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IRON-FORMATIONS AND THE LABRADOR GEOSYNCLINE

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G. A. Gross

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Younger Precambrian rocks lie unconformably above older Precambrian granite, granodiorite, and gneisses along the west side of the geosyncline north of Sawbill Lake, in the north part of the region north of Hopes Advance Bay, and on the east side between Snelgrove Lake and the Ashuanipi River. Along the east side of the belt, rock groups recognized as part of the geosyncline appear to be in contact with granitic gneisses, hypersthene granites, and amphibolites along faults in the border zone between Andre Lake in the south and Lac Herodier in the north. The eastern border between Lac Herodier and Hopes Advance Bay is less well defined; highly metamorphosed rocks of the geosyncline are difficult to distinguish from granitic gneisses and amphibolite of uncertain origin that are in part at least derived from geosyncline rocks. In the southeast between Snelgrove Lake and the Ashuanipi River, the border of the geosyncline is difficult to define. Wynne-Edwards noted that "although the passage from clastic sediments to granitic gneiss is abrupt both are mineralogically similar and the former are sheared and recrystallized to a point where they closely resemble gneisses."

Southwest of Sawbill Lake the rank of metamorphism increases to the upper epidote amphibolite facies, two ages of folding are recognized, and distinctive lithological types, such as iron-formation, quartzite, or dolomite, that can be recognized as part of the geosynclinal assemblage, are broken up into complex structural segments associated with granitic gneisses, foliated amphibolites, or gabbro intrusions.

Age determinations based on analyses of potassium and argon, although limited in number, indicate that micas in unit a rocks are 2,365 million years old; in unit b rocks they range in age from 1,635 to 1,935 million years, and in unit c rocks, from 440 to 1,580 million years. The ages indicated for rocks in the geosyncline are based on potassium-argon analyses of recrystallized slate (Menihek) overlying the iron-formation at Knob Lake; in the Cambrian Lake area the younger dates are based on lead-isotope analyses of authigenic galena, and the older dates on galena from a vein in meta-gabbro.

The succession of sedimentary rocks in which the iron-formation occurs is present mainly in the western part of the belt; in the central and eastern part, sedimentary beds are less abundant and are interbanded with volcanic rocks and sills of gabbro and diabase. The volcanic rocks and sedimentary rocks are considered to be contemporaneous because lava flows are interbedded with iron-formation and quartzite southwest of Knob Lake. Positive correlation of the Knob Lake group of sediments and the major groups of volcanic and sedimentary rocks in the central and eastern parts of the region has not been possible because of displacement along thrust faults and emplacement of numerous gabbro sills. Volcanic rocks are interbanded with sediments in the belt north of Otelnuk Lake but the major group of volcanics appears to be present in the upper part of the sedimentary-rock succession.

In most places along the western margin of the belt north of Wabush Lake the succession of rocks overlying the gneisses consists of grey to greenish black slate or argillite overlain by a continuous member composed of orthoquartzite, arkosic quartzite, conglomerate, and grit. This in turn is succeeded by a red to grey-black slate, iron-formation, black slate, and grey to greenish argillite. In the Knob Lake area these rock members thicken eastward, dolomite and chert breccia members are present immediately below the quartzite, and thinner dolomite beds are present in the black slate and argillite above the iron-formation. This general succession of rocks is found throughout most of the western part of the belt, although individual members thicken and thin from place to place and dolomite and chert breccia are absent in some areas. A thick dolomite member is present in the succession of argillite rocks above the iron-formation north of the Koksoak River and west of Wakuach Lake. Baragar has indeed indicated that three dolomite members may be present in the Wakuach Lake area; one below the lower slate, one below the main quartzite formation, and one above the iron-formation.

In the Cambrian Lake area, east-west-trending belts are composed of buff arkose, red and maroon arkose, grit, minor quartz-pebble conglomerate, red siltstone, and sandy dolomite, exceeding 5,000 feet in thickness. These are present below the normal part of the succession consisting of quartzite, red and black slate, iron-formation, and black slate.

