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A PRELIMINARY REPORT ON GEOLOGICAL MAPPING OF THE GRØNDALEN AREA, GRONGFELTET

1977

TO ELKEM A/S, SKOROVAS GRUBER.

I. L. FERRIDAY.

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1. INTRODUCTION.

In the summer of 1977, geological mapping was carried out at a scale of 1 : 10,000 of the Grøndalen area of Grongfeltet. This area is continuous eastward with that mapped by Halls and Walker (1972), and south-westward with that mapped by Halls and Ferriday (1975 - Finnkrudáma-Nesápiggen, 1976- South Grøndalsfjell). Mapping was carried out in 1977 by I. L. Ferriday and student assistant K. Wilson from The Royal School of Mines, Imperial College, London.

The area is predominantly occupied by the south-western quadrant of the Grøndalsfjell intrusive complex which, though essentially dioritic, includes intrusives of widely ranging composition, from granitic to gabbroic, together with inclusions of earlier material of both layered gabbroic and extrusive origin. The Grøndalsfjell intrusive complex lies structurally above the extrusives of the area as a saucer-shaped body, being defined by a thrust plane dipping moderately to steeply in an eastward to northward direction beneath the complex.

The surrounding extrusives are generally strongly tectonised and not uncommonly prograded to some extent, having well-developed schistosities concordant with the margins of the Grøndalsfjell complex.

To the south of the area there occurs an intrusive complex of tectonised trondhjemitic and altered gabbroic material, which lies structurally beneath both the extrusives and the Grøndalsfjell complex, this being termed the Storberget intrusive complex.

The forms of mineralization which occur in the area are as follows:

i) DISSEMINATED : PYRITE, MAGNETITE, PYRRHOTITE
Associated with variably hydrated gabbroic rafts.

ii) DISSEMINATED : PYRRHOTITE, CHALCOPYRITE
MASSIVE AND DISSEMINATED : MAGNETITE
MASSIVE, DISSEMINATED, IN QUARTZ VEINS : PYRITE.
Associated with extrusive hornfels and rafts.

iii) DISSEMINATED : CHALCOPYRITE, MAGNETITE, PYRRHOTITE
MASSIVE AND DISSEMINATED : PYRITE.
Associated with acid pyroclastics or jasperoids, exhalative, within the extrusives.

2. STRATIGRAPHY.

i) Grøndalsfjell intrusive complex.

Gabbroic rafts and xenoliths.

Material of amphibolite to hypersthene gabbro and pyroxenite* composition representative of variably hydrated layered gabbro, forms rafts and xenoliths within the diorite in the northern tracts of the Grøndalsfjell intrusive complex. The dimensions of the rafts, which are commonly of equidimensional form, vary greatly but are on average of the order of 50 x 50 m. Contacts with the surrounding diorite may be sharp or diffuse over several metres, while diorites in localities containing a high proportion of inclusions tend to be more basic. This suggests widespread digestion of gabbro by the diorite and that at least locally, diorite chemistry contains a significant contribution from primary gabbroic material. Similarly, contacts within rafts, between hydrated gabbro (essentially DARK GREEN, hornblendic, with epidote, chlorite and feldspar) and relatively fresh gabbro (essentially dark red-brown, pyroxene with glassy feldspar.) may be sharp or diffuse, relatively unaltered material generally occurring as equidimensional bodies within, or veined by, hydrated material. Layering within the gabbro rafts, being much less commonly observed than on east Grøndalsfjell, strikes in a north-south direction, with sub-vertical dips to east and west. As on east Grøndalsfjell, one can conclude from the fact that such gabbroic material is intruded by all other intrusive components of the Grøndalsfjell complex that the rafts and xenoliths represent a body of layered gabbro with ultramafic cumulates which was the earliest intrusive in the Skorovas region.

* To be confirmed.

Extrusive hornfels.

Hornfelsed extrusive material of basic to acid composition occurs as rafts, xenoliths and as a large 'lobe' projecting into the diorites from the western margin of the Grøndalsfjell intrusive complex on Murfjellet.

Rafts and xenoliths of predominantly basic composition occur within diorite in the southern tracts of the Grøndalsfjell complex, this belt being continuous with that extending along the southern and thence eastern margins of the Grøndalsfjell complex. Xenoliths are predominantly angular in form and are generally oriented with their long axes roughly parallel with the trend of broad zones within the Grøndalsfjell complex. Textures within the xenoliths vary from being that of relatively fresh basaltic to doleritic to fine 'gabbroic', while in certain localities, shadows of xenolithic form occur, having fine to medium-grained gabbroic textures. It is therefore evident that extrusive material, by digestion, has also contributed significantly to the volume of diorite.

