Relationship of the Gardiner and Mullins coal seams in the Sydney field of Cape Breton Island, Nova Scotia

by

Peter A. Hacquebard (Emeritus Scientist)

Natural Resources Canada
Geological Survey of Canada (Atlantic)
P.O. Box 1006, Dartmouth, NS B2Y 4A2, Canada

GSC Open File 4283

2002

Canada

Natural Resources Canada | Ressources naturelles Canada

ABSTRACT

The stratigraphic position of the Gardiner and Mullins seams in the Sydney coalfield is examined and is illustrated with six figures. They show petrographic and borehole sections, as well as outcrop maps and seam thickness variations in the New Waterford and Glace Bay districts. Notwithstanding the remarkable petrographic similarity, the study shows that indeed two separate coal seams are present.

INTRODUCTION

Since 1952, when Haites first suggested that the Gardiner and Mullins could be the same seams, it has been a controversial question. Haites (1952) pointed out that the Gardiner seam is known only from the Glace Bay district and has not been discovered in the New Waterford district, except for Robert's shaft on the north shore of Lingan Bay (Fig.6). He also stated that both seams have a rider seam and that their thicknesses and stratigraphic positions match roughly. Moreover, their sections show certain coal-petrological similarities, as mentioned by Hacquebard (personal communication in 1952).

In the present study a detailed coal petrological analysis of both seams is presented and stratigraphic sequences obtained from old drill hole records in Dosco files were examined. In addition, the records of the drilling program carried out by S. Forgeron (1977) for the Cape Breton Development Corporation were used. This drilling program was carried out in the New Waterford district at the locations proposed by Hacquebard in his 1977 technical report on the Mullins seam and proved to be critical for this study.

Petrographic Analyses

The analyses were carried out in 1951 with polished coal sections cut across the bedding plane and measured 6x8 cm. For the four columns examined of the Mullins and Gardiner seams, a total of 150 sections were prepared and their microlithotype composition determined under reflected light, at 100x magnification. The sequence was then recorded at true scale in so-called coal logs, which are shown in simplified and reduced form in Figures 1 and 2.

The coal logs were subsequently subdivided into units of similar coal types, referred to as petrographic intervals. They were identified by the occurrence of distinct dull bands (durite) and bright coal units (clarite). The intervals reflect the changing conditions of peat formation during the development of the seam.

In the Mullins seam there are ten intervals in sections XI-1 and XI-2 (Fig.1) and the Gardiner seam has eight intervals in sections X-2 and X-3 (Fig.2).

The petrographic sections of the two seams are remarkably similar. Durite bands and stone partings occur at about the same position. However, the exines of squat bulky "spores" (pollen of *Whittleseyinae*) are present only in the Mullins seam. They are a characteristic feature of the Tracy seam and were used for seam identification (Hacquebard, 1952).

In the whole-seam coal facies determination shown in Figure 3 (after Hacquebard, 1993, p.6), both seams originated in the Forest Moor environment, resulting in the formation of identical types of coal.

The similarity in petrographic composition was used by Haites (1952) as an additional argument for the correlation of the Mullins and Gardiner seams as mentioned in the introduction of this report.

Figure 3 also shows the complete stratigraphic sequence of the major coal seams of the

Sydney field. There are ten major seams which have been mined in different collieries over a period of about two hundred years. They outcrop in the land area as shown in Figure 4, and the major seams are mined below the sea. The entire interval measures 945 m (3100 ft) and includes the Gardiner and Mullins seams in the lower part of the section. A correlation of these two seams would cut the Sydney sequence by 183 m (600 ft). However, the stratigraphic sections shown in Figure 5 make this highly unlikely.

Stratigraphic Examination

The strata that occur associated with the Mullins and Gardiner seams in the New Waterford and Glace Bay districts are shown in Figure 5. The data for five borehole sections marked C, were obtained from Forgeron's report of 1977. The locations of these holes are those proposed by Hacquebard in his 1977 report on the Mullins seam. The four borehole in the Glace Bay area, marked B, were drilled by DOSCO between 1920 and 1939.