In most places iron-formation facies are recognized in the following order of succession: ferruginous, slaty argillite underlying the iron-formation transitional upward through a zone of interbanded chert and argillite to a cherty magnetite-silicate-carbonate facies. This is succeeded by a thin-banded, red, jasper-magnetite-hematite facies or cherty metallic iron-formation. A cherty silicate-carbonate bed is present in places, followed by lean ferruginous cherts, or siderite and dolomite bearing cherty rocks. There is evidence at Knob Lake to suggest that this generalized succession may be repeated by cyclic sedimentation. The iron-formation ranges in thickness from less than 100 to more than 500 feet. It is believed to be the same member throughout the belt north of Wabush Lake, except for thin jasper bands in the lower part of the succession near Cambrian Lake, and cherty magnetite, iron-silicate, and siderite lenses in the eastern part of the belt.

South of Wabush Lake the predominant types of iron-formation vary in composition from hematite-quartz, to hematite-magnetite-quartz, to magnetite-iron-silicate-carbonate-quartz in different structural segments. They are associated with quartzite and in places dolomite. The succession of metasedimentary rocks associated with iron-formation in the southwest is not consistent. Because it has not been possible to determine stratigraphic tops of beds or to correlate from one structural segment to another, it is difficult if not impossible from the information available, to form unique interpretations of stratigraphy and structure in local areas. Iron-formation occurs at two stratigraphic horizons around Bloom Lake north of Mount Wright, and there are thought to be other occurrences of iron-formation within a restricted part of the succession of metasedimentary rocks. There may indeed be several distinct iron-formation members.

The relationship of the succession — red to white sandstone, arkosic sandstone, and quartzite with minor pebble-conglomerate, boulder-conglomerate, and red mudstone, the whole intruded by gabbro sills in the Otish Mountains area — to rocks of the geosyncline or to rocks of unit 8, is not known.

North-striking diabase dykes, not shown on the map, cut sedimentary rocks in the Knob Lake area.

Metamorphism throughout the geosyncline from Sawbill Lake to Finger Lake is generally in the lower green schist facies, with higher-rank metamorphic facies present along the eastern border. The rank of regional metamorphism increases progressively north and east of Finger Lake with epidote amphibolite facies present around Hopes Advance Bay and Payne Bay, and garnet, biotite, hornblende, and staurolite schists and sillimanite-bearing gneisses occurring in the areas of Lac Herodier and Thévenet Lake. Southwest of Sawbill Lake, epidote amphibolite and amphibolite metamorphic facies are present, and hypersthene-bearing granodiorites occur west of Wabush Lake in the gneiss complex.

The iron-formation and some of the associated sedimentary rocks thicken eastward from the exposed unconformable contact with the gneisses west of Knob Lake and in the Ford Lake iron range. This suggests that these contact zones may parallel the shorelines of ancient basins in which the ferruginous sediments were deposited.

The characteristic structural pattern throughout much of the basin consists of doubly plunging isoclinal folds overturned to the southwest. These are cut by numerous thrust faults that strike northwest and dip steeply northeast. Post-Cretaceous faults have been recognized in the Knob Lake area, and Middle Ordovician limestone is deformed by faulting and intruded by diabase along Manicouagan Lake. Low-angle thrust faults are present in the Ungava Bay area. At least two ages of folding and several sets of faults are recognized southwest of Wabush Lake with the development of very complex local structures.

The Labrador geosyncline can be divided into three geological divisions for consideration of economic aspects. The southern division lies southwest of Sawbill Lake. It contains extensive deposits of coarse-grained metamorphosed iron-formation, some of which are being developed on a large scale for the production of high-grade iron-ore concentrate. The central division extends north from Sawbill Lake to Finger Lake. In it the rocks are not highly metamorphosed and contain well known hematite-goethite ore deposits in the Knob Lake area. These are derived from iron-formation through leaching of the silica and some redistribution of the iron. Partly leached iron-formation is found in many other parts of the division. Base-metal sulphide minerals occur in the basic intrusive rocks, and asbestos minerals are present in parts of the ultramafic rocks and in fracture fillings in some of the iron-formation. In the northern division the iron-formation is in more highly metamorphosed rocks. It is recrystallized and forms potential iron-ore deposits suitable for beneficiation.

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