Rafts of extrusive material, having a textural range similar to that of xenoliths, occur to large dimensions. Within such rafts, although such structures as relict pillows are not recorded, the local occurrence of large epidote knots and segregations, which are identical in form with those occurring in non-hornfelsed extrusives throughout the Skorovas region, together with relict vesicules, testify to the extrusive nature of raft material. At one locality (x. 69310, y. 12465), mineralization associated with such a raft includes graphite and is thus exhalative in origin, confirming the extrusive nature of its host rocks.

The large area of extrusive hornfels on northern Murfjellet includes material of basic to acid composition. Basic to intermediate extrusive material makes up the bulk of this area, having massive textures from relatively unaltered andesite/basalt to doleritic. Epidote knots, relict vesicules and pillow-like structures having quartz-feldspar-epidote cusps occur locally (x.70140, y.13530). Within this area, acid rocks of both extrusive and intrusive nature occur, and in several localities, classification of the acid lithologies as extrusive or intrusive is problematical. If other, lower metamorphic grade, areas of the Skorovas region are taken as a model, where similar problems are also encountered, then one can expect a physical continuity between intrusives and extrusives to occur. In the majority of localities however, the cross-cutting character of acid intrusives demonstrates their nature.

At numerous localities within the extrusive hornfels, pyritic mineralization occurs either as discreet horizons or as irregular bodies and disseminations, the strongest expressions of such mineralization being associated with the occurrence of acid extrusives. These will be discussed in part 4 of this report.

Diorite, diorite-pegmatite, feldspar-porphyry diorite.

The diorites, which form the bulk of the Grøndalsfjell complex, can be broadly divided into two zones, one having inclusion material of predominantly gabbroic origin, the other having inclusion material of predominantly extrusive origin. Within these divisions, the diorite varies over short distances in texture and chemistry locally in response to the activity of its own late stage fluids, to the proportion and type of inclusions present, and to a lesser extent tectonism. The diorite is essentially light to cream-grey weathering, consisting of approximately equal amounts of amphibole and feldspar. Unlike the gabbros, fresh diorite does not exist (or at least has not been recorded) since the mode of intrusion of the diorite magma, with evidently ample supply of volatile late-stage fluids, has resulted in complete self-alteration

The diorite pegmatite represents the most advanced stage of such deuteric alteration, consisting of long amphiboles forming 'branches' and monomineralic bands within a feldspathic matrix. This lithology occurs in minor amounts over the Grøndalsfjell complex, being only significantly developed around (x. 70500, y. 11620), in contrast to the eastern tracts of the complex where it is extensively developed.

Feldspar porphyritic diorite occurs in sharply defined bodies (x. 68200, y. 10550; x, 69690, y. 14650), consisting of 5-15 m.m phenocrysts of feldspar in a fine-grained dioritic matrix. This lithology does not appear to be particularly associated with any other specific lithology apart from minor trondhjemitic intrusives, nor any specific geological environment.

Trondhjemite, quartz-diorite.

Trondhjemite occurs within the Grøndalsfjell complex as relatively minor intrusive sheets, similar to east Grøndalsfjell. Also similar to the eastern parts of the Grøndalsfjell complex, the trondhjemite sheets are, without exception, later than the diorite. In contrast to the latter area however, the trondhjemites of the Grøndalen area have a predominant trend east - west to ENE - WSW.

No mineralization is associated with the trondhjemites, except for a locality on west Morfjellet (x. 69220, y. 14420) where the trondhjemite contains xenoliths of basic extrusive material which themselves contain pyritic exhalative mineralization. Such pyritic mineralization also occurs in extrusives outside the Grøndalsfjell complex within a few hundred metres and it is therefore without doubt that the mineralization occurring within the trondhjemite represents digested and remobilized exhalative mineralization.

Quartz-diorite occurs in small amounts locally as a phase derived by alteration of diorite by trondhjemite (x.69850, y.11600) and in one locality (x.71050, y.13820) as a distinct phase net-veining gabbro. The type and frequency of occurrence of this lithology in the Grøndalen area of the Grøndalsfjell complex is similar to that in east Grøndalsfjell.

Trondhjemite pegmatite.

