GEOLOGY OF CARBONIFEROUS STRATA IN THE CORMACK (12H/6) AND SILVER MOUNTAIN (12H/11) MAP AREAS

by

Richard S. Hyde and Michael J. Ware*

INTRODUCTION

Discoveries of uranium-rich sandstone fragments in tills by Westfield Minerals in 1978 prompted mapping of Carboniferous strata in the Cormack (12H/6) and Silver Mountain (12H/11) areas in 1979, as part of an ongoing project to map the Deer Lake Basin on a 1:50,000 scale. Carboniferous strata in the map area unconformably overlie Late Precambrian to Devonian crystalline and metasedimentary rocks, but locally, fault contacts are present. These pre-Carboniferous rocks were briefly examined near the contact with the main body of Carboniferous strata. The map area is part of a Carboniferous graben-like trough termed the Deer Lake Basin. Carboniferous rocks of the Deer Lake Basin consist of two groups: (1) the lower Mississippian Anguille Group, and (2) the upper Mississippian to lower Pennsylvanian Deer Lake Group. Popper (1970) and Hyde (1979) have informally subdivided the Anguille Group. Subdivision of the Deer Lake Group (Belt, 1969) is, in ascending order: (1) North Brook Formation; (2) Rocky Brook Formation; (3) Humber Falls Formation; and (4) Howley Beds.

Important results include:

(1) Discovery of radioactive anomalies in the Deer Lake Group and in Cambrian metasandstones.

(2) Delineation of an outlier of the North Brook Formation consisting of lithologies new to this formation.

(3) Extending the known distribution of the North Brook Formation in a northeastward direction along the southeastern part of Birchy Ridge.

(4) Recognition of the Rocky Brook Formation along Boot and Big Falls Brooks. This unit is not shown at these localities on previously published maps.

(5) The absence of a regional fold closure, as is usually shown on older maps, involving the Deer Lake Group in the northern part of the Cormack area.

(6) Presence of a synclinal fold closure southeast of Adies Pond involving the Humber Falls Formation, and a new distribution of the Rocky Brook and Humber Falls Formations in the southern part of 12H/6 area.

STRATIGRAPHY

Anguille Group (Map Unit 6)

Hyde (1979) subdivided the Anguille Group into four mappable units, which occur in two fault blocks called the Glide Mountain and Birchy Ridge - White Bay blocks. In the Cormack area, the latter structural block is present and is mainly underlain by dark gray to black fine grained sandstones, siltstones, and mudstones. These rocks contain abundant detrital white mica and carbonaceous material. Sedimentary structures include cross-lamination, climbing ripple lamination, convoluted bedding and slumping. These fine grained beds are intercalated thickly-bedded, medium to coarse grained, micaceous, light gray sandstones that have erosive

*Department of Geology, Memorial University, St. John's, Newfoundland A1B 3X5

LEGEND

CARBONIFEROUS

DEER LAKE GROUP

10 Howley Beds: Brown and yellow-brown, coarse grained sandstone and pebble conglomerate.

9 Humber Falls Formation: Pink, orange, red and gray, predominantly medium to coarse grained sandstone; pink and gray pebble conglomerate; red and gray silstone.

8 Rocky Brook Formation: Calcareous red and gray silstone and mudstone, limestone (including algal, oolitic and pisolitic types); very fine to fine grained red and gray sandstone; oil shale.

7 North Brook Formation: 7a, Red and gray medium to coarse grained sandstone; red and gray, pebble to boulder conglomerate; gray and pink limestone; red siltstone and mudstone; 7b, pebble to boulder limestone conglomerate set in calcareous matrix; vuggy, gray and yellow microsparic limestone.

ANGUILLE GROUP

6 Gray, micaceous, medium to coarse grained sandstone; dark gray to black, micaceous fine to very fine grained sandstone, siltstone, and mudstone; light gray pebble conglomerate; gray, micritic limestone.

DEVONIAN

5 Gales Brook Stock: Gray and white granitoid rock, minor gabbro.

SILURIAN

4 4a, Felsic volcanic rocks; 4b, mafic volcanic rocks.

