NOTES
TO ACCOMPANY MAP
OF THE
CAMSELL RIVER SILVER DISTRICT
GREAT BEAR LAKE AREA
DISTRICT OF MACKENZIE
NORTHWEST TERRITORIES

BY

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THE REGION

The Camsell River Silver District is an area of approximately thirty square miles within map sheets 86 E/9 and 86 E/12 between latitudes 65°34' and 65°38'N and longitudes 117°55' and 118°10'W. There is approximately 60 per cent outcrop in the area which has local relief of as much as four hundred feet. Such variations in relief may bring different rocks into juxtaposition on a map surface. Depressions which are generally associated with fault blocks are commonly water-filled and provide good drainage routes. Jointing trends northeast and is especially well developed in outcrops of uniform lithology. There is a general development of quartz stockworks and giant quartz veins in the set of northeast-trending fractures.

GENERAL GEOLOGY

Andesite lavas and tuffs of the Echo Bay Group, the dominant rocks of the area, represent a normal calc-alkaline suite. They exhibit flow breccia and vesicular tops in several places. Conglomerate,greywacke, crossbedded tuffs and siltstones are found between sequences of intermediate volcanic flows. A band of cherty iron-formation, cherty tuff and silty limestone is host to an iron-copper sulphide deposit, and probably represents a period of quiescence between volcanic and clastic sedimentation. Acidic pyroclastics in the southwest portion of the map area, west of the Bull Fault,

overlie these lavas. The Echo Bay Group has been intruded by a syenite-granite complex with smaller associated dioritic intrusions and granodiorite dykes that extend for miles from the contact. Explosion breccias, alteration zones, pegmatitic magnetite-rich phases and magnetite-apatite pipes are associated with the periphery of the intrusive complex as are the high-grade copper veins, lead-zinc showings and silver-arsenide veins which form the ore deposits of the district.

THE ECHO BAY GROUP

Basaltic Lavas and Pyroclastics

The basalts of the map-area probably formed the base of the extrusive sequence. They are generally massive, locally agglomeratic and may contain poorly-preserved pillows. In some areas they are interlayered with andesite flows, minor andesite lenses, or welded basalt agglomerate. The basalts generally weather to a dark rusty brown but may weather buff or black. Hand specimens are crystalline, black or deep brown and contain hornblende phenocrysts. Disseminated, recrystallized pyrite occurs locally in the basalt and forms large gossans when weathered.

Cherty, Calcareous and Silty Tuffs

Interbedded cherty, calcareous and silty tuffs occur at the base of the exposed Echo Bay Group on the southwest side of the Terra peninsula, along a contact with intrusive syenite. These tuffs, consisting of colour-banded and alternating siliceous and limey layers, have a corduroy-textured, weathered surface produced by differential erosion. Such alternating layers probably represent a transitional stage from predominantly limey deposition to cherty deposition.

In hand specimen the chert of the siliceous layers is massive, white, pink, grey or black. Some samples contain disseminated sulphides. The limey, silty tuff is dark green, finely banded and softer than the cherty layers. Iron and copper sulphides are common in this unit and, along with minor lead and zinc sulphides, comprise the "copper zone" of the Terra Mine. Locally, the limey tuffs have been completely recrystallized, producing pyrite metacrysts and large carbonate crystals of an ankerite-calcite mixture. The western portion of the Terra sequence is displaced 1.5 miles to the northeast on a dextral fault. The displaced portion of the sequence is much richer in carbonate than the sequence on the peninsula. Hematitic iron-formation is closely associated with the limey siltstone. Near the border of the intrusive syenite contact metamorphism has changed the iron-formation to a folded magnetite-epidote-quartz iron-formation.

Andesitic Tuffs, Greywackes, Siltstones and Conglomerates

Above the cherty, calcareous and silty tuffs in the Terra Mine area lie a sequence of water-lain andesitic tuffs and sediments. This sequence is repeated at least four times on the east shore of the Camsell River and elsewhere in the map-area. The water-lain tuffs are well bedded and locally exhibit cross bedding, graded bedding and rounded volcanic fragments indicating substantial reworking. There are gradations from tuffs and bedded tuffs to greywackes and siltstones. All units contain many sedimentary features suggestive of turbidite deposition including slump structures, concretions, graded bedding, and cross bedding. Flattened pumice fragments are found in one greywacke horizon. The sedimentary units grade upwards into finely-bedded silt or intercalated cherty units and are covered by younger andesitic flows. Minor lenses of conglomerate are found within the deltaic sediments of the Terra peninsula.

