cherty
h	Variolitic	q	Sheared
i	Leucocratic	r	Massive
		s	Lithic

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- Mineral/stretch lineation
- Anticline, syncline with plunge
- Mineral occurrence
- Adit
- A A' Location of cross-section
- Base metal mineralized zone

ABBREVIATIONS

py	pyrite
po	pyrrhotite
sph	sphalerite
jsp	jasper
cpy	chalcopyrite
mt	magnetite
ep	epidotized
carb	carbonatized
sil	silicified
ser	sericitized
chl	chloritized
hem	hematitized
Fe-carb	iron carbonate alteration
QV	quartz vein
mag	magnetic
mag'c	magnetic

N

SHEET INDEX

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DATE COMPILED June 1987 | SHEET NUMBER BW

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CHEMAINUS JOINT VENTURE
GEOLOGY

100 0 100 200 300 metres

Work by: MGM | Date: Dec 88 | Proj No: 116 | **Figure 3f**

LEGEND

MAJOR ROCK UNITS

11	Nanaimo Sediments
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e	Mafic-Feldspar Phyric	n	Calcareous
f	Amygdaloidal	o	Argillaceous
g	Spherulitic	p	Siliceous/Cherty
h	Variolitic	q	Sheared
l	Leucocratic	r	Massive
		s	Lithic

SYMBOLS

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- Mineral/stretch lineation
- Anticline, syncline with plunge
- Mineral occurrence
- Adit
- Location of cross-section
- Base metal mineralized zone

ABBREVIATIONS

py	pyrite
po	pyrrhotite
sph	sphalerite
jsp	jasper
cpy	chalcopyrite
mt	magnetite
ep	epidotized
carb	carbonatized
sil	silicified
ser	sericitized
chl	chloritized
hem	hematitized
Fe-carb	iron carbonate alteration
QV	quartz vein
mag	magnetic
mag'c	magnetic

SHEET INDEX

EE DW DE CW CE BW BE AW AE

The McElhanney Group Ltd.
1166 Alberni Street, Vancouver B.C., Canada

Compiled from aerial photography taken in May 1987 of an approximate scale of 1:30 000

SCALE 1:5000 | CONTOUR INTERVAL 20 metres
DATE COMPILED June 1987 | SHEET NUMBER CE

FALCONBRIDGE LIMITED

CHEMAINUS JOINT VENTURE

GEOLOGY

100 0 100 200 300 metres

Work by: MGM | Date: Dec 88 | Proj No: 116 | Figure 3e

LEGEND

MAJOR ROCK UNITS

11	Nanaimo Sediments
10	Late Mafic Intrusions
9	Felsic Intrusive Rocks
8	Intermediate Intrusive Rocks
7	Mafic Intrusive Rocks
6	Ultramafic Intrusive Rocks
5	Sedimentary Rocks
4	Felsic Volcanic Rocks
3	Intermediate Volcanic Rocks
2	Mafic Volcanic Rocks
1	Ultramafic Volcanic Rocks

ROCK UNIT LETTER QUALIFIERS

The second letter indicates the type of rock; if omitted a dash should be inserted if a third letter is used.

a	Tuff	k	Wacke
b	Lapilli Tuff	l	Conglomerate
c	Tuff Breccia	m	Chert
d	Massive Flow	n	Iron Formation
e	Pillowed Flow	o	Limestone
f	Flow Breccia	p	Exhalite/Sulphides
g	Pillow Breccia	q	Tuffaceous Sediments
h	Intrusive	r	Fine Grained
i	Argillite	s	Medium Grained
j	Siltstone	t	Coarse Grained
		u	Chlorite Schist

The third and fourth letters are placed in alphabetical order; they are optional and further define the rock.

a	Quartz Phyric	j	Melanocratic
b	Feldspar Phyric	k	Bedded
c	Quartz-Felspar Phyric	l	Chloritic
d	Mafic Phyric	m	Graphitic
e	Mafic-Feldspar Phyric	n	Calcareous
f	Amygdaloidal	o	Argillaceous
g	Spherulitic	p	Siliceous/Cherty
h	Variolitic	q	Sheared
i	Leucocratic	r	Massive
		s	Lithic

SYMBOLS

- Small bedrock outcrop
- Area of bedrock outcrop
- Bedding, top unknown; (inclined, vertical)
- Bedding, top(arrow); (inclined, overturned)
- Schistosity; (inclined, vertical)
- Shear zone, fault; (inclined, vertical)
- Geological boundary, observed
- Geological boundary, position interpreted
- Geological boundary, fault contact
- Drag fold with plunge (S-fold, Z-fold)
- Mineral/stretch lineation
- Anticline, syncline with plunge
- Mineral occurrence
- Adit
- A A1 Location of cross-section
- Base metal mineralized zone

