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SULFIDE MINERALIZATION IN PRE-SILURIAN ROCKS, THRASHER PEAKS, WESTERN MAINE

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The area at Thrasher Peaks affords an opportunity to observe several aspects of the geology of northwestern Maine. The present trip will include examination of the lithologies and structure in the Magalloway Member of the Dixville Formation and some of the features of the sulfide mineralization present in this member. There will also be a short traverse to study the relationship of the Magalloway Member to some younger (?), well-preserved agglomerates, arkoses, slates and Devonian microgranite.

Thrasher Peaks, a series of low, northeast trending hills, lies on the northwest limb of the Boundary Mountain anticlinorium. As indicated on geologic maps by Green (1968) and Harwood (1966, 1969), the southeastern slopes of the Peaks are underlain by the Magalloway Member of the Middle Ordovician Dixville Formation and Devonian microgranite. Green's map shows a small detached body of Seboomook slate at the southwest end of this slope. The northwestern slopes are underlain by the Devonian Seboomook Formation and the crest-line of the Peaks is underlain by Ordovician greenstones and agglomerates, Silurian conglomerates and Devonian microgranite. Assignment by Green of the greenstone and agglomerate unit to the Ordovician and the conglomerates to the Silurian is tentative. A structure section through the area by Green (1968) shows Thrasher Peaks as a minor anticline, slightly over-turned to the southeast. Details of the structure and regional stratigraphy may be found in articles by Green (1968), Green and Guidotti (1968), and Harwood (1966, 1969; also Harwood and others, this guidebook).

With the exception of a few additional rock types located during preliminary work by the author, the local stratigraphic sequence is that of Green, as summarized below.

Magalloway rocks in the area consist predominantly of quartz-feldspar-sericite schist with dark gray, thinly laminated chloritic slates and light green phyllites as minor elements. There are also lenses of dark gray siliceous metagreywacke and black chert in the dark gray slates. The dark slates commonly are highly distorted, especially at the contacts with the siliceous units described above. The quartz-feldspar-sericite schist is medium to coarse grained and at places may be aptly described as "augen schist". The protolith of the schists is problematical due to the extreme shearing in the rock; some are certainly clastic sediments whereas others, as suggested by Green (1968), have been derived from felsic volcanics.

The greenstone and agglomerate unit which crops out on the ridge-line of Thrasher Peaks contain cobbles of quartz-feldspar grit which are similar in mineralogy and texture to the quartz-feldspar schists of the Magalloway. The relationship is complicated, however, by the presence of an arkosic unit in contact with the agglomerates, which although similar to the quartz-feldspar-sericite schist of the Magalloway, is relatively unmetamorphosed and lacks evidence of the extreme deformation found in the Magalloway rocks. As the arkosic unit is in contact with the agglomerates, this unit would appear to be a more likely source for the grits in the agglomerates than the quartz-feldspar-schist of the Magalloway.

In addition to the presence of the arkosic grits in the agglomerate, rounded to subrounded cobbles and boulders of these grits are present in a thin-bedded slate which lies between Magalloway rocks and the arkosic unit described above. Green mapped these slates as Seboomook. The arkosic cobbles and boulders are randomly and sparsely distributed throughout the slates. In addition to the boulders there are several large exotic blocks of microgranite. The source of the arkosic boulders is probably the arkosic unit mentioned above; the source of the microgranite is probably the large microgranite body which crops out about 500 feet from the microgranite blocks.

A suitable mechanism to account for the presence of the boulders of arkose and exotic microgranite in the slate has yet to be worked out. Movement of the slate unit through gravity sliding, submarine slumping or mudflow are possibilities. There also is the possibility that the exotic microgranite blocks represent slices of the nearby microgranite body taken during thrusting. The exact nature of the mechanism rests on the age relationship of the slate to the arkose unit, to the microgranite and to the Magalloway rocks.

Sulfide mineralization in the Thrasher Peaks area is present in the metasediments and metavolcanics of the Magalloway Member. Presence of copper, iron, lead and zinc sulfides is of interest as they appear to be genetically related to volcanic activity during the period of deposition of the Magalloway. Post depositional deformation mobilized the sulfides into fold hinges where they are presently concentrated.