Andesitic Lavas and Pyroclastics

Andesitic flows from a few feet to several hundred feet in thickness are intercalated with the tuffaceous units. A flow may be laminated at the base, porphyritic in the middle and brecciated or vesiculated at the top. The flows are generally chilled at the base and sometimes

chilled at the top. Angular flow breccias may grade upwards into rounded flow breccias, agglomerates, or into massive tuffs. The andesites, which range in colour from hematitic red to dark purple or black in hand specimen, weather buff, are always porphyritic and are locally trachytic. They are the most widespread extrusive unit of the map-area.

Andesitic Conglomerate

A thick extensive conglomerate lying on top of the volcanic pile consists predominantly of andesite pebbles with minor chert, rhyolite and tuff pebbles in a silty to sandy matrix. There is a gradation from the lower andesitic agglomerate into the overlying andesitic conglomerate.

Rhyolitic Pyroclastics and Lavas

Rhyolitic tuffs and coarse-grained pyroclastics with lapilli to bomb-size fragments are found within the western portion of the map-area. The pyroclastics contain small fragments of quartz and feldspar in the matrix, and are white to light brown in hand specimen. Thin tuffaceous to silty lenses are locally interspersed in this otherwise massive unit. Thin lenticular rhyolitic flows are intercalated with the andesites or more commonly, as on the

Terra peninsula, they occur associated with cherty tuff layers where they may be overlain by a rhyolite fragmental unit with a tuffaceous matrix. These rhyolites may be extensively hematitized and silicified which makes some of them indistinguishable from the cherts except for their light pink weathering.

INTRUSIONS

Granite

Pink, fine-grained granite occurs in the southwest sector of the map-area and is intruded by coarse-grained syenite. In the northeast sector the granite has a coarse-grained texture and is intruded by fine-grained syenite. Granitic dykes crosscut both the intrusive bodies and the volcanic units and are found as lenses four miles from the nearest granite. These dykes vary from white to light brown quartz-feldspar porphyries to pink feldspar porphyries and light pink aplites.

Syenite

The syenite is a coarsely crystalline, porphyritic, light to dark green or salmon-red rock. It contains fine-grained, chilled or altered zones and toward the periphery

of the bodies, an ophitic texture in which potassium feldspars form pegmatitic laths in a magnetite, called "ptarmigan track" texture in this area. The syenite contact is usually regular but it may take the form of lobes cutting the country rock. In several places along the border of the syenite there is a more siliceous phase of pink granite or grey granodiorite. Magnetite-apatite-actinolite dykes are associated with the margins of the syenite as are two pipe-shaped magnetite-apatite-quartz bodies.

Diorite

Diorite occurs as small hypabyssal bodies or as dykes that cut the syenite and Echo Bay Groups rocks and as border phases of the granite and syenite. The diorite of the hypabyssal intrusions is dark grey and porphyritic whereas in the border phases it is medium to fine-grained and grey.

STRUCTURE

A large syncline with a northwesterly-plunging axis lies in the northwest part of the map-area. A thick sequence of conglomerate, forming the core of the syncline, is underlain by interlayered tuffs, andesites and basal rhyolites. A smaller syncline on the Terra peninsula was probably formed during intrusion. It is a doubly-plunging

fold with an axial plane trending along the strike of the peninsula. On the south limb of the syncline the sequence dips at approximately 45° towards the fold axis, with shallower dips closer to the fold axis.

There are three general directions of fracture : the major direction is northeast; the intermediate, north; and the minor, east. The northeast trending Bull Fault has several branches, three fracture separated bodies of syenite are evidence of at least three separate periods of fracturing and displacement of the syenite along this fault. Northeast-trending fractures have generally been silicified, producing, in places, quartz stockworks and giant quartz veins such as those in the Smallwood and Bull Faults. Dykes from the igneous complex intruded northeast and north-trending fractures. Later diabase dykes have intruded east-trending fractures.