ABBREVIATIONS

py	pyrite
po	pyrrhotite
sph	sphalerite
jsp	jasper
cpy	chalcopyrite
mt	magnetite
ep	epidotized
carb	carbonatized
sil	silicified
ser	sericitized
chl	chloritized
hem	hematitized
Fe-carb	iron carbonate alteration
QV	quartz vein
mag	magnetic
mag'c	magnetic

N

SHEET INDEX

EE DW DE CW CE BW BE AW AE

The McElhanney Group Ltd.
1166 Alberni Street, Vancouver B.C., Canada

Compiled from aerial photography taken in May 1987 at an approximate scale of 1:30 000

SCALE 1:5 000 | CONTOUR INTERVAL 20 metres

DATE COMPILED June 1987 | SHEET NUMBER C W

FALCONBRIDGE LIMITED

CHEMAINUS JOINT VENTURE

GEOLOGY

100 0 100 200 300 metres

Work by: MGM | Date: Dec 88 | Proj No: 116 | **Figure 3d**

LEGEND

MAJOR ROCK UNITS

- 11 Nanaimo Sediments
- 10 Late Mafic Intrusions
- 9 Felsic Intrusive Rocks
- 8 Intermediate Intrusive Rocks
- 7 Mafic Intrusive Rocks
- 6 Ultramafic Intrusive Rocks
- 5 Sedimentary Rocks
- 4 Felsic Volcanic Rocks
- 3 Intermediate Volcanic Rocks
- 2 Mafic Volcanic Rocks
- 1 Ultramafic Volcanic Rocks

ROCK UNIT LETTER QUALIFIERS

The second letter indicates the type of rock; if omitted a dash should be inserted if a third letter is used.

a	Tuff	k	Wacke
b	Lapilli Tuff	l	Conglomerate
c	Tuff Breccia	m	Chert
d	Massive Flow	n	Iron Formation
e	Pillowed Flow	o	Limestone
f	Flow Breccia	p	Exhalite/Sulphides
g	Pillow Breccia	q	Tuffaceous Sediments
h	Intrusive	r	Fine Grained
i	Argillite	s	Medium Grained
j	Siltstone	t	Coarse Grained
		u	Chlorite Schist

The third and fourth letters are placed in alphabetical order; they are optional and further define the rock.

a	Quartz Phyric	j	Melanocratic
b	Feldspar Phyric	k	Bedded
c	Quartz-Felspar Phyric	l	Chloritic
d	Mafic Phyric	m	Graphitic
e	Mafic-Feldspar Phyric	n	Calcareous
f	Amygdaloidal	o	Argillaceous
g	Spherulitic	p	Siliceous/Cherty
h	Variolitic	q	Sheared
i	Leucocratic	r	Massive
		s	Lithic

SYMBOLS

- Small bedrock outcrop
- Area of bedrock outcrop
- Bedding, top unknown; (inclined, vertical)
- Bedding, top(arrow); (inclined, overturned)
- Schistosity; (inclined, vertical)
- Shear zone, fault; (inclined, vertical)
- Geological boundary, observed
- Geological boundary, position interpreted
- Geological boundary, fault contact
- Drag fold with plunge (S-fold, Z-fold)
- Mineral/stretch lineation
- Anticline, syncline with plunge
- Mineral occurrence
- Adit
- A — A1 Location of cross-section
- Base metal mineralized zone

ABBREVIATIONS

py	pyrite
po	pyrrhotite
sph	sphalerite
jsp	jasper
cpy	chalcopyrite
mt	magnetite
ep	epidotized
carb	carbonatized
sil	silicified
ser	sericitized
chl	chloritized
hem	hematitized
Fe-carb	iron carbonate alteration
QV	quartz vein
mag	magnetic
mag'c	magnetic

N

SHEET INDEX

EE | DW | DE | CW | CE | BW | BE | AW | AE

The McElhanney Group Ltd.
1166 Alberni Street, Vancouver B.C., Canada

Compiled from aerial photography taken in May 1987 at an approximate scale of 1:30 000

SCALE 1:5000	CONTOUR INTERVAL 20 metres
DATE COMPILED June 1987	SHEET NUMBER DE

FALCONBRIDGE LIMITED

CHEMAINUS JOINT VENTURE

GEOLOGY

100 0 100 200 300 metres

Work by: MGM	Date: Dec 88	Proj No: 116	**Figure 3c**

LEGEND

MAJOR ROCK UNITS

11	Nanaimo Sediments
10	Late Mafic Intrusions
9	Felsic Intrusive Rocks
8	Intermediate Intrusive Rocks
7	Mafic Intrusive Rocks
6	Ultramafic Intrusive Rocks
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ROCK UNIT LETTER QUALIFIERS