Termed a trondhjemite pegmatite in the field, this lithology essentially consists of coarse euhedra of muscovite (to 10 mm.), garnet (to 2 m.m.) and dark amphibole (to 5 m.m) in a fine-grained saccharoidal-textured groundmass, the composition of which varies from trondhjemitic to granitic or granodioritic according to occurrence of K-feldspar.

The lithology, forming sheets and veins, is restricted to the north of the Grøndalen area (e.g X.72765, Y.12740), where it is intruded into hydrated gabbro and diorite. In east Grøndalsfjell, a lithology of similar type, but lacking in garnet and amphibole, occurs only in small amounts at a single locality.

Minor basic intrusions.

Minor basic intrusions, dolerites or 'black dykes' occur throughout the Grøndalsfjell complex, having thicknesses rarely exceeding the average order of 10-30 cms, and trending either east-west or NNE-SSW. As far as the chronology of intrusion of these sheets is concerned, Walker (1972) considers them to have been intruded prior to the trondhjemites on east Grøndalsfjell. In the Grøndalen area this is also generally the case, however examples do occur where such minor basic sheets cut trondhjemites. It can only be concluded then, that intrusion of such basic material took place in the later stages of evolution of the Grøndalsfjell complex.

No mineralization is genetically associated with the minor basic intrusions. In certain localities where the sheets are intruded into gabbro and hydrated gabbro however, coarse concentrations of pyrite occur along their contacts within chloritized gabbro, this being evidently the result of high temperature alteration of the gabbro.

ii) Storberget intrusive complex.

Trondhjemite.

The trondhjemite of the Storberget intrusive complex is continuous with that occurring to the south-east around Midtre Nesåvatn and Piggvatnet. In contrast to that of the Grøndalsfjell complex, the trondhjemite of the Storberget complex occurs as a thick and important entity. The mineralogy of the trondhjemites in both complexes is, however, similar, and a common parentage for the two is plausible. Texturally, the trondhjemite of the Storberget complex differs from that of the Grøndalsfjell complex in that it is strongly sheared, a rudimentary schistosity being commonly developed. This schistosity is concordant with that of the surrounding extrusives and with that of the thrust plane extending beneath the Grøndalsfjell complex to the north and north-east.

The trondhjemite of the Storberget complex was evidently much more active and efficient in alteration / digestion of its country rocks, namely gabbro and extrusives, this being almost certainly due to the larger volume and correspondingly higher heat capacity of the Storberget trondhjemite. The high but variable degree of digestion of country rock by this trondhjemite is reflected by the wide lithological variation encountered i.e from relatively uncontaminated trondhjemite to lithologies approaching fine-grained banded diorite in appearance but which evidently represent trondhjemite-plus-digested-extrusive or gabbro that has been subsequently been subject to shearing.

It is of interest that no examples of trondhjemite containing coherent gabbroic or extrusive xenoliths have been recorded in the Storberget complex, suggesting that the net-veining 'front' of the original intrusive body has been displaced and lost within the highly sheared belt that separates the Grøndalsfjell and Storberget complexes. A remnant of this front may be represented by the trondhjemite-extrusive xenolith association at the margins of the Grøndalsfjell complex on Murfjellet.

Quartz-eye gabbro, dolerite.

This fine- to medium-grained lithology is characteristically extremely dark and dense, being rich in finely disseminated magnetite, pyrrhotite and pyrite, containing abundant microveinlets and clear eyes of distinctively blue tinted quartz ('metamorphic' or 'strained' quartz). The lithology occurs both as a large body directly south of Grøndalsvatnet and as sheet-like bodies, and is interpreted as the result of silicification of gabbroic to doleritic material by trondhjemite and its residual solutions at a relatively deep level.

iii) Extrusives.

The extrusives of the Grøndalen area extend in a belt from the vicinity of Spissknullen, separating the Grøndalsfjell and Storberget complexes, thence westward and northward along the western boundary of the Grøndalsfjell complex to the Vestre Lillefjellet area.

Within the belt separating the large intrusive complexes, the extrusives are highly tectonised and variably altered, having a well-developed schistosity. Due to the relatively poor exposure and high deformation in this belt, a satisfactory stratigraphical sub-division of the extrusives is not possible. It is apparent however that the extrusives are essentially basaltic to andesitic in composition, locally variable to dacite-andesite. Finely disseminated pyrite and magnetite is common, while in certain localities coherent exhalite horizons can be recognised, consisting of coarse pyrite-impregnated quartz-chlorite schists (X.68910, Y.13110). No acid pyroclastic lithologies have been recognised within the belt.