In the Glace Bay district, the Gardiner seam occurs between 118 and 122 m below the Emery seam, except in borehole B-23, where the distance is 132 m. The increased thickness is due to a fault in the borehole at a depth of 182 m. In the B-holes several thin rider seams (0.1 to 0.8 m thick) are present to within 17 m above the main seam.

Below the Gardiner seam in sections C-109 and B-60 there occurs the Lorway seam, which is 0.6 m thick. This seamlet has also been identified in the New Waterford district in sections C-104 and C-107.

Below the Lorway seam occurs a mineable seam which has been identified as the Mullins seam. It lies 167 m and 170 m below the Gardiner in borehole C-109 and B-60.

In the New Waterford district the Mullins seam was intersected in boreholes C-104, C-105, C-107 and C-108. Boreholes C-107 and C-108 did not intersect the Gardiner seam, although the projected depth was cored. This confirms Haites statement mentioned in the Introduction on page 1, that the Gardiner seam has not been discovered in the New Waterford district.

Data on Thickness Variations of the Mullins and Gardiner seams

In Figure 6, twenty-two sections of the Mullins seam and the Gardiner seam are shown. In the western part of the New Waterford district, the Mullins seam is between 178 and 228 cm thick, averaging 196 cm (6'4"). This thickness includes a 41-50 cm thick rider seam and also a 2-25 cm thick stone parting (sections C-102 and CR).

In the eastern part of the New Waterford district, the thickness is between 109 and 140 cm without the rider seam. It averages 124 cm (4'2") (C-108 and C-107). In the most easterly section, at borehole C-104, the seam thickness measures 160 cm, and probably includes the rider seam.

The underground coal resources of the Mullins seam amount to 78 million short tons, when using a minimum thickness of 1.2 m (4 ft). An additional 2.5 million tons is present in near surface coal resources (Gillis, 1979).

In the Glace Bay district the Gardiner seam consists of a main seam which is between 61 and 112 cm thick, averaging 119 cm (B-79, C-110). It is overlain by a rider seam which is between 30 and 105 cm thick, averaging 62 cm (X-3, B-16). Only in the most westerly part of the Glace Bay area is the seam developed as one unit, giving a total thickness of 206 cm (X-2). The Gardiner seam has been mined in Dominion No.25 Colliery. The coal resources of this mine

are 3.5 million short tons (MacKay, 1947).

CONCLUSIONS

The Gardiner and Mullins seams are indeed two separate coals, which notwithstanding their remarkable petrographic similarity should not be correlated. The borehole data obtained in the New Waterford district in 1977 and in the Glace Bay area in 1920 and 1939, clearly show that two separate coal seams are present.

ACKNOWLEDGEMENTS

The report was reviewed by A.C. Grant and M.P. Avery, who also did the computer work of the figures. Both are personnel of the Geological Survey of Canada (Atlantic) in Dartmouth, Nova Scotia. Their efforts have been much appreciated.

REFERENCES

DOSCO Files. Drill hole records of entire Sydney coal field - blue prints of 189 wells in four categories: A1-41, B1-106, C1-24, D1-18. Drilled between 1905 and 1951. Records obtained from DOSCO (DEVCO) in Glace Bay.

Forgeron, S., 1977. Results of Mullins seam drilling program, New Waterford area, Cape Breton Island. Cape Breton Development Corporation, Glace Bay, Nova Scotia, p.1-13 (records of boreholes C-104, C-105, C-106, C-107, C-108, C-109, C-110 - also analytical data).

Gillis, K.S., 1979. Report on the exploration of the Mullins seam. Nova Scotia Department of Mines, Report of 1979, 7 p., 3 figures.

Hacquebard, P.A., 1952. A petrographic investigation of the Tracy seam of the Sydney coalfield,

Nova Scotia; 2nd Confernce on the Origin and Const. of Coal, Crystal Cliffs, Nova Scotia, p.293-309.

