Bergvesenet

Postboks 3021, N-7441 Trondheim

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Tittel

Note to the significance og samples 1189(110, 1198/144A and the molybdenite occurance at Grønndalsdam.

Forfatter	Dato År	Bedrift (oppdragsgiver og/eller oppdragstaker)
G. H. Gale R. Kvien	6.3. 1974	Grong Gruber AS

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
Røyrvik	Nord-Trøndelag		19244	Grong

Fagområde	Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt)
Geologi		Grongfeltet
Råstoffgruppe	**Råstofftype**	
Malm/metall	Cu Mo	

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Prove 189/110 er en håndprøve fra trondhjemittsonen nord for Langtjern. Prøven er beskrevet og analysert. Analysen viser et Mo-innhold på 0,03 %.

Den andre prøven, prøve 1189/144A,er fra samme område men her forekommer Molybden i cm tykke kvartstriper i trondhjemitten. Innholdet av Molybden er analysert til 0,06%.

Rapporten beskriver flere eldre Mo-funn ved Grønndalsdam - Tunnsjø og på flere steder langs Sandøla.

NORGES GEOLOGISKE UNDERSØKELSE
GG/SP 6.3.1974

Til Grongprosjektets styringsgruppe

fra G.H. Gale og R. Kvien.

Note on the significance of samples 1189/110, 1189/144A and the molybdenite occurrence at Grønndalsdam.

1. In view of what we consider to be a rather warm response to the NGU proposal for further prospecting of the Sanddøla trondhjemites we feel that an elaboration of the ideas behind the proposal should be set down in order to aquaint the styringsgruppe with the full implications of the economic significance of the Mo-Cu occurrences.

Sample 1189/110 is a hand specimen of a fine grained porphyritic trondhjemite zone approximately 200 m wide and more than 300 m long just north of Langtjern. The rock is schistose, and strongly altered. 5-10 % pyrite occurs as disseminated grains (<1 mm in diameter) and along microfractures. Tiny molybdenite grains are visible with the naked eye and up to 10 grains have been seen on a cut surface of approximately 8 cm^2. Chemical analysis gave 0.03 % Mo. Minor chalcopyrite has been seen in polished sections but not in economic quantities. Disseminated Mo was observed in four places from the zone of pyritized, fine grained trondhjemite. (Fig 1)

Sample 1189/144A is a medium grained trondhjemite, with a 1 cm grey quartz vein, containing 0.06 % Mo. Molybdenite occurs within and along the margins of the quartz vein as well as along fractures in the altered trondhjemite alongside of the quartz vein. The alteration is less intense than in sample 1189/110 and only a few grains of pyrite are visible. Although the rocks in the vicinity of sample 1189/144A and to the northwest of it are fine-medium grained, pyritized (<10 %) trondhjemite, Molybdenite was not observed - probably because it was not looked for. It may also be significant that the quartz vein in sample 1189/144A was not detected on the weathered outcrop surface so that we are unable to evaluate the extent of quartz veining in the area. (The significance of the quartz vein was not realized at the time).

In addition an angular erratic approx. 40x30x20 cm with a chalcopyrite--pyrite vein, with an estimated 2 % Cu, occurring in a fine-medium grained trondhjemite was found about 200 meters south of sample 1189/144A. (Fig 4)

A 1 cm quartz vein with molybdenite was collected in 1969 from a locality near Grønndalsdam - Tunnsjø. The quartz vein occurs in a medium grained, strongly epidotized, trondhjemite (Fig. 3).

2. It can be seen from Fig. 2 that there are significant Mo and Cu anomalies in the Langtjern area both within the area from which sample 1189/110 was collected and outside in unmapped areas.

3. Although we do not contend that all trondhjemites in the Grong area are intrusive, mapping in the Sanddøla area has clearly demonstrated that the Sanddøla trondhjemite massif is clearly intruded into the greenstones (late orogenic faulting/thrusting has produced tectonic contacts in several places along Sanddøla). In fact the whole or most of the sequences in the Grong area are allochthonous (Oftedahl, 1955; Gale and Roberts, in preparation).

We interpret the Cu-Mo mineralization occurring near the roof of an intruded trondhjemite as a porphyry-Mo type of deposit.