ORDOVICIAN OR OLDER

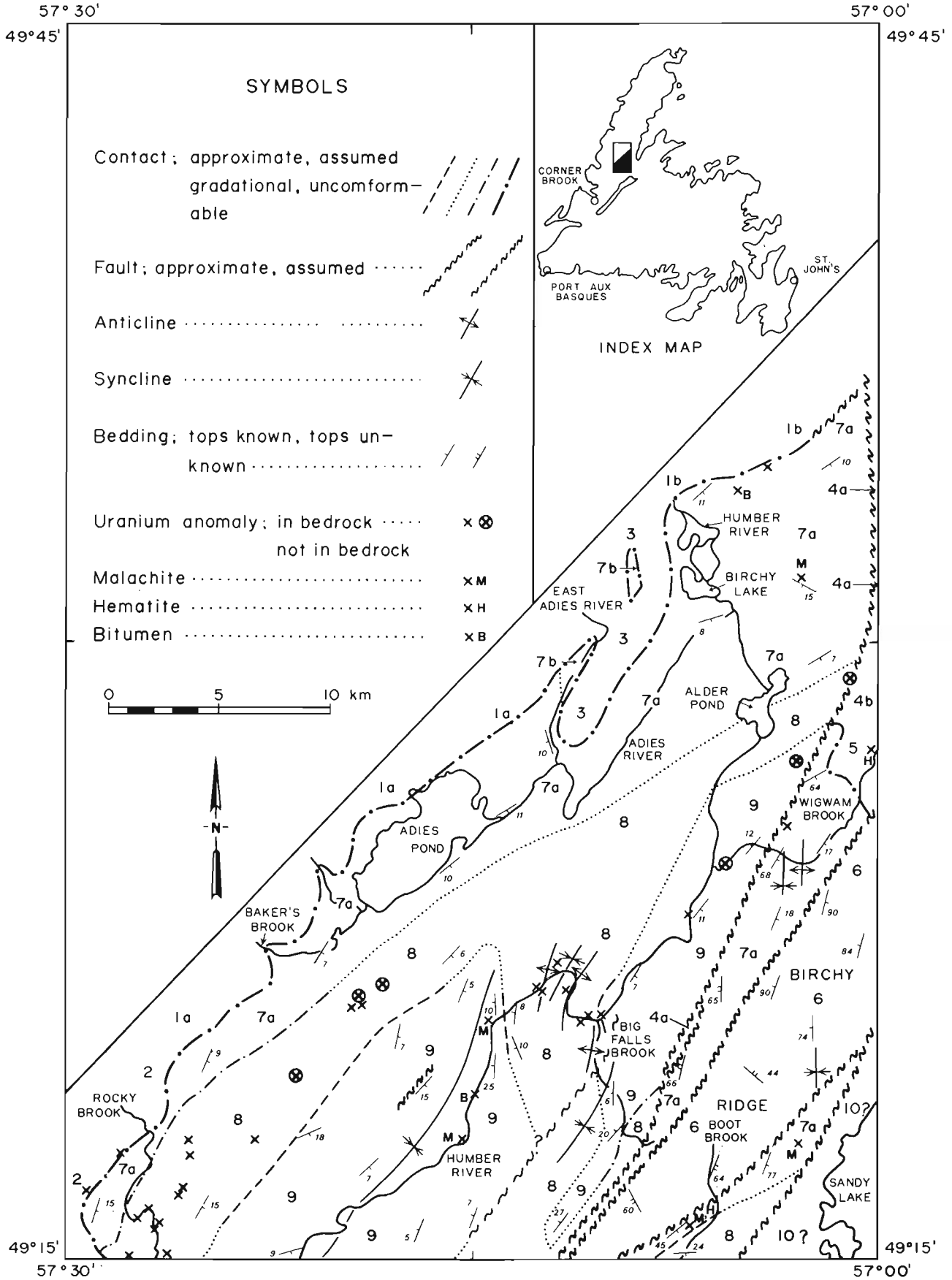
3 Marble and recrystallized limestone

CAMBRIAN

2 Quartz-mica schist, chlorite schist, marble, quartzite.

PRECAMBRIAN

1 1a, Granitoid and granitoid gneiss; 1b, Gabbro and gabbroic gneiss.



bases and are cross-stratified and parallel laminated. Pebble conglomerates with clasts dominated by vein quartz and felsic volcanics are also present in the Anguille Group. Gray, microcrystalline limestones occur at one locality, and are interbedded with fine grained sandstone and siltstone.

It is very difficult to estimate a thickness for this unit due to folding and faulting, but it is probably at least 1000 m. Based on observations elsewhere in the Deer Lake Basin, Hyde (1979) interpreted this unit as the product of a lacustrine delta with a network of distributary channels. None of the observations in the Cormack map area alter this interpretation.