The second letter indicates the type of rock; if omitted a dash should be inserted if a third letter is used.

a	Tuff	k	Wacke
b	Lapilli Tuff	l	Conglomerate
c	Tuff Breccia	m	Chert
d	Massive Flow	n	Iron Formation
e	Pillowed Flow	o	Limestone
f	Flow Breccia	p	Exhalite/Sulphides
g	Pillow Breccia	q	Tuffaceous Sediments
h	Intrusive	r	Fine Grained
i	Argillite	s	Medium Grained
j	Siltstone	t	Coarse Grained
		u	Chlorite Schist

The third and fourth letters are placed in alphabetical order; they are optional and further define the rock.

a	Quartz Phyric	j	Melanocratic
b	Feldspar Phyric	k	Bedded
c	Quartz-Felspar Phyric	l	Chloritic
d	Mafic Phyric	m	Graphitic
e	Mafic-Feldspar Phyric	n	Calcareous
f	Amygdaloidal	o	Argillaceous
g	Spherulitic	p	Siliceous/Cherty
h	Variolitic	q	Sheared
i	Leucocratic	r	Massive
		s	Lithic

SYMBOLS

- Small bedrock outcrop
- Area of bedrock outcrop
- Bedding, top unknown; (inclined, vertical)
- Bedding, top(arrow); (inclined, overturned)
- Schistosity; (inclined, vertical)
- Shear zone, fault; (inclined, vertical)
- Geological boundary, observed
- Geological boundary, position interpreted
- Geological boundary, fault contact
- Drag fold with plunge (S-fold, Z-fold)
- Mineral/stretch lineation
- Anticline, syncline with plunge
- Mineral occurrence
- Adit
- A A' Location of cross-section
- Base metal mineralized zone

ABBREVIATIONS

py	pyrite
po	pyrrhotite
sph	sphalerite
jsp	jasper
cpy	chalcopyrite
mt	magnetite
ep	epidotized
carb	carbonatized
sil	silicified
ser	sericitized
chl	chloritized
hem	hematitized
Fe-carb	iron carbonate alteration
QV	quartz vein
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SHEET INDEX

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SCALE	1:5 000	CONTOUR INTERVAL	20 metres
DATE COMPILED	June 1987	SHEET NUMBER	D W

FALCONBRIDGE LIMITED
CHEMAINUS JOINT VENTURE
GEOLOGY

100 0 100 200 300 metres

Work by: MGM	Date: Dec 88	Proj No: 116	Figure 3b

LEGEND

MAJOR ROCK UNITS

11	Nanaimo Sediments
10	Late Mafic Intrusions
9	Felsic Intrusive Rocks
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f	Flow Breccia	p	Exhalite/Sulphides
g	Pillow Breccia	q	Tuffaceous Sediments
h	Intrusive	r	Fine Grained
i	Argillite	s	Medium Grained
j	Siltstone	t	Coarse Grained
		u	Chlorite Schist

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f	Amygdaloidal	o	Argillaceous
g	Spherulitic	p	Siliceous/Cherty
h	Variolitic	q	Sheared
i	Leucocratic	r	Massive
		s	Lithic