Hacquebard, P.A., 1977. Development and mining prospects of the Mullins seam, Sydney coal field, Nova Scotia. Technical Report no.11-K/G-77-1, p.1-9, 4 figures.

Hacquebard, P.A., 1993. The Sydney coalfield of Nova Scotia, Canada. International Journal of Coal Geology, v.23, p.29-42.

Haites, T.B., 1952. Conjectural shape and extent of the Sydney coalfield. Canadian Institute of Mining and Metallurgy, Transactions, v.55, p.202-212.

MacKay, B.R., 1947. Coal reserves of Canada. Geological Survey of Canada, Reprint of 1946 report of the Royal Commission on Coal, p.1-113. (For Gardiner seam see p.19.)

FIGURE CAPTIONS

Figure 1 Petrographic correlation of sections X1-1 and X1-2 of the Mullins seam in the New Waterford district.

Figure 2 Petrography of sections X-2 and X-3 of the Gardiner seam in the Glace Bay district.

Figure 3 Whole-seam facies variations of ten major coals of the Sydney coal field based on microlithotype determinations (modified from Hacquebard, 1993).

Figure 4 Sydney coal field, Nova Scotia, showing seam outcrops and locations of column samples of the Gardiner and Mullins seams.

Figure 5 Stratigraphic sections overlying the Gardiner and Mullins coal seams.

Figure 6 Seam sections of the Mullins and Gardiner seams in the New Waterford and Glace Bay districts.