Deer Lake Group

North Brook Formation (Map Units 7a, 7b)

In the map area, two units in the North Brook Formation are distinguished. The first consists of red and gray, medium to very coarse grained sandstones, and pebble to boulder conglomerates (Unit 7a). Also present are pink and gray limestones and red and gray, very fine to fine grained sandstones, siltstones and mudstones. Gray beds are restricted to the area southwest of Baker's Brook on the west side of the basin and within fault slices on both sides of Birchy Ridge.

Red sandstones are calcareous and commonly contain green and gray reduction spots. The sandstones contain abundant large-scale cross-stratification (mainly trough type) and channels. Abundant plant fossils were observed near and along Wigwam Brook. On the east side of Birchy Ridge, gray sandstones and red siltstones are arranged in fining-upward sequences.

Conglomerates are more abundant towards the base of the North Brook Formation. Close to the unconformable contact with pre-Carboniferous rocks, boulder conglomerates are commonly present with clasts greater than 1 m in size. Typically, beds are thick and show no internal stratification. Clasts are poorly sorted. Conglomerates at higher stratigraphic levels have smaller clasts, are more thinly bedded and form lenses within predominantly sandy rocks. Clast rock types reflect local derivation from the underlying basement rock. Conglomerates along Baker's Brook and some other streams contain calcified and silicified wood fragments.

On the west side of the basin, pink and cream-colored microcrystalline limestones form beds up to 20 cm thick. In some areas, calcite has extensively replaced quartz to form sandy limestones. Within the fault slice on the west side of Birchy Ridge, gray, sparry to micritic limestones contain pisolites and algal (?) laminations.

The second unit in the North Brook Formation (Unit 7b) contains two lithologies. The first type is oligomictic, pebble to boulder carbonate conglomerate set in a limestone matrix. This is interbedded with sparites and micrites that are characterized by completely and partially filled vugs, laminations, oolites, and pisolites.

Deposition of map unit 7a of the North Brook Formation occurred on alluvial fans close to the basin margin and within braided river conditions farther away from the basin margin. Near the center of the basin (*e.g.* east side of Brichy Ridge) deposition occured in meandering rivers. Conglomerates in unit 7b developed as mass flow deposits adjacent to pre-Carboniferous carbonate highlands. Interbedded limestones are interpreted to be mainly carbonate soils, which developed during inactive periods of gravel deposition.

Paleocurrents from the west side of the basin show paleoflow directed toward the southeast and east. A maximum thickness of 500 m is assigned to the North Brook Formation in the map area.

Rocky Brook Formation (Map Unit 8)

The Rocky Brook Formation gradationally overlies the North Brook Formation, and near its base consists of red and gray, fine to very fine grained sandstones, red, gray and green siltstones and mudstones, and oolitic and microcrystalline limestones. Siliciclastic lithologies tend to be calcareous. Sedimentary structures are dominated by cross-lamination and dessication cracks.

Red beds are absent from the upper part of the formation. The uppermost beds of the Rocky Brook Formation are well exposed along the Humber River, and contain calcareous gray siltstones and mudstones, gray microcrystalline limestones, algal, oolitic and pisolitic limestones, and oil shales. Siltstones and mudstones contain large carbonate concretions (tens of centimetres in size) and pyrite nodules. One type of limestone is gray and massive, forming beds 20-40 cm thick. These limestones exhibit spheroidal weathering and are cut by numerous veinlets of calcite that in some places brecciate the rock. Another type of limestone contains oolites and pisolites in beds and 1-5 cm thick. These limestones alternate with laminated, dark brown oil shale. Disseminated fish remains are associated with the oolite-pisolite layers. Stromatolitic limestones are also associated with oolitic layers.

Red sandstones and siltstones near the base of the Rocky Brook Formation are interpreted as fluvial in origin. Most of the Rocky Brook Formation records lacustrine deposition for reasons cited elsewhere (Hyde, 1979). The maximum thickness of the Rocky Brook Formation in the map area is estimated to be 550 m. Drilling for natural gas in the map area in the 1950's revealed about 415 m of Rocky Brook strata (Fleming, 1970).

Humber Falls Formation (Map Unit 9)

The Humber Falls Formation sharply overlies the Rocky Brook Formation and based on drill hole information provided by Westfield Minerals is shown here to crop out in two separate areas, unlike previous geological maps of the area. Orange, pink, gray, and nearly white arkosic sandstones dominate the Humber Falls Formation. The sandstones are mostly medium to very coarse grained, and kaolinized feldspar is a characteristic feature. Fine grained sandstones are also present and tend to be redder and more calcareous than the coarser grained sandstones. Pebble conglomerates are interlensed with the sandstones, and contain a wide variety of clast rock types. The most abundant are felsic volcanics, quartz, recrystallized quartz and granitoid clasts. Red and gray siltstones also occur in the Humber Falls Formation, with beds up to 1.5 m in thickness.

