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Summary Report No. 7

FURTHER NOTES ON FIELD WORK IN THE COPPER-NICKEL
PROSPECT AREA, LAKE AND ST. LOUIS COUNTIES, MINNESOTA

by

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June 1954

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Mapping of the contact between the Duluth gabbro and the Giant's Range granite in the vicinity of Birch Lake by the Minnesota Geological Survey was started in the summer of 1952 and continued in the summer of 1953. Interest in the work was stimulated by the discovery in 1948 of copper and nickel sulfides in the basal part of the gabbro along the South Kawishiwi River. Two previous papers summarized the geologic setting and the field work prior to 1953.* Most of the work in 1953 was in St. Louis County.

*Geologic Setting of the Copper-Nickel Prospect in the Duluth Gabbro near Ely, Minnesota. G. M. Schwartz and D. M. Davidson. Mining Engineering. July, 1952. pp. 699-702.

*Notes on Field Work in the Copper-Nickel Prospect Area, Lake County, Minnesota. G. M. Schwartz and J. M. Harris, M.G.S., Summary Report No. 6, November, 1952.

South of Birch Lake in Sec. 26, T. 61 N., R. 12 W., and from there southwestward, the Biwabik Iron Formation (the eastward extension of the Mesabi Range) forms a narrow belt between the gabbro and the granite. Mapping from here southwestward was extended to cover both contacts.

The first work of the 1953 season was in Lake County in T. 62 N., R. 10 W. A newly-cut survey line was found running north from a recently-opened gravel pit near the east side of Section 19 on the new portion of Spruce Road. The gravel pit was the east-most point on Spruce Road that could be travelled in the summer of 1953. The survey line was not on the section line but about 600 feet west of it. It was followed in mapping, however, because it provided easier access to the north and was not too far from the section line. The line crossed the Gabbro Trail near the NE corner of the section, and on the Gabbro Trail a Forest Service yellow tag was found indicating the NE corner of the section to the east, marked with an iron pin. Our line was then brought to coincide with the section line between sections 17 and 18 and ran north along it for half a mile. The line passed from gabbro into granite just before reaching the "1/4-corner". No more granite outcrops were found near the line until very close to the "1/4-corner" between sections 17 and 18. The line was turned east at this point and followed the "1/4-line" nearly one half mile to the shore of Little Gabbro Lake. The line crossed from granite back to gabbro about half way from the west edge to the center of Section 17. At neither of the crossings of our line over the contact, or near it, were any sulfides found. Reviewing the work at this (east) end of the area mapped, the east-most point at which sulfides have been found is in the SW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 19, T. 62 N., R. 10W.

The remainder of the field season, 1953, was spent in mapping the contact beginning where the work of the previous field had terminated on the west side of Birch Lake in Sec. 7, T. 61 N., R. 11W., and extending the area to the southwest, crossing the west arm of Birch Lake and ending with the south line of Sec. 34, T. 61 N., R. 12 W. No meander corners were found on the west side of Birch Lake except the one which marks the Lake-St. Louis County line. Therefore, in the north part of the area lines running west were laid out beginning on the lake shore starting from points which could be scaled off from identifiable geographic points noted on the Ely Quadrangle topographic map. The starting points were clearly blazed as indicated in the field book (#327). Lines were run every quarter mile beginning with the center line of Section 7

and ending with the center line of Section 18. These lines began on the lake shore, as stated, and continued westward across the contact wherever possible. Much of the terrain was swampy, especially in the vicinity of the contact, so that to carry an undeviating line that far was not always feasible. Open water was encountered in some cases. In some of these cases it was possible to "square around" the open water by offsetting the line by a tally or two. In other cases the remainder of the line had to be tied to the adjacent line by squaring off a quarter mile at the (west) end and coming in from behind. By one or the other of these methods four lines approximately a mile and a half long were run. A fifth (the north "40-line" in Sec. 18, T. 61 N., R. 11 W.) was never finished on the west side of a large beaver pond. The south-most, long line run was the center line of Section 18, the west end of which entered St. Louis County before reaching granite. The gabbro-granite contact, therefore, crosses from Lake County to St. Louis County somewhat north of the "1/4-corner" on the west boundary of Sec. 18, T. 61 N., R. 11 W. The exact distance north of the "1/4-corner" is unknown but is probably between 1/8 and 1/4 mile. The indefiniteness is due to the open water, mentioned above, which prevented the line mentioned (in parentheses) above from being carried out.