From west Murfjellet to the Vestre Lillefjellet area, the trend of the extrusives is concordant with that of their contact with the Grøndalsfjell complex, a thrust plane dipping east to south-east at 30-50°. On west Murfjellet, the extrusives are andesitic to basaltic, locally containing an acid pyroclastic horizon (X.70000, Y.15055) in association with a pyritic exhalite horizon which outcrops close to and trends parallel to the thrust plane. In the Vestre Lillefjellet area, the extrusives contain a much higher proportion of acid pyroclastics which vary from fine-grained to lapilli tuffs. Correspondingly, sulphidic mineralisation is strongly expressed in this area, both as discreet horizons and as irregular knots and disseminations within the lavas. The occurrence of the more strongly mineralised horizons is directly tied to that of the acid pyroclastic horizons, which reach considerable thicknesses, and locally with that of beds of jasperoid. Therefore, although deformation is relatively strong in this area, and intrusive alteration is locally extensive, especially towards the north-east, one can safely assume that the bulk of mineralisation is of exhalative type.

The extrusives of Vestre Lillefjellet have been intruded by a trondhjemitic body, which outcrops to the west and north of Vestre Lillefjellet summit, having a partly tectonised contact trending north-east – south-west. This intrusive consists of deformed quartz phenocrysts in a fine-grained saccharoidal trondhjemite matrix, with minor local K-rich variations. Although no contact relationships between this intrusive and other trondhjemites in the Grøndalen area were observed, from similarities in texture and mineralogy there seems little doubt that the Vestre-Lillefjellet trondhjemite was intruded more-or-less concurrently with other trondhjemites in the evolutionary histories of the Grøndalsfjell and Storberget complexes.

3 STRUCTURE.

i) Phase f_1 and thrusting.

The first phase of regional deformation which produced the primary schistosity most penetratively developed in the extrusives is little represented in terms of isoclinal folds, in fact no f_1 minor folds are recorded in the Grøndalen area. This is due to the overwhelming dominance of the large intrusive complexes which were evidently massive and unyielding in behaviour compared to the surrounding extrusive material under f_1 deformation, such that deformation within the complexes was slight while at their margins and within the extrusives, deformation was extreme. Under such conditions, early developed f_1 minor folds within the extrusives have evidently been flattened beyond detection, whilst with continuing strain, the extreme deformation at and in the vicinity of the contact between the extrusives and the intrusive complexes has led to shearing and the development of thrust fractures. The results of such deformation are exemplified in the belt of extrusives separating the Grøndalsfjell and Storberget complexes. The order of magnitude of displacement on the thrust plane beneath the Grøndalsfjell complex is difficult to assess, but one can safely assume that it is not very great i.e of the order of hundreds of metres rather than kilometres. Of more importance is the nett displacement which has occurred along imbricate thrusts and other fractures within the extrusives in the south Grøndalen area. If one assumes that the Grøndalsfjell and Storberget intrusive complexes were originally parts of one single complex, which is certainly within reasonable bounds, then one must conclude that a nett displacement of the order of kilometres has occurred within the extrusives in this zone of the Grøndalen area.

i) Phase f2 and late fracturing.

Second phase, or post schistosity deformation is of relatively little importance in the Grøndalen area, being represented solely by minor shear and chevron folds which occur locally within the extrusives in the south of the area.

Late stage high angle fractures traverse the entire area, generally trending north-east - south-west and having insignificant displacements.

4. MINERALIZATION

i) ASSOCIATED with gabbro

Macroscopic mineralization associated with the gabbroic rafts of the Grøndalsfjell complex and with the silicified gabbros of the Storberget complex consists of variable pyritic and magnetitic impregnation, commonly together with pyrrhotite.

Within the Grøndalsfjell complex, very dark dense lithologies, possibly representing thoroughly altered pyroxenite, contain abundant magnetite in fine dislocated bands, together with pyrrhotite. No chalcopyrite or pentlandite was observed although grains or intergrowths consisting of these minerals may well be present in microscopic amounts, as on east Grøndalsfjell. This is to be confirmed by polished section examination.

Within the Storberget complex, similarly, magnetite appears to be the predominant ore mineral, within dark dense lithologies which also contain relatively small amounts of pyrite and pyrrhotite. No copper or nickel mineralization was recorded.

Elsewhere, minor coarse pyritic mineralization occurs within the gabbros where they have been intruded by late doleritic dykes. This is attributed to local remobilization of sulphides within the gabbro.

ii) Associated with extrusive hornfels.