SYMBOLS

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A A[1] Location of cross-section
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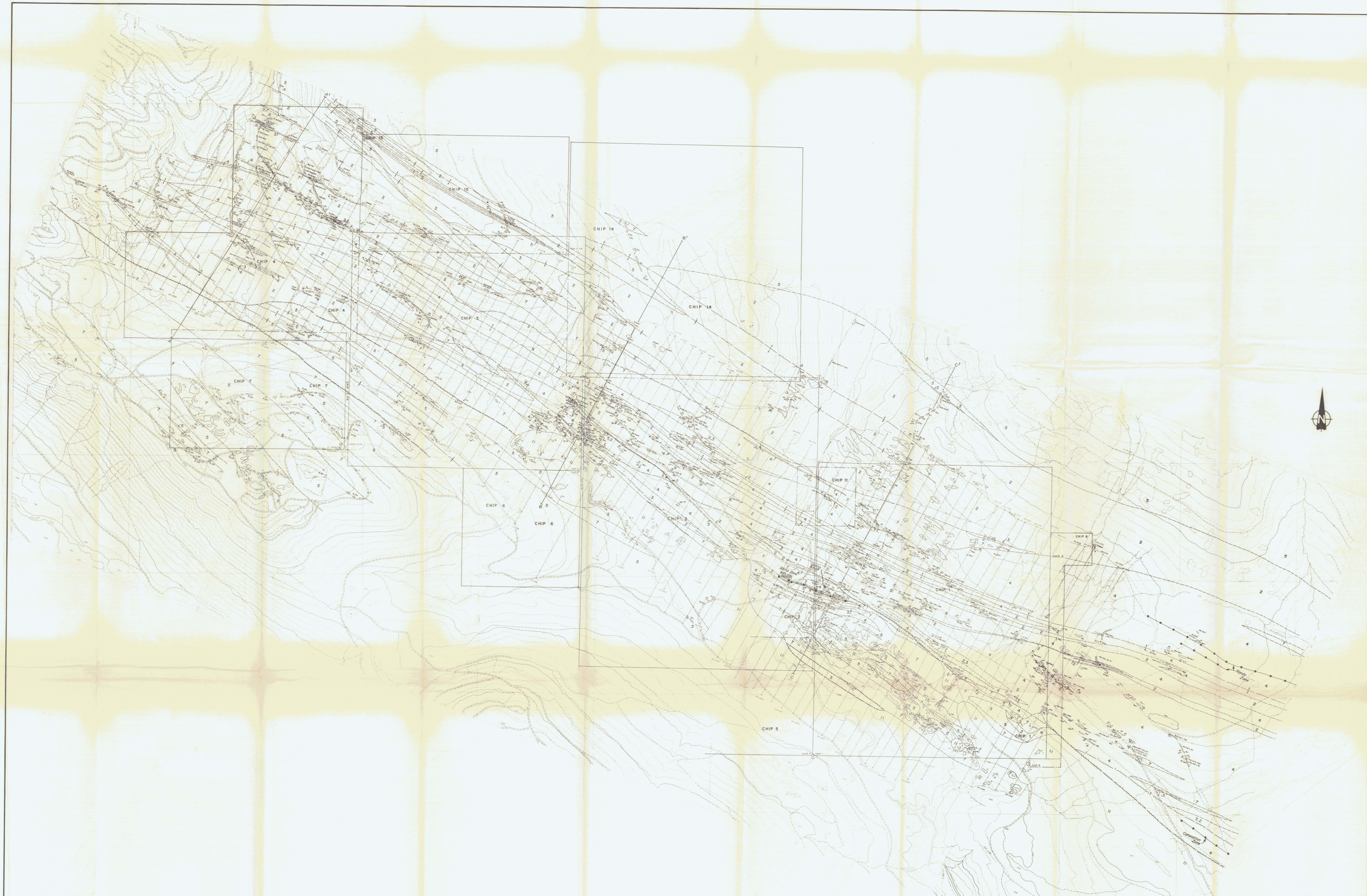
SCALE 1:5000 — CONTOUR INTERVAL 20 metres
DATE COMPILED June 1987 — SHEET NUMBER EE

FALCONBRIDGE LIMITED
CHEMAINUS JOINT VENTURE
GEOLOGY

100 0 100 200 300 metres

Work by: MGM | Date: Dec 88 | Proj No: 116 | **Figure 3a**



LEGEND

MAJOR ROCK UNITS

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		s	Lithic

SYMBOLS

x Small bedrock outcrop

Area of bedrock outcrop

45 Bedding, top unknown; (inclined, vertical)

50 50 Bedding, top(arrow); (inclined,overturned)

75 Schistosity; (inclined,vertical)

80 Shear zone, fault; (inclined,vertical)

Geological boundary, observed

Geological boundary, position interpreted

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65 65 Drag fold with plunge (S-fold,Z-fold)

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20 Anticline, syncline with plunge

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FALCONBRIDGE LIMITED

CHEMAINUS JOINT VENTURE

GEOLOGY OF THE CHIP CLAIMS

WORK BY	DRAWN BY	DATE: Dec 1988
MGM		

100 0 100 200 300

SCALE IN METRES 1 : 10 000

Figure: 4

LEGEND

MAJOR ROCK UNITS

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hem	hematitized
Fe-carb	iron carbonate alteration
QV	quartz vein
mag	magnetic
mag'c	magnetic

FALCONBRIDGE LIMITED

CHEMAINUS JOINT VENTURE

GEOLOGY OF THE HOLYOAK·BRENT CLAIMS

WORK BY	DRAWN BY	DATE: Dec 1988
MGM		

SCALE IN METRES 100 0 100 200 300

1 : 10 000

Figure: 5