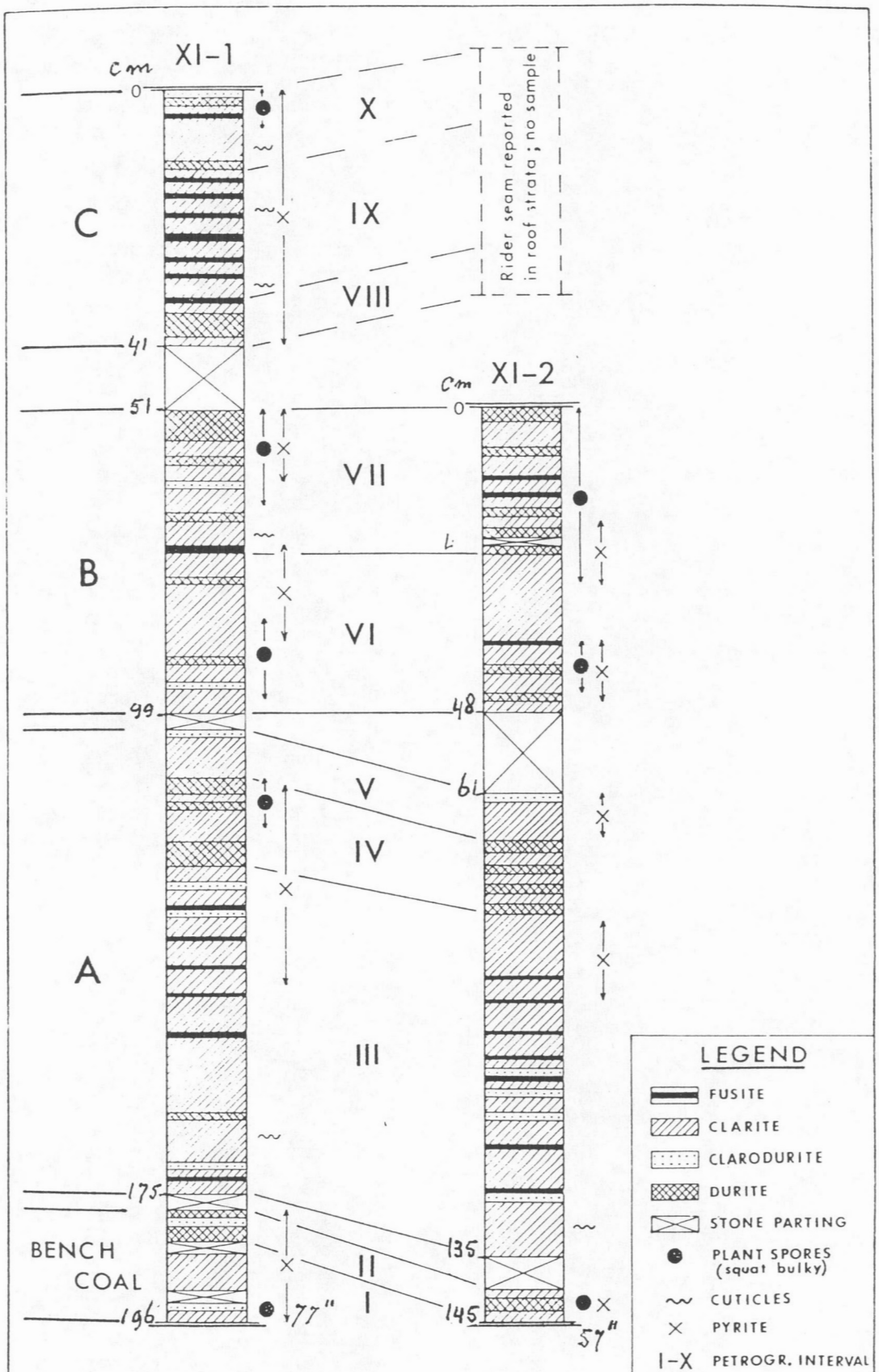

Fig. 1 Petrographic correlation of sections XI-1 and XI-2 of the Mullins seam in New Waterford District.