South of the center of Section 18 easier access to the contact was gained by running north from the west arm of Birch Lake along the county line and the County Line Trail and at appropriate points running E-W lines defining the contact. Six more lines from 1/4 mile to a mile in length were run on the north side of Birch Lake, thus tracing the contact to the water's edge. The county line constitutes a surveying correction line, the sections on the St. Louis (west) side being offset nearly 1/4 mile to the south of the corresponding rows on the Lake County side. As viewed from the St. Louis County side the contact enters that county somewhere in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 13, T. 61 N., R. 12 W., and continues S-SW into SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 24, where it enters the waters of Birch Lake.

Because section corners were so rarely found in the area of St. Louis County north and west of Birch Lake, it seems worthwhile to describe those that were found. The original bearing tree (MC) for the county line on Birch Lake was found. It is a pine (?) snag about 6 feet high a few feet from the water's edge, appropriately blazed and scribed toward the water. Nearby are several Norway pine one of which has been blazed about 5 feet above ground, also toward the water. In looking for this meander corner it is important not to use the Forest Service maps of the area. They place the County line too far west. Use rather the new "Dunka River NE" topographic sheet of the U. S. Geological Survey. The first section corner north of the lake along the county line (SE corner Sec. 24 and NE Sec. 25, T. 61 N., R. 12 W.) was found about 440 feet north of the meander corner just described. The original marker was not seen but a 10" poplar well-blazed (square) on a rather recently-cut surveyor's line, and approximately in the right place, was taken to be the re-established corner. The NE corner of Sec. 24 (and the SE of 13) --same T. and R.-- was found 48 paces east of the "County Line Trail" (see Ely Quadrangle Topographic Map) and 48 paces short of a mile north of the last previous corner described. It was marked by a Forest Service yellow tag on an old, tall, pine(?) snag. (The snag was blazed but probably is not the original bearing tree). The next corner north on the county line (and on the opposite side of the correction line) was the NW corner of Sec. 19 (and the SW of Sec. 18), T. 61 N., R. 11W. It was found to be about 1120 feet north of the last corner described, and likewise was marked by a yellow tag. It was 53 paces east of the County Line Trail. These were the only section corners found on the north and west side of Birch Lake.

From the point where the contact emerges from Birch Lake in Sec. 6, T. 61 N., R. 11 W., opposite the mouth of the South Kawishiwi River, to the point where it again enters the lake, considerable variation in geology was encountered. Although many of the gabbro outcrops near the contact are of the much-weathered variety, in which sulfides are commonly found elsewhere, only the most meager traces of sulfides is not to be ruled out. In fact, a possibility exists that the presence of swamps there may be, in part, explained by sulfides present in the underlying gabbro. The granites found nearest the contact in this area showed considerable variety. Many of the granite outcrops, especially near the north end, were fine-grained, contained pink feldspars and very much resembled those near the contact along the Gabbro Trail near the Singing Waters Road in Sec. 26, T. 62 N., R. 11W. Here, as there, the outcrops were usually low, though definite. Farther south, particularly in Sec. 24, near the lake shore, the granites were generally quite different in character. Some were fine-grained but most were coarse. But whether fine or coarse they were mostly very dark, apparently because of an excess of hornblende. Quartz was nearly absent and the feldspars white to gray, rather than pink, as was common farther north. It is interesting to note that in an early map of the area by Winchell, these granites (probably granodiorite or diorite would be a more correct classification) were mapped as gabbros.* One outcrop at the

*See Geological and Natural History Survey Vol. 6, Atlas, Plate 77, by N. H. Winchell.

water's edge in SW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 24, T. 61 N., R. 12 W. (at the west extremity of what is known locally as "Airplane Bay") varies from what is clearly granite at the southwest end to what is probably a hornfels resembling fine-grained gabbro, within a distance of less than 50 feet.** Unquestionably intrusion of

**See samples M. 3629 and M. 3630.

the gabbro has greatly altered the granite here. In the part that most resembles gabbro a small showing of sulfides was found.