Mineralization associated with hornfelsed extrusive material occurs in all states from that which has presumably been totally remobilized to that where remobilization of ore minerals and thermal reconstitution of the host rock is minor.

The first extreme is represented by saccharoidal quartz veins containing very coarse grained (to 1.5 cm.) pyrite euhedra

(x. 70065 y. 15075) or veins of massive magnetite (x. 70585 y. 12920). In the latter locality, the distance between such extreme remobilization and clearly recognisable magnetitic jasperoid is only about 50 metres, both occurring within small rafts of what were originally basaltic to andesitic lavas. Identical quartz-vein remobilization of pyrite also occurs outside the Grøndalen area, km to the east, on the north east slope of Heklefjell, where the Skorovas intrusive arc is presumably responsible for remobilization of local massive sulphides.

Within the extensive lobe of hornfelsed extrusive material, of basaltic to dacitic character, which occurs on Hurfjellet, isolated outcrops of predominantly pyritic mineralization are very numerous. In this area, such mineralization occurs as beds resembling exhalites or as pockets of irregular form having vein-like extensions into the country rock. It is clear that here also there is great variation in the degree of sulphide remobilization. No clearly recognisable examples of jasperoid have been recorded in the area, although one can appreciate that at the temperatures to which the extrusives had been elevated, the survival of essentially quartz horizons must have been close to impossible. Quartz, as distinctly blue-coloured, 'metamorphic quartz' forming masses consisting of mutually interlocking 'eyes', does occur commonly however in association with pyritic mineralization, and such material may represent remnants of local jasperoidal silica that has since been tectonised. No Cu or Zn mineralization was recorded in this area.

Elsewhere in the Grøndalen complex, to the north and north-east of Grøndalsvatnet, rafts of hornfelsed extrusive material occur in all states of digestion (p. 5). In this area, chalcopyritic mineralization is closely associated with such lithologies, while in one locality (X. 69310, Y. 12465), chalcopyrite - pyrite - pyrrhotite - magnetite mineralization is accompanied by graphite, testifying to an exhalative genesis. Around (X. 69315 Y. 11205), pyrite - chalcopyrite mineralization occurs within diorite textured lithologies and, similar to northern Murfjellet, in irregular vein-like pockets or discontinuous beds within or close to the margins of rafts of extrusive origin. The area is in general anomalously Cu rich as demonstrated by the common occurrence of Viscaria alpina on lithologies of both dioritic and hornfels character, and, considering that the diorites have demostrably digested large volumes of extrusive material, it is reasonable to assume that the extrusives were the source of the metal. Such mineralization may be the root source for the Co anomaly recorded in stream sediments in the Grønaalsvatnet outlet locality. This is to be investigated by analysis and polished section examination.

It is interesting to note that the rafts, together with their bedded examples of mineralization, to the north-east of Grøndalsvatnet have trends which are broadly parallel to the extrusive hornfels on Murfjellet. This suggests a possible original continuity between the two and also a possible original continuity south-eastward to the mineralization of the Spissknulen area, considering evidence from the Grøndalen area as a whole that the diorite was emplaced passively, with little or no displacement or re-orientation of the country rocks it was intruded into and which it assimilated. Speculation apart however, the actual trend (133^g on 400g circle) is important to note should geophysical investigations be carried out in the area, since it is not readily apparent in the field.

iii) <u>Associated with acid pyroclastics and jasperoids - Exhalative</u>

Mineralization of exhalative type within relatively unaltered extrusives occurs locally in the vicinity of the margins of the Grøndalsfjell complex to the south and west of Murfjellet. Within this zone there are obvious genetic links between the horizons of massive to disseminated pyritic mineralization, locally in contact with thin acid pyroclastics and of unquestionable exhalative origin, and the metamorphosed, part digested mineralization lying short distances away within the Grøndalsfjell complex. No cupriferous mineralization was recorded in this zone.

To the northwest of the Grøndalsfjell complex, towards Lillefjellet, mineralization of predominantly pyritic type is very common, as horizons intimately associated with fine to lapilli tuffs with or without grey, magnetite poor jasperoid. Pyritic mineralization is also present as innumerable centimetre-thin 'shreds' and discontinuous bands lying irregularly within but conformable to the principally andesitic lavas. Over most of the area in fact, one cannot traverse across strike more than 10-15m. without recording pyritic mineralization in one form or another. No Cu mineralization was discovered in this area, although approximately 1 km. to to north-east, there occurs an outcrop of copper-bearing sulphidic mineralization. The area around this outcrop, one of the original Foslie skjerps, and towards Lillefjellet is practically devoid of exposure, making undoubted correlation between the two areas impossible. However the mineralization of the Foslie skjerp has undergone strong thermal and dynamic metamorphism and texturally strongly resembles mineralization occurring in hornfelsed extrusive material within the Grøndalsfjell complex, such as that at the outlet of Grøndalsvatnet. On these grounds and the fact that the mineralized horizons in the S. Lillefjellet area trend directly towards the locality of the Foslie skjerp, it is considered highly unlikely that the latter represents anything other than metamorphosed exhalative mineralization.