Gale and Roberts (in prep.) have shown on the basis of greenstone petrochemistry that the volcanics and associated intrusives are part of an island arc sequence which has been obducted onto the continental margin during the end stages of the Caledonian orogeny.

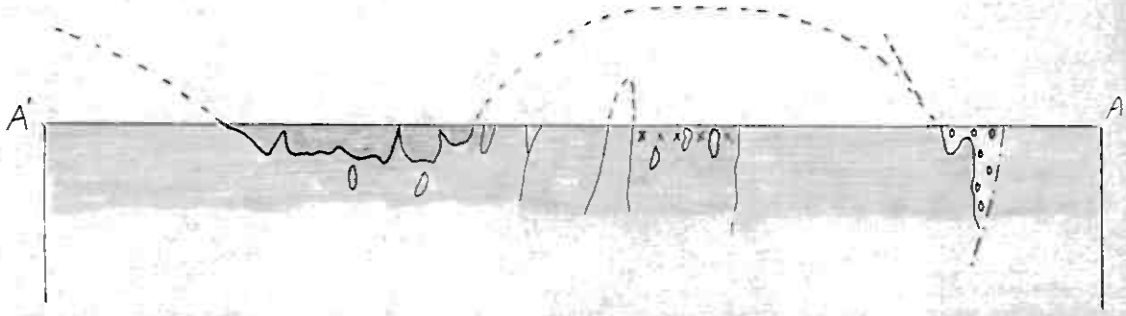
4. In a paper (in prep.) on "Porphyry copper type mineralization of the Northern Part of the Appalachian orogen" Hollister, Potter and Barker describe the occurrence of Appalachian porphyry Cu and Mo deposits and relevant sections of their paper are attached. The association of Mo and tungsten mineralization may be of some interest in view of its previously known occurrences in the Grong area and the discovery of scheelite in sample 1189/145 by Harald Elstad.

5. We cannot stipulate or even guess at the economic potential of Mo and Cu mineralization in the trondhjemites of the Grong area. The majority of the known porphyry Mo and Cu deposits are located in island arc terrains of ~~both~~ Recent to Palaeozoic age. Thus in view of the occurrence of a possible porphyry type deposit in the Grong area and the interpretation of the area as an island arc sequence (Gale & Roberts, 1972 in Nature; and in prep.) it

would be a pity to allow the area to pass out of control of Grong Gruber A/S without a proper investigation being made.

Trondheim 7/3/74
G.H.Gale
Rick Kreiner

CROSS SECTION FOR LANGTJERN AREA (Fig 1)



NORGES GEOLOGISKE UNDERSØKELSE

Trondheim 6/3 1974.

Geolog George Gale,
her.

Resultat av prøver merket:

		Mo	Cu
1189/110	Gronn.	0,93 %	0,04 %
1189/114	"	0,06 "	25 ppm

Med hilsen
Per-Reidar Graff.
Per Reidar Graff.