ALTERATION AND METAMORPHISM

The metamorphic grade of the supracrustal rocks has reached only the lower greenschist facies and the rocks are mostly remarkably fresh. Contact metamorphism of country rocks near the periphery of the igneous complex has produced magnetite skarn from a banded hematitic iron-formation. Roughly circular zones of fine-grained syenite and silicified country rocks are found within the roof of the syenite, as

are xenoliths of basalt and andesite from a few feet to two hundred feet in diameter. These xenoliths have sharp, gradational, or patchy boundaries and may consist of alternating andesite, basalt and their silicified counterparts.

Rocks on the Norex property probably represent a zone of andesitic country rock which has been locally fractured, silicified and mineralized with iron, lead and zinc sulphides to produce a pink and green rock with quartz-feldspar phenocrysts within a fine-grained chlorite-quartz groundmass. Alternatively these rocks may be the results of late stage hydrothermal solutions which here may have solidified near the roof of the igneous complex. Similar but smaller zones of this rock type are found one quarter mile northeast of the Federated veins.

Intrusive breccia occurs sporadically on the periphery of the syenite of the region and is prominent in the syenite periphery of the Terra peninsula. Such breccias formed either by collapse or by gas explosions.

GEOLOGICAL EVOLUTION

Deposition of the Echo Bay Group began with basaltic flows followed by quiescence when cherts, iron-formation, limey silt and limestone were deposited in depressions to be later covered by a deltaic sequence. Sedimentation was followed by andesite volcanism and intermittent pyroclastic activity

which produced thick volcanic deposits. Rapid erosion of this sequence permitted accumulation of 300 feet of conglomerate. The entire region was then folded, and the major syncline formed. Faulting and jointing was followed by intrusion of the granite-syenite-diorite complex which provided mineralizing solutions to the country rocks. In a final igneous event diabase dykes intruded the region. Although the major dykes throughout the Bear Province trend northeast, only minor east-trending dykes are found in the map-area. Long continued erosion produced the present day topography.

METALLOGENESIS

Magnetite-Apatite

The magnetite-apatite pipes were derived from the syenite and accompanied by gas explosions, which produced the intrusive breccias seen in the immediate area. Both brecciation and pipe formation have occurred preferentially in the limey silt unit. Actinolite-magnetite-apatite dykes and small magnetite-apatite pods occur at other contacts, and pegmatitic, ophitic intergrowths of magnetite and potassium- feldspar occur at the border of the syenite. In places specularite impregnates syenite and country rock.

Copper Veins

Chalcopyrite is generally widespread but not abundant within the andesite and limey silt units. It is found as high grade veins up to six inches thick within the syenite and in pegmatite dykes which cut the syenite. One pit containing fine-grained molybdenite was also observed within the syenite. The better developed pegmatite dykes are found near the periphery of the syenite. Some are accompanied by quartz stockworks and quartz-magnetite-hematite veins.

Quartz-Carbonate Veins

Veins of quartz carbonate with or without fluorite, chalcopyrite and hematite are found randomly distributed throughout the area. These veins are probably related to the silver-arsenide veins of the area.

Silver Veins

Terra, Norex, and Federated Mines are known to contain silver mineralization, minor uranium, bismuth, mercury, antimony, gold, and/or cobalt-nickel arsenides as well as related sulpho-salts and sulphides of iron, copper, lead, and zinc. These veins do not show any general pattern as to attitude or host rock but they do have similar mineralogies. Because their most significant common feature is their proximity to the syenite contact, and because the general world-wide,

syenite igneous complexes; the writer considers the granite-syenite complex of the map-area to be the most probable source of the silver. The fracture pattern produced by intrusion, as well as the presence of pre-existing fractures, would be the most probable factor controlling the localization of these deposits. The similarity in mineralogy of the Camsell River deposits to that of Contact Lake, and the Port Radium-Echo Bay deposits, suggest that these deposits have a similar origin and perhaps a similar, if not the same, igneous source.