5. CONCLUSIONS.

Firstly, evidence of potentially economic liquid magmatic mineralization was not encountered in mapping the Grøndalen area. It is likely however that traces of nickel and copper mineralization occur on the microscopic scale, associated with the magnetite - pyrite - pyrrhotite assemblages predominating in gabbroic rafts which lie within the diorite of the Grøndalsfjell igneous complex. The magnitude of the Grøndalsfjell complex must also be taken into consideration. One can estimate a probable depth to the base of the tectonically bounded mass of 900-1200 m, from the approximate centre of the complex on Grøndalsfjell at 800 m above sea level. Of the zones of the complex containing traces of Ni/Cu mineralization, i.e. those zones having abundant gabbroic rafts, the vertical exposure provided by topography is only about 500m, leaving 400-700m depth in which it is impossible to predict any changes in character that might occur in the igneous complex. Similar mineralization was recorded in the Storberget complex to the south of Grøndalsvatnet, this complex being similarly tectonically bounded and continuous southward with the Trondhjemite mass of Midtre Nesåvatn - Piggvatnet and also with the layered gabbros and diorites forming Nesåpiggen. Therefore, considering the size of these complexes, their obviously complex history and, due to their tectonic boundaries, their unknown behaviour at depth, they are clearly of economic interest. At present, K. Wilson is undertaking a study of the comparative aspects of mineralization within the Grøndalsfjell, Storberget and Nesåpiggen igneous complexes as his special project which will be an integral part of the degree (BSc) dissertation. It is hoped that, in the following months, more will be understood of metallogenesis within the complexes, with particular reference to Cu and Ni mineralization.

With respect to exhalative mineralization, two areas are of interest. The first lies north and north-east of Grøndalsvatnet (X 69000 - X 70000, Y 12500 - Y 11.000), within the Grøndalsfjell complex, where rafts of hornfelsed basic extrusive material contain massive to impregnated pyrite - pyrrhotite - magnetite - chalcopyrite mineralization in horizons and in irregular vein-like bodies. The matrix diorites are similarly enriched in Cu, locally containing chalcopyrite, while viscaria alpina is commonly found on both diorite and hornfels in the area. Within this area, two localities are particularly noteworthy (1) X. 69310, Y. 12465 (2) X. 69315, Y. 11205. The former consists of massive and disseminated pyrite together with pyrrhotite, magnetite, chalcopyrite and graphite, trending approximately east-west, the westerly continuation being covered in drift. At the second locality a basic 'diorite', or rather diorite having a high degree of basaltic contamination, contains significant quantities of evenly distributed chalcopyrite with pyrite.

The second area of interest lies in the south V. Lillefjellet-Grøndalselva tract, where predominantly pyritic mineralization occurs very commonly, as horizons or thin shreds within the lavas. The horizons strike north-eastward towards the chalcopyrite-bearing skjerp discovered by Foslie (X. 72830, Y. 14310) which has been the attention of geophysical investigations, the results of which did not indicate significant strike continuation. The horizons extend south-westward and westward into Lillefjelldomma, this area having been mapped previously at 1:50.000 scale by Sigbjørn Kollung and partly covered by geophysics in 1971, 72. In the field season of 1977, after continuing westward from the mapping of Halls and Walker on Grøndalsfjell, it was found that there was highly insufficient time to cover the Lillefjelldomma and further western areas in the detail that they obviously demanded., thus investigations in these areas were of a recconaissance nature. The mapping of S. Kollung was found to be completely adequate at the scale used. The area demands mapping at a scale no less than 1:10,000 however, since it is of obvious economic interest, and also possibly greater coverage by VLF and magnetometry geophysics. The former is problematical since the largest scale maps available are at 1:25.000. It is suggested therefore that if further mapping is to be carried out in this area, the use of enlarged 1.30,000 aerial photographs, with subsequent controlled transfer of data to the 1:25.000 grid, would be satisfactory.

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