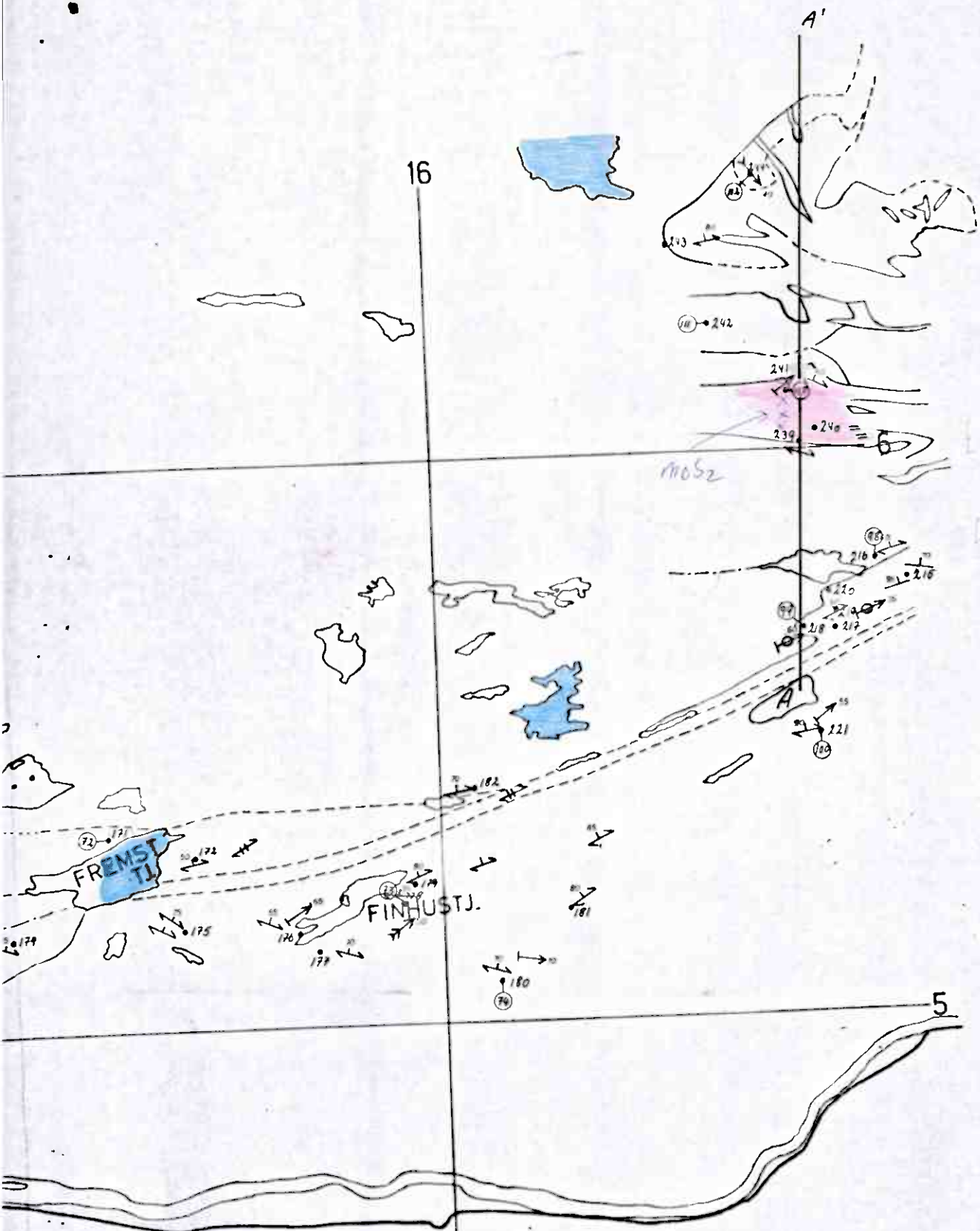
