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Volcanic Series. This sample and the results from the sparker suggest that the bulk of Cashes Ledge probably consists of granite. Relief of the ledge is probably due to resistance of this granite core to erosion.

The inferred Paleozoic and locally Mesozoic surface in the Gulf of Maine may be part of the Fall Zone Peneplain, which was drowned and mantled by a wedge of sediments to form the continental shelf and slope off eastern United States. Throughout most of the continental margin the prism of Mesozoic and Cenozoic sediment is hundreds to thousands of metres thick, but within the Gulf of Maine it is largely absent and its thickness exceeds 100 metres in only a few places. The relative thinness of the sedimentary apron atop the crystalline basement is believed to be due mainly to glacial erosion during the Pleistocene. Sediments eroded from the gulf must have been transported beyond the confines of the Gulf of Maine by way of Northeast Channel and deposited on the continental slope and continental rise: deposition seaward of Northeast Channel was so great that the continental slope drops only about 800 to 1000 metres before reaching the rise, in contrast to the slope off Georges Bank, which has a relief of 1900 metres. Degradation within the Gulf of Maine was so extensive that segments of the crystalline basement, as at Cashes Ledge, have been exposed.

Reference cited

TOULMIN, PETER, 1957, Notes on a peralkaline granite from Cashes Ledge, Gulf of Maine: Am. Mineralogist, v. 42, p. 912-915.

Sedimentation and Paleocurrents during Pennsylvanian Time in the Moncton Basin, New Brunswick*

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A study of paleocurrents, provenance and lithofacies distributions within the Pennsylvanian Petitcodiac Group of sedimentary rocks in the Moncton Basin was initiated by the NEW BRUNSWICK MINES BRANCH in 1965. This program is designed to gain a better understanding of the Carboniferous stratigraphy, tectonics and basin configurations, to aid an overall economic evaluation that will eventually cover all the Carboniferous rocks in the province.

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Petitcodiac Group

The Petitcodiac Group is of Middle and Upper Pennsylvanian age and comprises a sequence of essentially flat-lying, terrestrial deposits of fluvial, paludal and deltaic origin. They blanket the pre-Carboniferous and Mississippian rocks with an angular unconformity, and the Lower Pennsylvanian rocks (Hopewell Group) with an apparent disconformity.

The name Petitcodiac Group was first introduced by WRIGHT (1922), but for the purposes of this report the group name has been retained as used and defined by NORMAN, (1941). As a result of this study, the previously suggested sub-divisions (WRIGHT, 1922; GUSSOW, 1953; CARR, 1961) have been replaced by two major facies sequences as follows:

The Fluvio-Paludal Facies Sequence is a distinctive sequence of sedimentary rocks that may be regarded as a lithostratigraphic unit with well defined lower limits but poorly defined upper limits. Its lithology includes grey-buff conglomerate, sandstone and grey siltstone. The finer facies represent swamp and interchannel deposits, whereas the coarser facies are deposits of fluvial origin. The stratigraphic boundaries and position of this facies sequence coincides with that of the Boss Point Formation of GUSSOW (1953). It is restricted to the margins of the basin and grades laterally and upwards into the younger fluvio-deltaic facies sequence towards the centre of the basin.

The Fluvio-Deltaic Facies Sequence is a mixed and variable sequence of sedimentary rocks with poorly defined lower limits and unknown upper limits. It has been mapped as a lithostratigraphic unit (Pictou Group) by previous workers and its lower limits are characterized by the onset of redbeds. It includes olive green sandstone and red siltstone which are presently considered to be end-members of a continuous series, with maroon silty sandstone as the predominant lithology. The olive green sandstones represent channel deposits, whereas the widespread occurrences of red siltstones indicate deposition of interchannel mud flats. The whole sequence represents a depositional environment of an advancing river delta. Lateral shifts due to changes in channel sinuousity resulted in numerous levee breaks, and formed a braided channel system with extensive co-mingling of the two end-members. Except for the olive-green channel sandstones, the litho-colours range from pale brown maroon to dark red, depending on the percentage of red silt present.

Sedimentary Structures

For the purposes of the present study, all primary directional structures have been systematically measured and recorded.

Crossbedding. Trough and planar crossbedding (POTTER and PETTIJOHN, 1963) is by far the most common one-way directional structure within the Petitcodiac Group (Figure 1). Of the 1558 recordings, 1536 were of the trough type, whereas the remaining 22 were of the planar type. The size ranges of the crossbed units correspond closely with variations in bedding thickness. The larger units, up to 60 inches thick, are confined to thick-bedded conglomerates along the basin margin, and occur in association with a few erosional channels and orderly oriented plant