The area of mineralization may be defined approximately by a narrow linear zone which parallels the regional structure along the southeastern flanks of Thrasher Peaks. Known limits of this zone are about 300 feet in width and more than three miles in length. Significant quantities of sulfides, however, are known at only a few locations within the zone. All sulfide mineralization appears to be limited to the quartz-feldspar sericite schists and chloritic slates of the Magalloway Member. Minor pyrite and chalcopyrite is associated with the greenstones and agglomerate unit described previously.

Mineralization is present either as massive accumulations associated with fold hinges or disseminated in the host rocks. Disseminated sulfide is predominently pyrite with very minor chalcopyrite. Commonly the pyrite in the schist is small (1-5 mm), angular to subangular grains arranged parallel to the foliation of the rock. Pyrite is also present as fine grained masses, 1/4" to 1/2" across, and in cross-cutting quartz stringers. In the slates, fine grained aggregates of pyrite are present parallel with the bedding of the slate. These masses, generally 1/2" to 3" across, are lenticular in shape. Finer, thin stringers of pyrite are parallel with the cleavage.

The larger sulfide masses are simple in mineral composition: pyrite, chalcopyrite and sphalerite. Galena generally is not associated with these sulfides, but is found in discrete thin layers close to these sulfide masses. Pyrite is ubiquitous, present as fractured cubes and subangular grains. These grains exhibit a wide range in size, from microscopic fragments to grains about one centimeter in size. The fractured pyrite has been invaded by chalcopyrite and sphalerite, which are present as intermixed poorly defined bands parallel with the foliation of the host rock. Rare chalcopyrite inclusions are found in the sphalerite.

At the present stage of the study of this area little may be said of the structural aspects of the mineralization. Detailed mapping at known mineralized areas indicates, however, that the sulfides are localized in the hinges of folds. In these areas masses of sulfides have replaced the quartz feldspar sericite schist resulting in zones 20 to 40 feet across. Although the precise relationships are not yet clear, the sulfides appear to have participated in the second period of folding which has resulted in tight, southwest plunging folds. These folds are asymmetric, overturned to the southeast and with small cross section and closure.

Spatial and temporal relations of the sulfides to the host rocks suggest that deposition of the sulfides was pene-contemporaneous with the pyroclastics and clastics of the Magalloway Member. Source of the mineralizing fluids may well have been subaqueous hydrothermal venting associated with the acid volcanic activity. The fluids may have impregnated the soft, water saturated sediments with sulfides resulting in broad dissemination of the base metals. Subsequent deformation mobilized the sulfides into the hinges of folds as the folds formed.