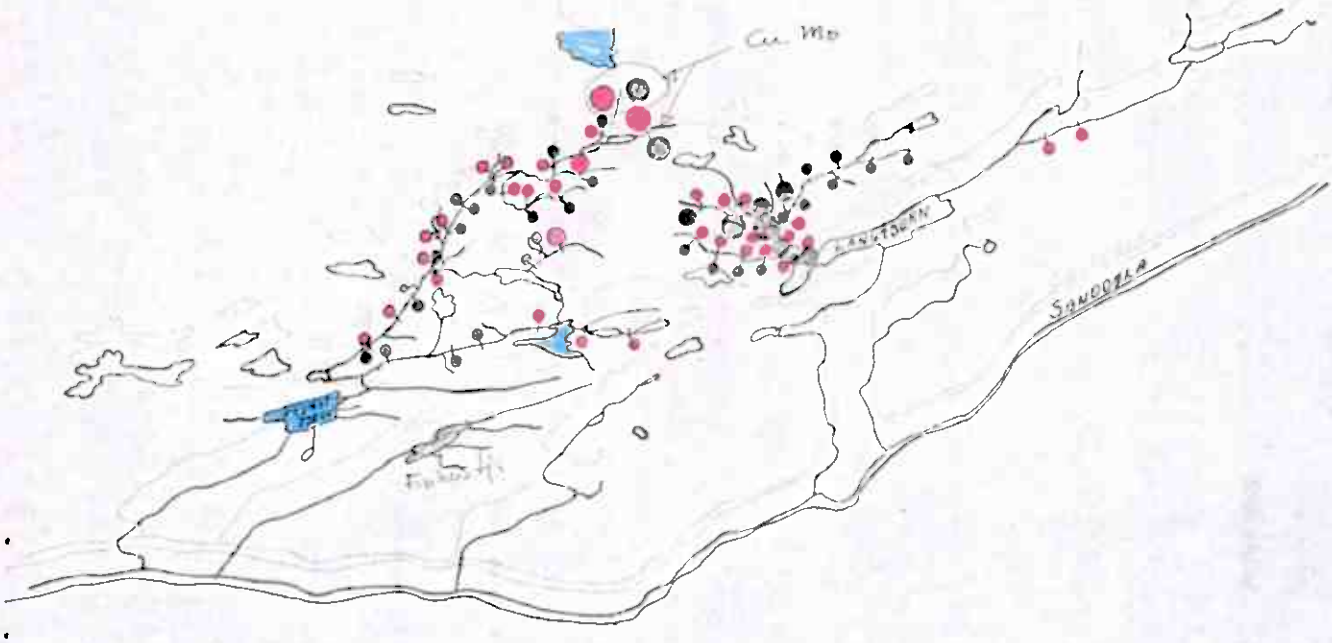