Large scale trough and planar cross-stratified sets are common in sandstones and also occur in conglomerates. Additional current produced structures are elongated scours and channels, reactivation surfaces, preserved megaripples, parallel lamination, and parting lineation. Other features noted are gray and green reduction zones, calcareous nodules, mudcracks, and fossil logs.

The Humber Falls Formation is interpreted to be a fluvial deposit in which the river system was dominantly braided. Paleoflow reconstruction shows that currents were directed to the south in the northeastern outcrop area but in the southwestern outcrop area, exposures along the Humber River yielded paleocurrents flowing in a generally westward direction. Over much of the Deer Lake Basin, the Humber Falls Formation forms the top of the Deer Lake Group, and much of the original sediment

has been eroded. As a maximum, it is estimated that 100 m has been preserved. A hole drilled for natural gas in th 1950's penetrated about 33 m of the Humber Falls Formation (Fleming, 1970).

Howley Beds

The Howley Beds of dominantly Pennsylvanian age are interpreted to underlie flat ground along and near the western shoreline of Sandy Lake. No outcrops were observed in this area, but medium to coarse grained, poorly indurated, gray and buff sandstones and pebble conglomerates are present a few kilometres to the southwest. These beds strike northeasterly, and probably extend into the present area. Lithologically, these rocks best match the description of the Howley Beds in Belt (1969), and are therefore assigned to this unit. Baird (1959) also showed the Howley Beds underlying this region.

STRUCTURAL GEOLOGY

Folding

Rocks in the Anguille Group are tightly folded. Dips of beds are usually greater than 45 degrees and vertical dips are not uncommon. The orientation of fold axes are at small angles to the orientation of major faults, in accord with observations made elsewhere in the Deer Lake Basin (Hyde, 1979). In contrast to folding in the Anguille Group, rocks in the Deer Lake Group assume steep dips and tight folds only in the vicinity of faults. Away from faults, folds are present but are only gentle warpings. The prominent anticlinorium which brings the Rocky Brook Formation to the surface west of Birchy Ridge, is no longer assumed to be doubly plunging within the map area. Parasitic minor anticlines and synclines are related to this major structure. West of this structure, a prominent syncline occurs within the Humber Falls Formation. This is part of a large doubly-plunging synclinal fold in the Deer Lake Group. The southwestern fold nose occurs outside the area mapped. Other maps for this region (Werner, 1955; Baird, 1959) show a fold closure southeast of Alder Pond. However, from strike directions in the North Brook and Humber Falls Formations and from drill hole information provided by mining companies (Westfield Minerals and Northgate Exploration), it appears that units of the Deer Lake Group strike continuously to the northeast and are truncated by a major fault bordering pre-Carboniferous volcanic rocks further east.

Faulting

As shown on the map, all Carboniferous units are affected by faulting. Faults have fairly straight surface traces, implying that the faults dip steeply. Rarely is it possible to determine the dip of a fault plane, hence the type of latest fault movement is difficult to show. A fault which forms the eastern boundary of a slice of pre-Carboniferous volcanic rocks on the west side of Brichy Ridge dips steeply (79 degrees) to the northwest. Hence, the latest movement on this fault at this locality was reverse. On Big Falls Brook, the fault between the Anguille Group and the North Brook Formation appears to dip steeply to the southeast (69o), which would indicate reverse movements. However, if this fault is traced to the northeast, granite of probable Devonian age is faulted against the Anguille Group, and the fault must be normal at this point, assuming the dip direction of the fault plane is still to the southeast. Thus, the latest movement on this fault seems to have been a scissors-type. This kind of motion has been inferred by Popper (1970) for the continuation of this fault to the southwest.

The latest movement of these major faults is demonstrably dip slip or oblique slip, but it has been argued elsewhere (Hyde, 1979) that earlier movements on the faults were dominantly strike-slip. One new finding this year

is the presence of sandstone pebbles similar to the Anguille Group in the North Brook Formation along Big Falls Brook. If these pebbles were derived from the Anguille Group, it may be an indication that dip-slip and/or oblique-slip movements had started, at least locally, prior to deposition of the North Brook Formation.