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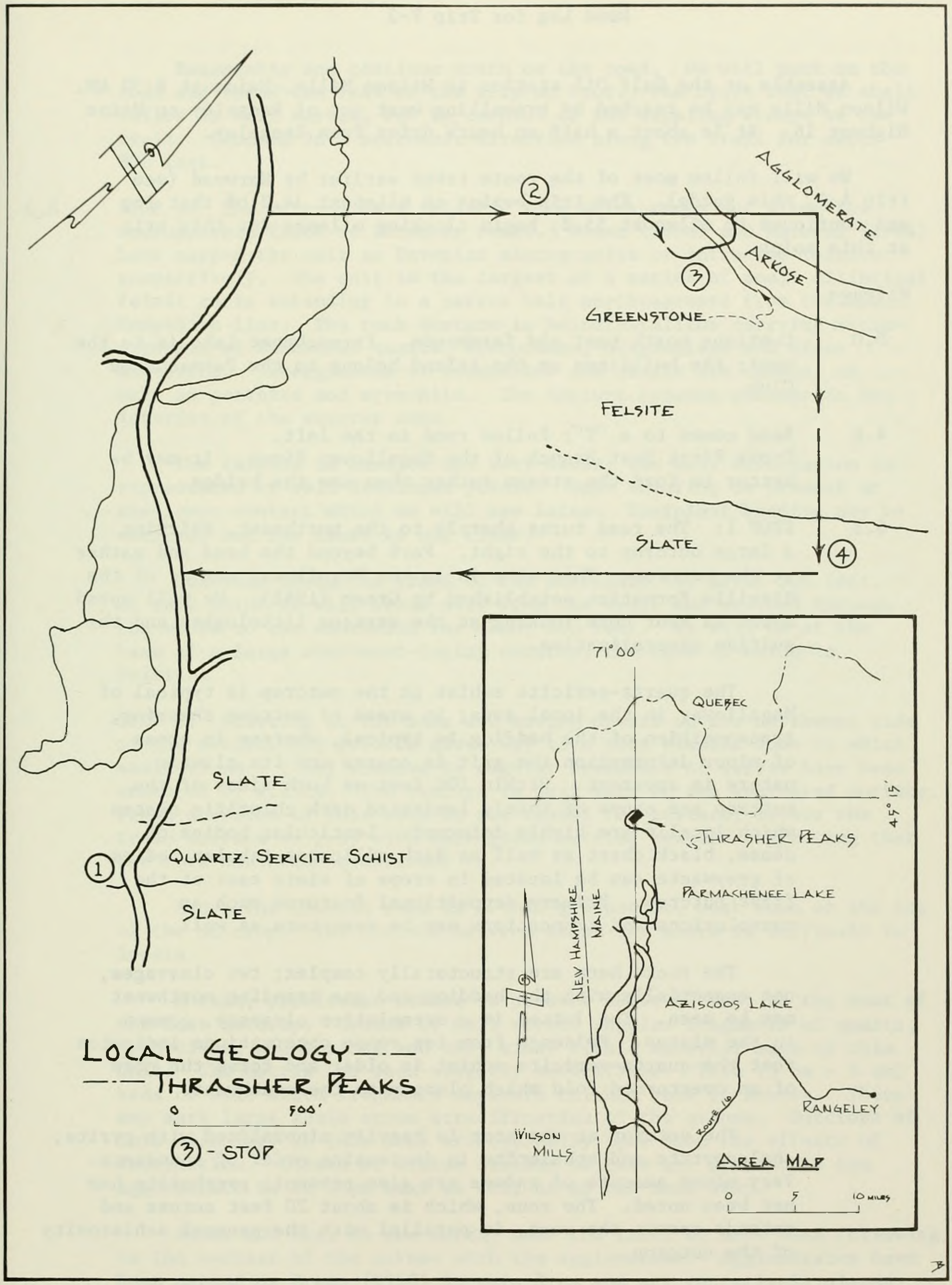
AGGLOMERATE
ARKOSE
GREENSTONE
FELSITE
SLATE
SLATE
QUARTZ-SERICITE SCHIST
SLATE
LOCAL GEOLOGY
THRASHER PEAKS
0
500'
- STOP
71°00'
QUEBEC
45°15'
THRASHER PEAKS
PARMACHENEE LAKE
NEW HAMPSHIRE
MAINE
AZISCOOS LAKE
RANGELEY
ROUTE 16
WILSON MILLS
AREA MAP
0
5
10 MILES

Road Log for Trip F-2

Assemble at the Gulf Oil station in Wilson Mills, Maine at 8:30 AM. Wilson Mills may be reached by travelling west out of Rangeley on Maine Highway 16. It is about a half an hour's drive from Rangeley.

We will follow most of the route taken earlier by Harwood (see trip A-3, this guide). The trip begins at milepost 34.2 of that log and continues to milepost 55.8; begin clocking mileage for this trip at this point.

Mileage

0.0 Continue north past old farmhouse. Parmachenee Lake is to the west; the buildings on the island belong to the Parmachenee Club.

4.6 Road comes to a "Y"; follow road to the left. Cross First East Branch of the Magalloway River. It may be better to ford the stream rather than use the bridge.

6.3 STOP 1: The road turns sharply to the northeast, skirting a large outcrop to the right. Park beyond the bend and gather at the outcrop. This stop is in the Magalloway member of the Dixville Formation established by Green (1968). We will spend about an hour here looking at the various lithologies and the sulfide mineralization.

The quartz-sericite schist at the outcrop is typical of Magalloway in the local area; in areas of extreme shearing, transposition of the bedding is typical, whereas in areas of minor deformation the grit is coarse and its clastic nature is apparent. Within 100 feet on both sides of the outcrop are crops of thinly laminated dark chloritic slates which locally are highly deformed. Lenticular bodies of dense, black chert as well as dark siliceous tabular bodies of greywacke can be located in crops of slate east of the first outcrop. Primary depositional features such as convolutions and truncations may be seen here as well.