FIG 1.



Mo - innhold

- 10 - 50 ppm
- 50 - 100 ppm
- > 100 ppm

Cu - innhold

- 30 - 100 ppm
- 100 - 200 ppm
- > 200 ppm

GRONGPROSJEKTET 1973

Cu - Mo I BEKKESEDIMENTER

(ikke kontrollerte prøver)

MALESTOKK 1 : 50.000

NORGES GEOLOGISKE UNDERSÖKELSE

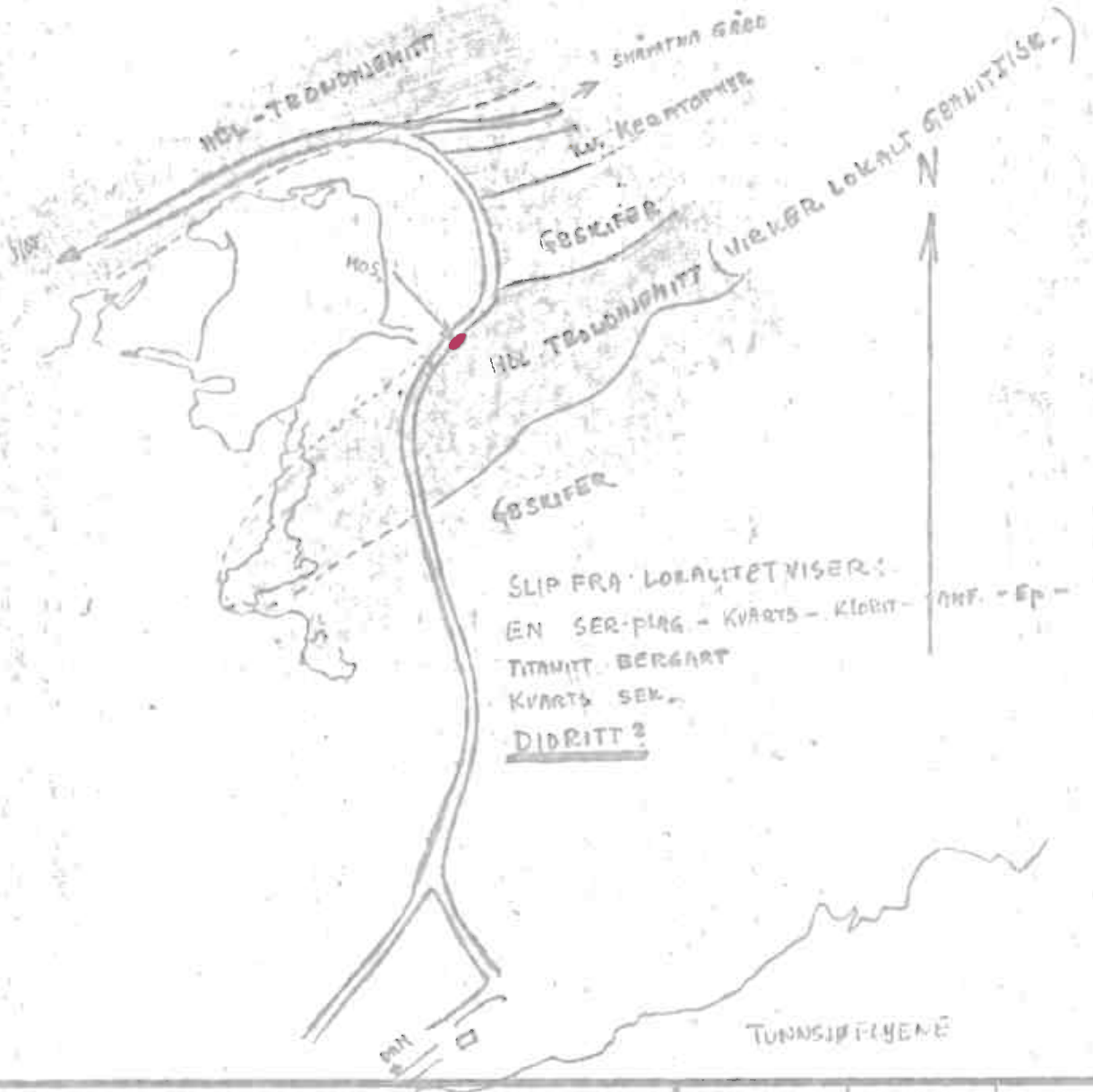
TRONDHEIM

Fig. 2

KARTBLAD 1823 I

MoS_2 ER PÅVIST. OPPTRER SOM EN TYNN FILM I SPREKKER I KVARTSRIKE PARTIER I EN AMFIBOLFØRENDE TRONDHJEMITT. TRONDHJEMITTEN VIRKER INTRUSIV

7 STK. SAMMENSLÅTTE PRØVER (SLITS) 905/400-407 BLE TATT. VÅTVEISANALYSE VAR NEGATIV. PRØVENE BLE KONTROLLERT PÅ SPEKTROGRAF, D.V.S. IKKE PÅVIST HENGDER OPPTIL 0,003% Mo...



MoS_2 - LOKALITET NÆR GRØNNDALSDAM - TUNNSJØ FLYENE...