DISCUSSION

The writer has been impressed with the similarity of the following local features with those of porphyry copper deposits:

1. small hypabyssal intrusions at the periphery of a larger intrusion.
2. extensive granitic and dioritic dykes.
3. monzonitic pegmatites rich in copper peripheral to the syenite.
4. crackle fractures in the syenite periphery which are bleached or filled with mineralization.
5. large xenoliths within the syenite.
6. sporadic intense silicification and alteration zones.
7. hydrothermal lead-zinc mineralization near small granitic intrusions.

8. disseminated, low-grade, copper-molybdenum showings in the syenite.

9. high-grade copper veins in the granite-syenite periphery

It can be suggested, therefore, that the silver deposits of the Camsell River District represent the peripheral precious metal deposits of a partly exposed igneous complex with porphyry copper affinities and perhaps a porphyry copper deposit is present at depth.

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APPENDIX "A"

Thin Section Studies

Basalts

Basalts are composed of pyroxene (hypersthene?) phenocrysts which are now mostly altered to actinolite in a felty groundmass of calcic plagioclase with minor amounts of sulphides and sericite groundmass. The modal composition is 60% feldspar, 35% pyroxene-amphibole, 5% sericite and opaques.

Rhyolites

Rhyolites are composed of shards and fragments of quartz and feldspar in a fine-grained, felty groundmass of quartz, feldspar and minor chlorite and sericite. Composition of the rhyolite varies with local changes in fragment composition.

Rhyolitic Pyroclastics

These rocks are composed of 50% fragments in a fine-grained, partly hematitized matrix of quartz, feldspar and sericite. The fragments are 30% feldspar, 20% rhyolite, and 50% quartz.

Andesites

Andesites contain laths of andesine up to 2 cm. long in a felty, fine-grained matrix of predominantly feldspar and minor sericite. The feldspars are relatively fresh in most samples by may show signs of sericite, hematite and chlorite-

carbonate alterations. The approximate modal composition is 60% plagioclase, 10% chlorite, 5 to 15 % sericite, 25% quartz, and 5% opaques.

Reworked Andesite Tuffs

These units can be described as volcanic greywackes with varying proportions and sizes of fragments and varying amounts of chlorite. The fragments which show varying degrees of roundness indicate substantial reworking. Approximate proportions of fragments are 15 to 25% andesite, 40 to 50% feldspar, 10 to 15% quartz, and 5 to 40% chlorite. The cementing matrix is composed of 10% to 20% chlorite, up to 10% carbonate, or up to 5% microcrystalline quartz.

Syenite

The syenite is composed of large K-feldspar laths as much as 5 cm long in a finer grained matrix of K-feldspar, chlorite, actinolite and minor quartz. The quartz in some samples occurs as micrographic intergrowths with the feldspar. The feldspar phenocrysts may be fresh but are commonly highly sericitized. Small numbers of mafic phenocrysts are present in minor amounts, but locally they are abundant enough to produce a dioritic composition. The approximate modal composition is 80% feldspar (predominantly K-feldspar), 5% to 10% actinolite and chlorite, 10% sericite-carbonate and minor quartz.

Granite

The granites show moderate sericitization of the feldspars. Two examples appear to have been altered and mineralized by deuteric or hydrothermal solutions that produced euhedral sulphides and an extremely quartz-rich matrix. The mafic minerals present are chlorite, biotite and amphibole. Staining of the feldspar by potassium cobaltinitrate reveals a predominance of orthoclase feldspar. Minor rutile and opaques are also present. The approximate modal composition is 70% feldspar, 15% to 20% quartz, 7% to 10% mafics, and up to 5% opaques.

One rock sample from the vicinity of Norex Mine is a quartz-monzonite porphyry.

Granitic dykes

Granitic dykes contain phenocrysts of quartz, feldspar, and minor actinolite in a groundmass of quartz and feldspar. Most of the feldspar appears to be alkalic, giving quartz-monzonite and granodiorite compositions for these dykes. The approximate modal composition is 40% to 50% feldspar, 20% to 40% quartz, and 10% amphibole and chlorite.

Diorite

The hypabyssal diorite consists of highly sericitized feldspars, chlorite patches with remnant actinolite grains and minor micrographic intergrowths of quartz. Remnant textures suggest that the rock may be intrusive. The approximate modal composition is 55% to 60% feldspar, 35% chlorite and actinolite, 0% to 3% quartz and 5% opaques.