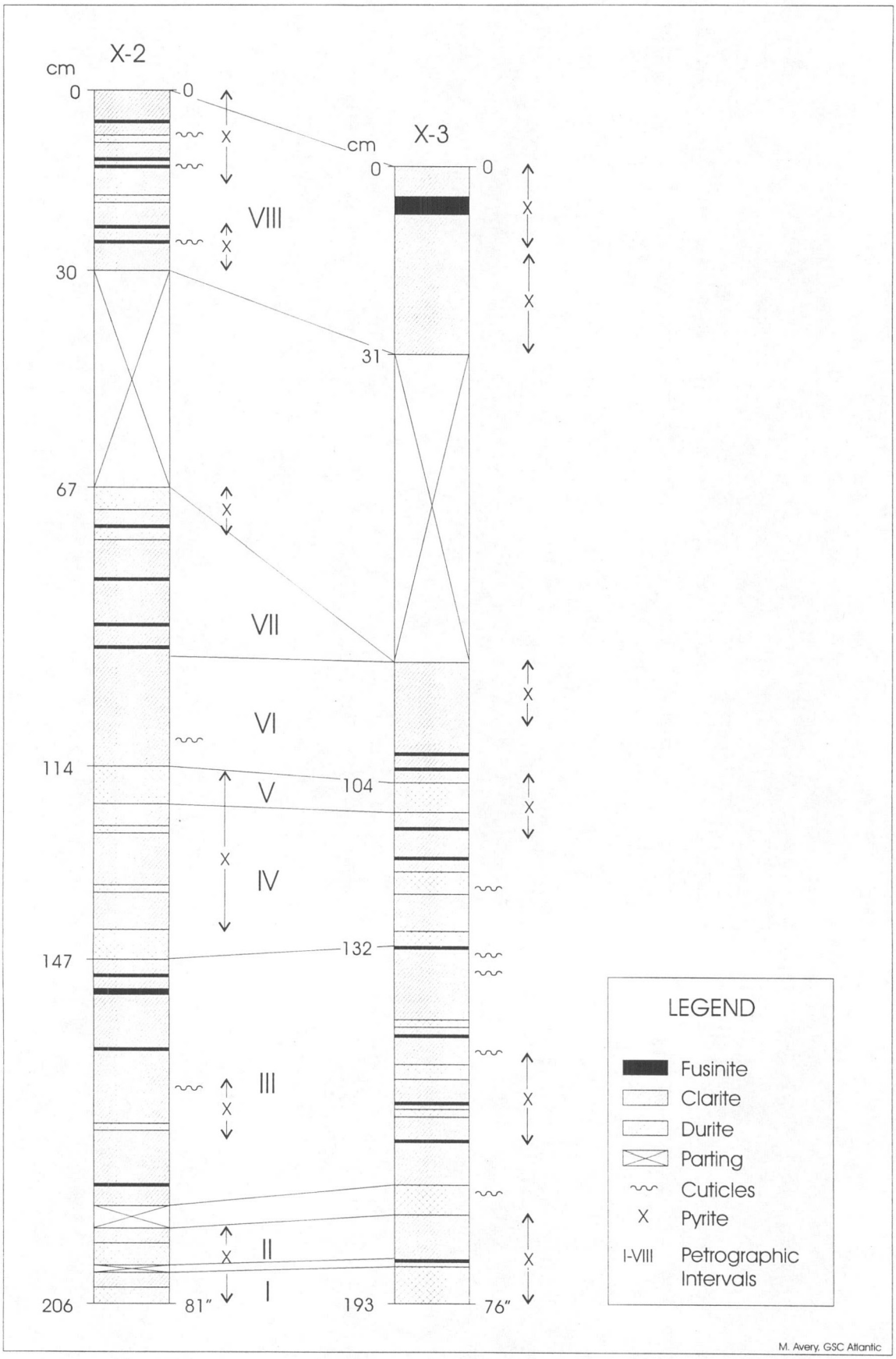

Fig. 2 Petrography of sections X-2 and X-3 of the Gardiner seam in the Glace Bay District.

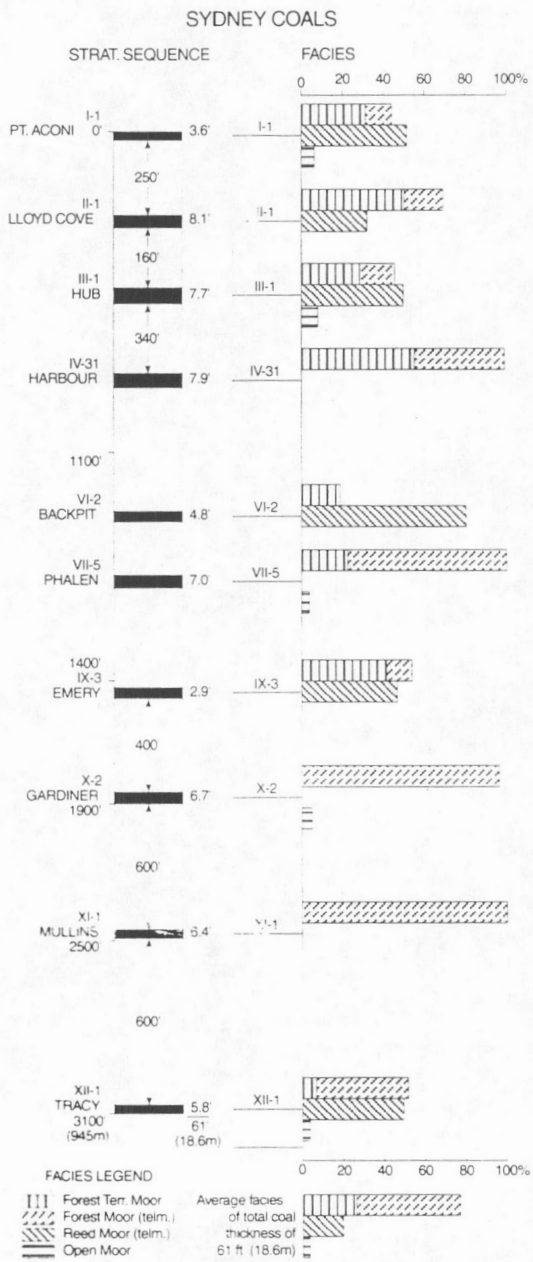

Figure 3. *Whole-seam facies variations of ten major coals of the Sydney coalfield based on microlithotype determinations (modified from Hacquebard, 1993).*