Small faults with displacements of less than 1 m are present within the Rocky Brook Formation along the Humber River. These faults cause the dip of the beds to exceed 25° on a local scale. Elongated bogs with straight boundaries may be geomorphic expressions of faults and, if so, there are numerous northeasterly trending faults which are not readily apparent because of poor exposure.

ECONOMIC GEOLOGY

Fifty-one radioactive anomalies were recorded during the field season using a BGS-IL total count scintillometer. Some of these are shown on the accompanying map. It is assumed that anomalies in Carboniferous rocks are due to uranium.

Pre-Carboniferous Basement Rocks

Two anomalies were recorded in Cambrian metasandstones in the southwestern part of the map area, the larger being 4 x back-ground. An anomaly (2 x background) was recorded from a gneissic boulder along the East Adies River.

North Brook Formation

Three anomalies were discovered in the map unit 7a of the North Brook Formation, one of which is in a limestone. This limestone is a thin (20 cm) breccia bed which rests unconformaly on Cambrian metasandstones. This anomaly was the strongest recorded in the North Brook Formation (3.5 x background).

Rocky Brook Formation

Forty-one anomalies were recorded in the Rocky Brook Formation, and these occur in the following lithologies: (1) gray, calcareous siltstone and mudstone (16 occurrences); (2) gray, microcrystalline limestone with calcite veinlets (11 occurrences); (3) thinly bedded oolitic and pisolitic limestone interbedded with oil shale and gray mudstone (4 occurrences); (4) gray, microcrystalline limestone with sparry vug fill (3 occurrences); (5) brownish-red, fine grained sandstone and siltstone (2 occurrences); and (6) oil shale (1 occurrence). Three anomalies occur in areas lacking outcrop, but it is assumed that the underlying bedrock is the Rocky Brook Formation. The anomalies in the Rocky Brook Formation are usually confined to a single bed, average about 30 cm thick, and have been traced laterally for up to 75 m. Most of the anomalies are 2-4 times background. The strongest anomaly occurred on Rocky Brook, and yielded 1700 total counts per second (11 x background).

Humber Falls Formation

The Humber Falls Formation seems to have the best potential for economic uranium deposits, judging from discoveries made in 1978 by Westfield Minerals (Northern Miner, Nov. 23, 1978). One anomaly was found in outcrop during the course of our mapping, and yielded 600 total counts per second (12 x background). Other anomalies were found in till cobbles near Westfield trenches.

Other Findings

Malachite staining was observed at three places in the North Brook Formation and twice in the Humber Falls Formation. Hematite was observed in the North Brook Formation as a coating on

bedding planes. Small amounts of hematite were also observed in a granite of presumed Devonian age. Barite occurs as a vein-filling mineral in carbonate concretions in the uppermost beds of the Rocky Brook Formation. A solid bituminous-like substance was also found in sandstones of the North Brook and Humber Falls Formations.

ACKNOWLEDGEMENTS

Pearce Bradley and Bill Connor served admirably as field assistants and Greg Connors and Ken Burton are thanked for cooking chores. John Tuach and Colum Byrne from Westfield Minerals and Rick Parker and John O'Sullivan from Northgate Exploration are thanked for showing us some of their anomalies and for stimulating discussions on the geology of the region. Gratitude is extended to Mrs. Jean Burton of Cormack (on whose property we camped) for taking care of our conversational needs, beer supply, and dirty field clothes. Thanks are again owed to Bowater Newfoundland Ltd. for use of their woods roads.

REFERENCES

Baird, D.M.
1959: Geology, Sandy Lake (west half), Newfoundland. Geological Survey of Canada, Map 47-1959.

Belt, E.S.
1969: Newfoundland Carboniferous stratigraphy and its relation to the Maritimes and Ireland. American Association of Petroleum Geologists, Memoir 12, pages 734-753.

Fleming, J.M.
1970: Petroleum exploration in Newfoundland and Labrador. Department of Mines and Energy, Mineral Development Division, Report 3, 118 pages.

Hyde, R.S.
1979: Geology of Carboniferous strata in portions of the Deer Lake Basin, western Newfoundland. Department of Mines and Energy, Mineral Development Division Report 79-6, 43 pages.

Popper, G.H.P.
1970: Paleobasin analysis and structure of the Anguille Group, west-central Newfoundland, Ph.D. thesis, Lehigh University, Bethlehem, Pennsylvania, 215 pages.

Werner, H.J.
1955: The Geology of Humber Valley, Newfoundland. Newkirk Mining Corporation, summary and final report, 116 pages.