Mål: 5000	DES. KK.	1969.
	TEGN KK.	FEB 1974

FIG 3

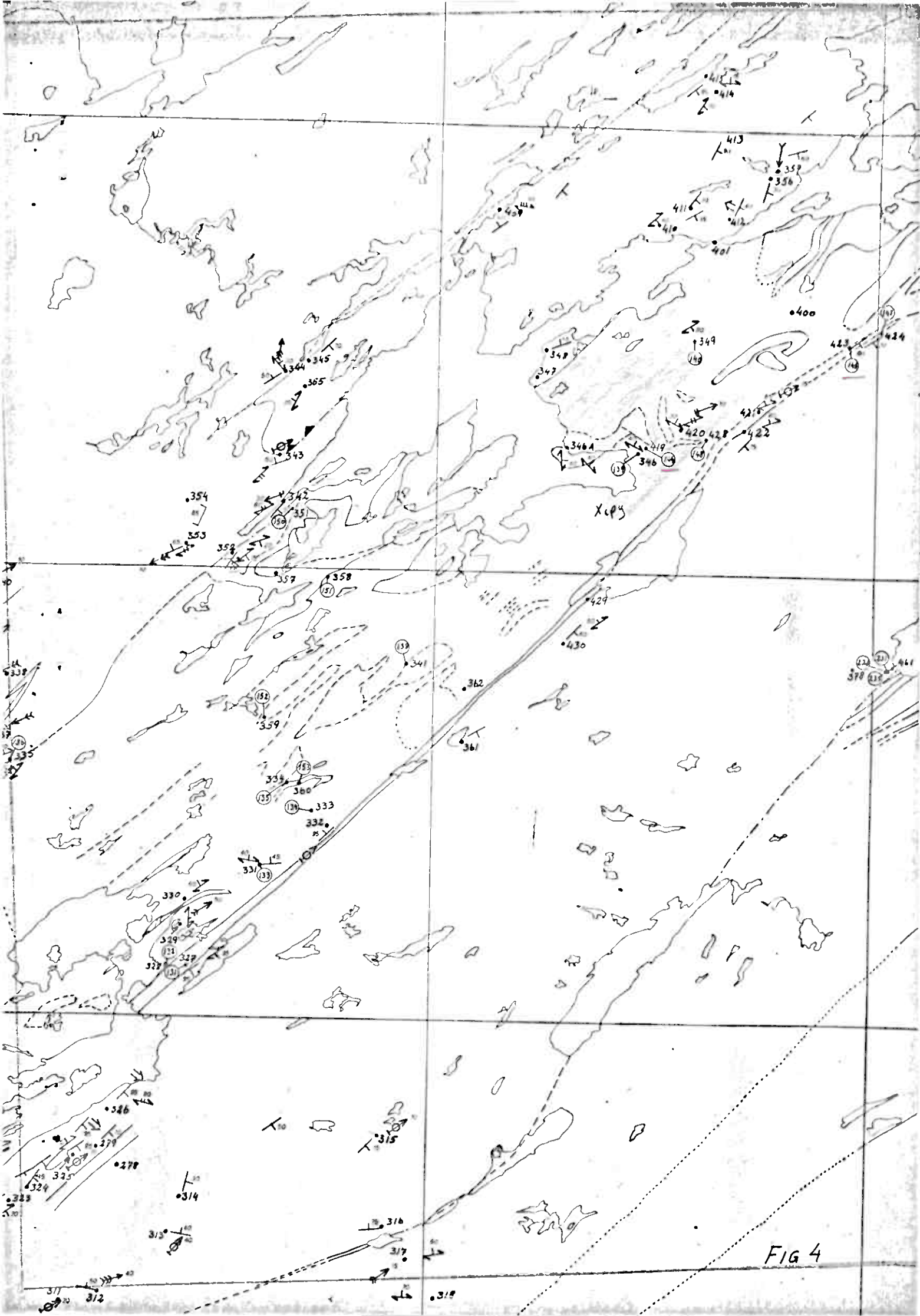


FIG 4

commenced in the Cambrian, appeared in the Ordovician, an o ha emerged again well into the Devonian.

Exploration Geochemistry: Nearly all porphyry copper prospects have been detected by stream sediment sampling. Possibly the weakest expression is at Alma, where the Cu anomaly in the streams cutting the intrusion is just barely above background. The most confusing is at Mariner where copper mineralization occurs both in the stock and in Carboniferous strata nearby. Geochemical results over the Attean pluton have been placed on the USGS open file (Chafee, M.A., et al, 1972).

CHARACTERISTICS OF APPALACHIAN PORPHYRY MOLYBDENUM DEPOSITS

Petrology: Most of the porphyry molybdenum deposits of the Appalachian orogen occur spatially associated with a granite porphyry, as noted on Table 1. The granite is not always porphyritic, but where this is the case, it usually has characteristic large subhedral quartz phenocrysts. The quartz monzonite and rhyolite at Mt. Pleasant are close chemical relatives of the granites found in other deposits. Orthoclase is the predominant feldspar, and biotite the most common mafic mineral.

Sulfides may occur as apparent magmatic constituents, and pyrite does so most frequently. Molybdenite is a constituent of some granites, and chalcopyrite very rarely has been identified. Molybdenum, tungsten, tin minerals and other lithophiles are most abundant in pegmatitic zones, dikes, or veinlets in these intrusions, however,

Alteration: Greisenization of the host rock is the m common type of alteration accompanying metals in the porphyry molybde deposits. Fluorite and topaz may accompany quartz and sericite, and rarely beryllium minerals have also been identified. By Cordilleran

From Hollister (et al)

controlled, with most greisens being confined to bands less than ten feet thick. The greisens may occur in porphyry Mo deposits in the same relative position to the argillic and potassic zones that the phyllic zone occupies in porphyry copper deposits.

The potassic zone in some deposits, such as the Cooper and Catherine, consists of a strong metasomatic replacement of the original silicates with orthoclase, minor biotite, and muscovite. In these deposits vugs in and near veins are lined with orthoclase, mica, quartz, and sulfide.