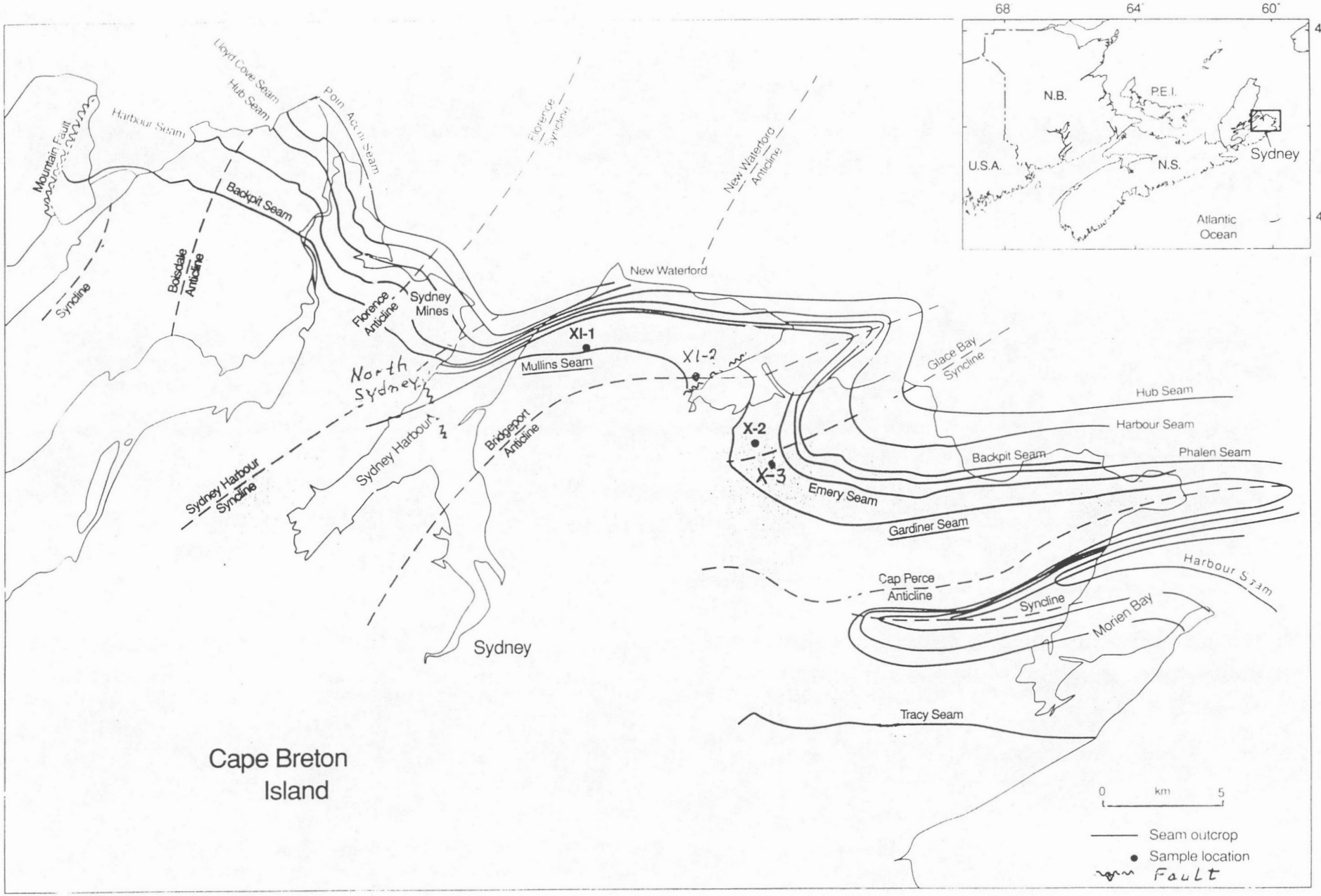

Figure 4. Sydney coalfield, Nova Scotia, showing seam outcrops and locations of column samples of the Gardiner and Mullins seams.

