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CANADA
DEPARTMENT
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GEOLOGICAL SURVEY OF CANADA
TOPICAL REPORT NO. 2

NOTES ON THE GEOLOGICAL INTERPRETATION
OF AEROMAGNETIC MAP OF
CONCEPTION BAY, NEWFOUNDLAND

By
W. D. McCartney



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Rocks underlying the area covered by the preliminary aeromagnetic map of Conception Bay include the Harbour Main group (volcanic rocks, mainly andesitic), the Conception group (sedimentary rocks, mainly slate and siltstone), the Holyrood intrusive rocks (mainly granite, but with small bodies of quartz monzonite and gabbro), and, overlying these, Cambrian and Ordovician rocks (shales, sandstones, limestone, and, on the northwest of Bell Island, beds of hematite ore). The structural trend of the Precambrian rocks is dominantly north-northeast, whereas the Palaeozoic beds strike northeast and dip gently northwest under Conception Bay. In general, the aeromagnetic contours appear to be controlled by rocks lying beneath the Palaeozoic beds. West of Bell Island, under Conception Bay, no obvious terminating structure of the Ordovician hematite deposits is apparent.

The maximum magnetic relief in the area is of the order of 1,000 gammas, but, except for five major anomalies, over most of the area magnetic relief is only 100 gammas.

Examination of the geological map of Torbay area (Rose, 1952)¹, shows that the prominent linear anomaly trending

¹ Dates in parentheses are those of references cited at the end of this report.

north-northeast along the east shore of Conception Bay may be assumed to mark the Topsail fault and those Harbour Main volcanic rocks to the east of it. Palaeozoic beds lie on the west of, and are terminated by the fault. Subsidiary faults, and probable variations in rock types within the Harbour Main group, account for some of the irregularities exhibited along this zone.

The anomalies lying 3 miles south of Kellys Island, 4 miles east-northeast of Kellys Island, and extending north from Bell Island are calculated by L. W. Morley to be caused by responding rocks at depths, respectively, of about 5,000, 6,000, and 10,000 to 15,000 feet. The Palaeozoic rocks in the area of the first two anomalies are about 1,000 feet thick, and in the area of the third anomaly are little more than 6,000 feet thick; the rocks that cause the anomalies are, therefore, believed to lie below the Palaeozoic beds. From a knowledge of the geology of the Holyrood map-area immediately to the south (McCartney), it is inferred that the elongate anomaly north from Bell Island, and the probably related anomaly east of Kellys Island, are caused by roof pendants of volcanic rocks in granite or by a structure similar to that responsible for the anomaly north of Colliers Bay, to be discussed below. The anomaly south of Kellys Island lies 3 miles north of a small gabbro body surrounded by granite, the intervening area being covered by Cambrian beds. This anomaly may be caused by an extension of the gabbro; by a separate but similar body; or by a small roof pendant of volcanic rock.

The anomaly trending north from Colliers Bay up the west shore of Conception Bay has been calculated to be of near-surface origin, and is caused by surface exposures of volcanic rocks of the Harbour Main group. It is noteworthy that it trends parallel with the anomaly north of Bell Island and suggests a similar origin for the latter.

One-half mile west of Colliers Bay in the Holyrood area, the Harbour Main group is unconformably overlain by westward dipping Conception slates. The volcanic rocks extend eastward beneath Colliers Bay to a faulted and contorted contact on the east side of the bay with generally eastward dipping Conception beds.

This contact lies approximately at the east boundary of the anomaly. The western boundary of the anomaly within the area follows the faulted contact of Harbour Main and Conception rocks as reported by Hutchinson (1951). Thus, in general, the rocks causing this anomaly are brought to the surface in a faulted anticline.

From geologic mapping in the vicinity of Colliers Bay, the writer has concluded that the Colliers Bay fault zone of Hayes, formerly postulated as the westward termination of the iron ore and supposed to lie under Colliers Bay, does not exist (Hayes, 1931; McCartney). On this map, if such a zone were present, the western anomaly should be truncated at the southern boundary of the area and, not only is such a truncation lacking, but also, from a knowledge of the rock types to the south, the anomaly probably continues and widens southward. The extension of the postulated fault zone to the north-northeast is not indicated by irregularities in the magnetic contours, as would be expected were it present.

As the Colliers Bay fault zone as a clear-cut western termination of the ore does not exist, and as the Ordovician rocks do not appear on the west side of Conception Bay, the alternatives are that the ore is terminated by other faults, by a syncline or basin, or by a combination of these. The east border of the western anomaly may represent a structure affecting the Palaeozoic rocks but, as pointed out above, the anomaly is basically representative of Precambrian rocks. It is also noteworthy that a shallow, elongate syncline of Lower and Middle Cambrian beds lies west of Colliers Bay and west of the southward extension of this anomaly. Numerous faults mapped in the Holyrood area extend under Conception Bay. On some of these faults the major movement is believed to have occurred in Precambrian time, and thus these faults could not affect the Palaeozoic beds; on others there is evidence of post-Cambrian movement. Several of the latter faults indicate a minimum

or, in one case, an actual stratigraphic displacement of the Cambrian beds of about 80 feet. When considering relatively small displacements of Cambrian rocks in the Holyrood area, a further complication arises from the possibility that faults in the Cambrian beds, adjacent to the structurally competent Precambrian rocks, may die out or pass into folds as they transect the 5,000 feet or more of relatively incompetent shales and sandstones that lie below the ore horizons.

The aeromagnetic map seems further to discredit the postulated Colliers Bay fault zone, but does not suggest an alternative structure for the westward termination of the ore. The eastward termination of the ore at the Topsail fault seems confirmed. The writer suggests that, west of Bell Island, a north-plunging syncline or a structural basin may prove to be the dominant control of the ore horizons, with lesser complications introduced by faults. A westward extension of the submarine workings, or some submarine exploration method, seems required to outline the ore strata with any degree of certainty.

Most of the interpretations suggested here were developed during discussion of the map with L. W. Morley and A. Larochelle of the geophysics section and, with L. J. Weeks and E. R. Rose. Calculations of depth of burial were made by A. Larochelle.

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