In all deposits pegmatitic phases exist which are characterized by coarse mixtures of orthoclase, quartz, and other silicates. Based on experience in the Cordilleran orogen, it seems logical to group these in with alteration phenomena. The silicates occur as veins or dikes, and the ore minerals occur in them as crystal clusters, pods or fracture fillings. Fluorite and fluo-silicates are common minerals in the pegmatite facies.

Mineralization and Structure: Both stockwork and breccia pipe type structures are controlling features for mineralization in porphyry molybdenum deposits. The outstanding example of a breccia pipe type is the description presented by Petruk (1972) for the Mt. Pleasant pipe. Here, fragments of igneous rocks are cemented with fluorite, quartz, silicates and ore minerals. The Cooper and Catherine intrusions in Maine were described previously by Emmons (1910) as being locally miariolitic and have what may be interpreted to be small breccia pipes. These two deposits are, however, predominantly stockwork types.

In the Cadillac Mountain pluton, on the other hand, weak and scattered molybdenum mineralization appears to be associated with a breccia. C.A. Chapman in Zen, et al (1968, p.387) describes

from Hollister (et al.)

deposits.

The ore deposit most accurately dated by stratigraphic means is Mt. Pleasant. A lower Mississippian age is indicated for it by correlating rhyolite in the volcanic neck with Mississippian flows (Ruitenberg, 1969).

On the other hand, igneous activity at Pabineau has a K-Ar date of 367 M.Y. and near New Ross has a K-Ar date of 370 M.Y., according to Tupper and Hart (1961). Mineral deposits associated with these stocks are believed to be of about the same general age as the intrusion.

Still other dates are given by Ruitenberg (1972) for epizonal intrusions which have no apparent association with molybdenu but which fall into the 380 to 320 M.Y. range. These intrusions are similar to those that may host sulfides, and they indicate that magma of the type accompanying the molybdenum porphyry deposits continued at least into the close of the Devonian. Their presence enhances the hope that additional ore deposits may eventually be discovered.

METALLOGENIC EVOLUTION IN PORPHYRY TYPE DEPOSITS

Taken together, porphyry type deposits of the Appalachian orogen appear, on the basis of present data, to form early as porphyry copper, then evolve through a period where both porphyry copper and porphyry molybdenum deposits formed separately but simultaneously; finally ending with porphyry molybdenum deposits developing alone. The porphyry copper and porphyry molybdenum province are not geographically coincident. As can be seen on Fig. 2, however, the area from the Cooper deposit in Maine north-east to Square Lake in New Brunswick, the two can be found in the same general terrain. In this area molybdenum deposits generally appear to be younger and post-tectonic. It is also noteworthy that porphyry copper prospects

the brecciated country rocks around the intrusion. He states, "The intensity of fracturing increases inward toward the granite and culminates in a mass of thoroughly jumbled breccia. The breccia consists of angular to rounded blocks of hornfels, generally up to a few feet across...". A second striking feature is the change in dip of the country rock near the "granite contacts". On the Cadillac Mountain pluton the centripetal dip pattern extends completely around the intrusion.

Molybdenum and other lithophile element mineralization accompanying late Devonian intrusions may appear in linear trends as shown in Fig. 3. This figure also shows radiometrically determined age dates where known. Distribution of molybdenum in this figure is from Chafee, et al (1972). The trend of these particular anomalies is N-E, paralleling tectonic fabric in the Appalachian orogen. Bedrock exposures in each deposit usually contain a set of veinlets or mineralized joints which also parallels the trend. Young (1962 and 1963), Wright (1940), Victor (1957) and Poitevin (1932) each show joint sets supporting this conclusion.

Generally, an additional set trending nearly N-S also exists. The N-S trend may be dominant, as at Cooper (Hess, 1908) or Gabarus Bay (Vokes, 1963). It may vary from deposit to deposit but ranges from N 15 W to N 10 E.

All of the porphyry molybdenum deposits carry varying amounts of fluorite as vein constituents with the molybdenite. Tungsten minerals, usually the wolframite family, also occur, and cassiterite has also been found in some deposits. Sulfide tin minerals are much rarer. Beryllium minerals have been detected in a number of deposits (see Table 1).

from Hollister et al The principal difference between the character of mineralization in the Appalachian orogen porphyry molybdenum deposits and