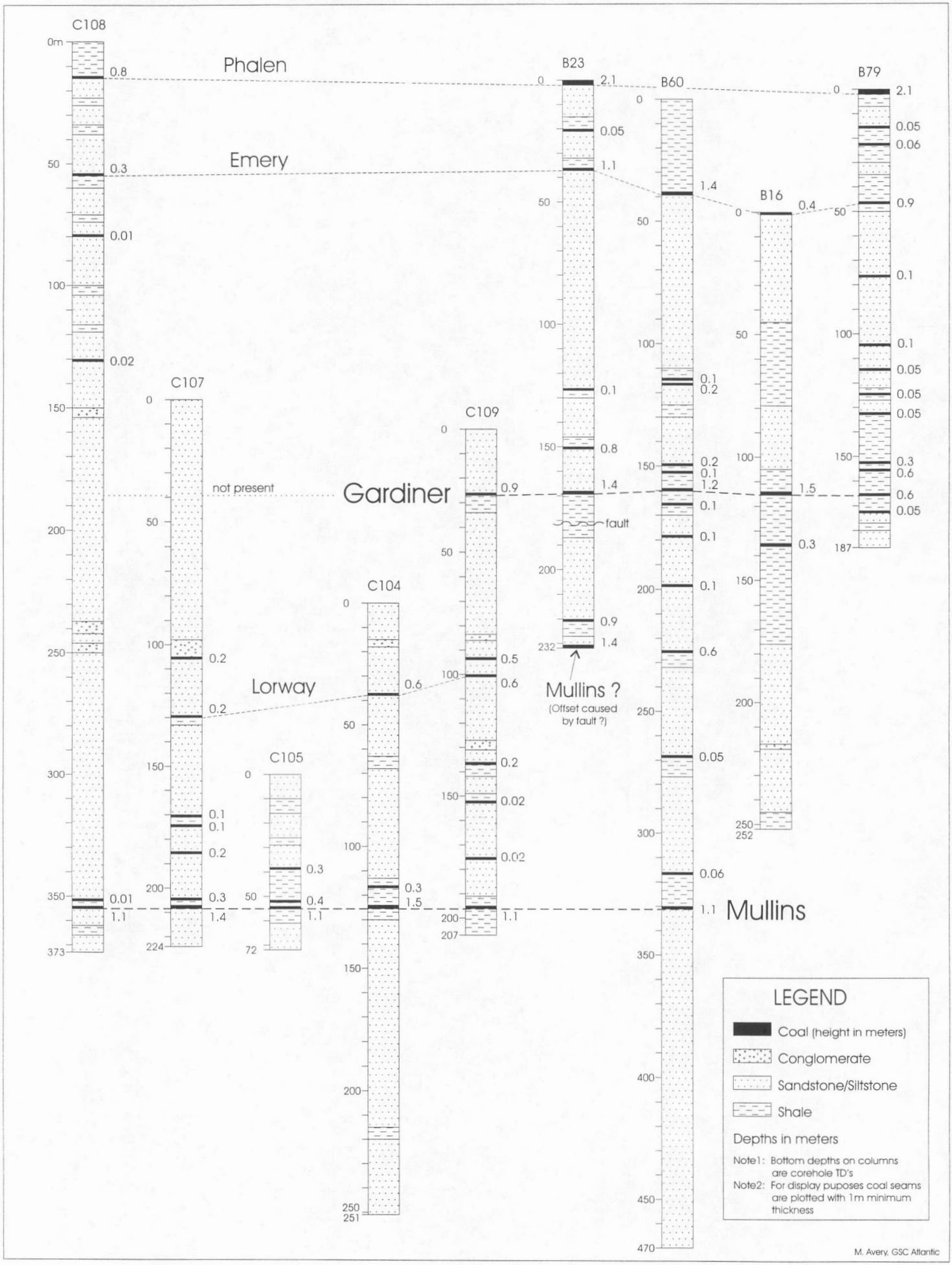

Fig. 5 Stratigraphic sections overlying the Gardiner and Mullins coal seams