The rocks here are structurally complex; two cleavages, one essentially with the bedding and one trending northwest may be seen. The latter is a crenulation cleavage, common in the slates. Evidence from top sense observations indicates that the quartz-sericite schist is older and forms the core of an overturned fold which plunges to the southwest.

The outcrop at the stop is heavily mineralized with pyrite, chalcopyrite and sphalerite in decreasing order of abundance. Very minor amounts of galena are also present; pyrrhotite has not been noted. The zone, which is about 20 feet across and extends across the road, is parallel with the general schistosity of the outcrop.

Reassemble and continue north on the road. We will park on the road and spend the rest of the trip on foot. The trail that we shall follow is well marked, but be careful of the sappling stumps on the trail. Proceed in a northeast direction along the trail for about 800 feet.

6.8 STOP 2: The outcrop is a felsitic rock which crops out along the southeastern flank of Thrasher peaks. Green (1968) and Harwood (1966) have mapped the unit as Devonian microgranite or intrusive felsite respectively. The unit is the largest of a series of small elliptical felsic rocks extending in a narrow belt northeastward from the New Hampshire line. The rock texture is holocrystalline carrying micro-crystals of subhedral quartz, orthoclase, plagioclase and minor muscovite. Intergrowths of tourmaline and quartz are common, as well as perthite and myrmekite. The texture becomes coarser in the interior of the outcrop zone.

The felsite is massive and very dense; the only deformation is represented by well developed joints. Some shearing is present at the lower contact which we will see later. Incipient banding may be noticed, but the cause is not clear.

Continue along the trail to the northeast for about 500 feet. At this point we will break away from the trail and proceed through the woods to the southeast for about 200 feet. We will be at the base of a large southwest-facing outcrop, the base of which is felsite.

STOP 3: Starting at the base and moving upward on the northwest side of the outcrop the felsite gives way to a thin clastic zone in which small (1 mm - 1 cm) rounded to angular fragments of quartz have been cemented by silica. The texture is best seen on the weathered surface. Fresh surfaces of this rock do not reveal the texture; rather the fresh surface is gray with dark-green mottled texture suggesting that the rock has been hornfelsed.

Above the clastic zone is a thin greenstone, best seen at the top of the outcrop. The contact between these two units is difficult to locate.

A thin, persistant arkose is present about 50 feet to the east of the last outcrop. Grains of well sorted angular fragments of quartz, orthoclase, plagioclase and very minor lithic material make up this unit. The matrix has been slightly sericitised. Thin (3 cm - 5 cm) beds of silt-sized fragments separate thicker beds of arkose. These may mark large scale cross stratification of the arkose. Outcrops of this lithology in this area are typically free from the effects of deformation. Clasts of arkose similar to this are present in the agglomerate to be seen next as well as at the next stop.

About 200 feet to the north, near the trail we have been following, is the contact of the arkose with the agglomerate. Agglomerates have been mapped by Green (1968) in this area and are tentatively placed within the Dixville. They are here composed of fragments of various volcanic lithologies, felsites and arkose. The arkose fragments are very similar to those seen just to the south. Pyrite and minor chalcopyrite are very common in the agglomerate.

Regroup at the intersection of the trails going to the northeast and southeast. Proceed to the southeast for about 1000 feet. We will be going downhill and across fairly continuous outcrops of felsite to its lower contact. The texture of the felsite is locally relatively coarse. Small patches of felsite containing arsenopyrite are associated with one of the joint sets.

STOP 4: At the lower contact of the felsite. In this area the felsite is in contact with a dark gray slate, but farther to the east it is in contact with Magalloway quartz-sericite schist. Here the contact is faulted, although the fault zone lacks quartz veining, gouge and mylonite. The slates were mapped by Green (1968) as a thin slice of Seboomook Formation; present work has extended the area of outcrop of this slate.

Proceed southeast across the small valley to a low ridge where good outcrops of folded slate may be seen. This slate is unusual because it contains sub-rounded cobbles and boulders of arkose similiar to that seen at stop three. Early folding appears to have resulted from slumping; later deformation has resulted in broader southwest plunging folds.

We will return to the vehicles along a trail to the southwest. Proceed about 2000 feet to the southwest until it comes out on the road. The vehicles are north along this road. Return to Rangeley.

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