Beginning about 250 feet northeast of the outcrop just described and running in a northeasterly direction for a quarter mile or more a number of old test pits in iron formation were found. The alignment of these test pits, in the general direction of the strike, suggests one or more fairly large inclusions of iron formation in the border phase of the gabbro. In several outcrops in this area gabbro and iron formation were so intermingled as to make classification into these two categories difficult if not improper.* A rule of thumb

*See Sample M. 3631.

used in mapping here and southwestward was that an outcrop was mapped as iron formation only if hematite and/or magnetite was clearly in evidence.

On the south side of Birch Lake the contact was not clearly defined at the water's edge due to a swamp that extended well into the SE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 26, T. 61 N., R. 12 W. The contact evidently passes beneath this swamp since it has granite to the west of it and gabbro to the east. About a quarter of a mile from the shore, on the center E-W line of the same section the contact is

pinned down very closely by good outcrops. The next east-west line (the south 40-line, same section) encountered iron formation between the gabbro and granite as did every other east-west line to the south as far as the mapping extended. A small showing of sulfide was found in the iron formation on the line mentioned last above. (See sample M. 3650). Sulfides were also found in four closely-spaced outcrops of weathered gabbro just west of the center of the next section south (Sec. 35), and again on the next east-west line 1/4 mile to the south. These sulfides were the most southwestwardly of any found in the area mapped.

Outcrops of the iron formation, first encountered in Sec. 26, T. 61 N., R. 12 W., as noted above, appeared on every east-west line in Sec. 35 (same T. and R.) until it passed into the SE corner of Sec. 34 (same T. and R.), thence into Sec. 3, T. 60 N., R. 12 W., and on to the southwest beyond the area mapped. Although the width of the outcrop area was somewhat variable it was approximately 1/4 mile wide after first attaining this width on the east-west line between Secs. 26 and 35.

Section corners were found in only two places in the area mapped south of Birch Lake. Fortunately a meander corner was located on the south bank of Birch Lake on the nearest north-south section line to the gabbro-granite contact, namely the line between Secs. 26 and 26, T. 61 N., R. 12 W. This meander corner was marked by a leaning, square, cedar (?) post at the water's edge and a few feet above water level. This may be the original post but both the lapsed time and the fact that the level of Birch Lake has been raised since the original survey cast some doubt upon this. This established the north-south line between the sections mentioned above and led to the discovery of the section corner at the southwest corner of Section 25 approximately 3/4 mile south of Birch Lake. It is marked by a metal tag on a tall, blazed, pine snag. This served as the anchor-point for work to the east and west. No other corners were found until a line was run along the south boundary of Sec. 34 (also the south boundary of the township). Here the 1/4 corner was found (marked by a yellow tag on a small jack pine). A brushed-out line was easily discernable west from this point and led to the well-marked corner at the southwest corner of Section 34, T. 61 N., R. 12 W. A yellow tag and a nearby iron pin in a pile of boulders were found on the tip of a "finger" of dry land that extends into a large swamp about a half mile east of Dunka Bay, at the mouth of the Dunka River on Birch Lake. The line was not continued to the west from this corner because of the swamp to the west. However, the section line is marked on a path along the east shore of Dunka Bay.

Close proximity between the iron formation and the granite was found along their contact across Secs. 26, 35 and 34, T. 61 N., R. 12 W. This is to be expected since it represents the surface of an unconformity. In a few places outcrops of iron formation were nearly surrounded by granite (see for example $SW\frac{1}{4}SE\frac{1}{4}$ Sec. 26 and $SW\frac{1}{4}NW\frac{1}{4}$ Sec. 35). Rather close contacts were also found between the iron formation and the gabbro (or what was mapped as gabbro) in these same sections. Quite a little of the gabbro near the contact was of the hornfels variety. This was also true in other places much further north and east but here the hornfels phase seemed somewhat different in that there was a rather pronounced tendency for it to split into rhombohedral blocks. Whether these represented border phases of the metamorphosed iron formation it was difficult to say. The possibility was suggested that some of it at least might be metamorphosed inclusions, or a thin stringer, of the Virginia Slate which extended that far to the northeast.