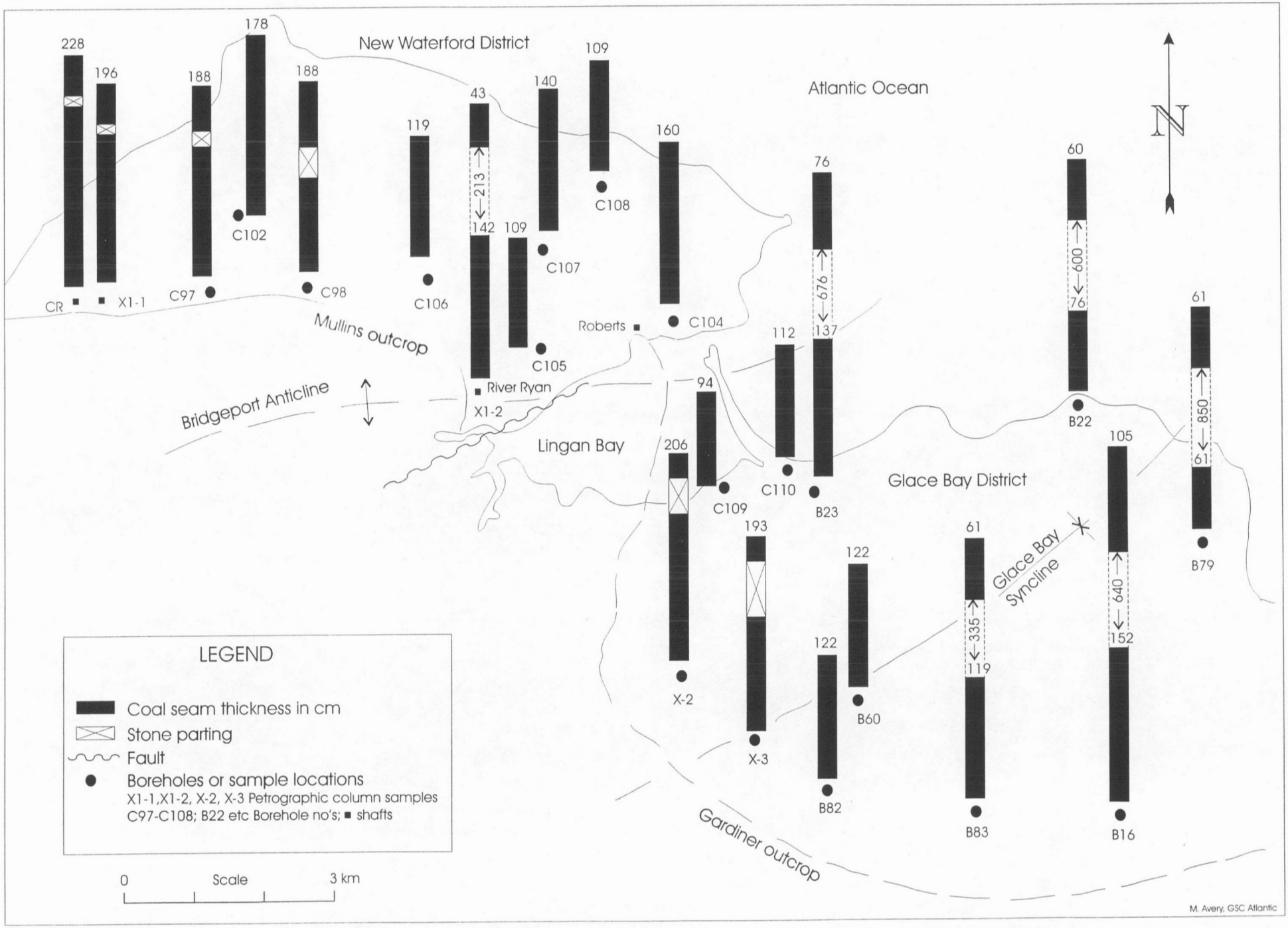

Fig.6 Seam sections of the Mullins & Gardiner seams in the New Waterford & Glace Bay districts.