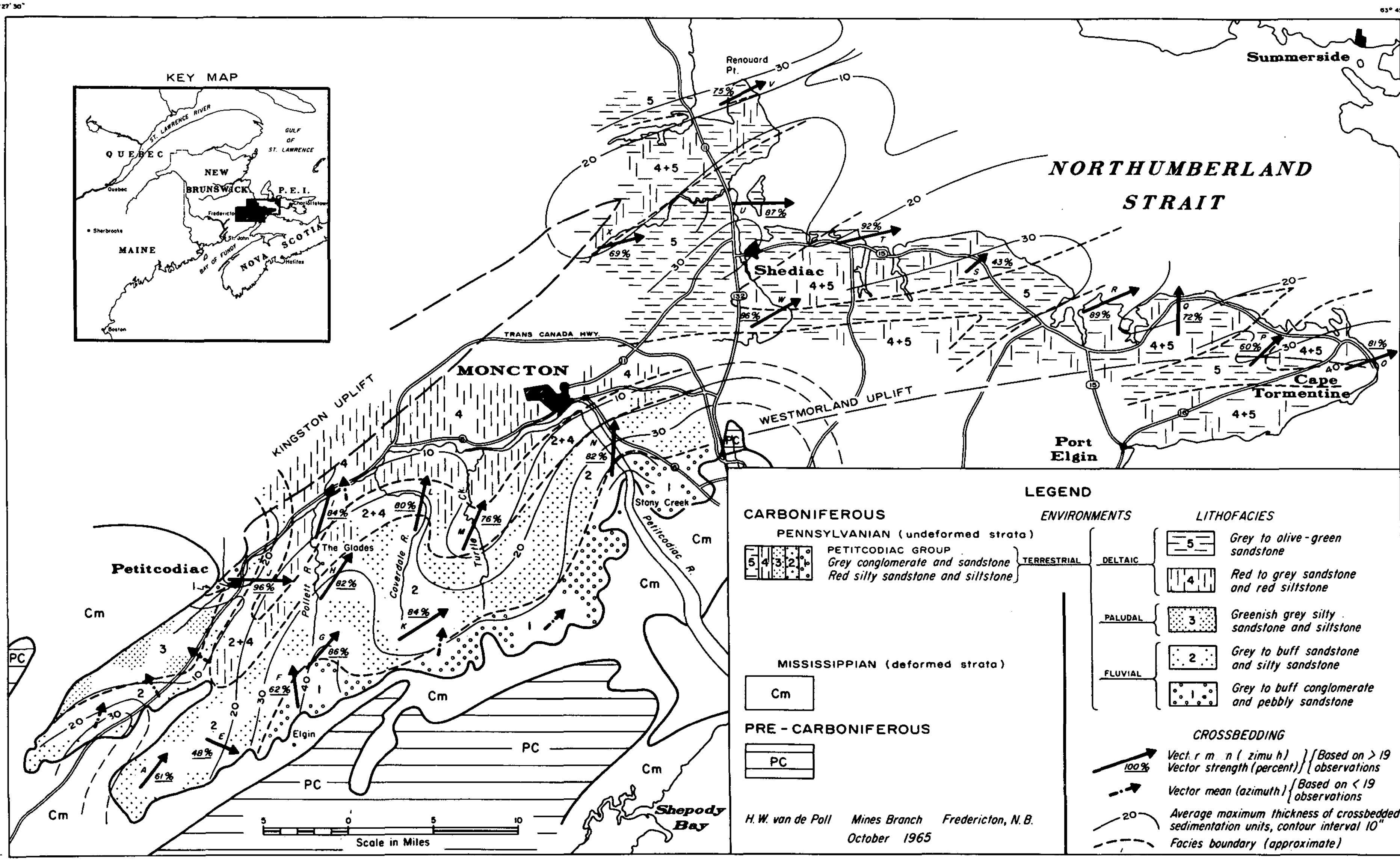

Figure 1. Lithology and dispersal patterns of Pennsylvanian strata, Moncton Basin, N.B.

fragments of tree-trunk size (see below). Small-scale crossbedding in fine to medium-grained sandstone or silty sandstone predominates in the interior region of the basin, and commonly occurs associated with parting lineations and randomly arranged plant debris.

Parting Lineation (Primary Current Lineation). Less common than crossbedding, parting lineations are entirely confined to the flaggy surfaces of uniform and thin-bedded sandstone, but occasionally have been found on flaggy foreset beds of crossbed units as well. Small-scale crossbedding, ripple marks and randomly oriented plant debris are commonly associated features.

Erosional Channels. Several well exposed erosional channels have been recognized along the Northumberland Straits coast in the northeastern part of the Moncton Basin. They are characterized by cyclic recurrences of red siltstone, crossbedded mud-pellet conglomerate, olive-green sandstone, maroon silty sandstone and red siltstone, of which the mud-pellet conglomerate and olive-green sandstone represents the coarser bottom facies of the channel proper. Individual channels may vary from approximately 10 to perhaps 100 feet in width; the larger outcrop patterns of olive-green sandstone (see Figure 1) should be regarded as multistory and multilateral sandstone bodies of composite channels.

Plant Fragments. Plant fragments may be useful current direction indicators if sampling is confined to the larger specimens. Large concentrations of small plant debris on the other hand represents an environmental condition that is dominated by slow currents and gentle influx of sedimentary material. The results of the present investigation tend to indicate that only the plant fragments which are not less than 20 inches in length, and with a better than 4:1 length to diameter ratio, are useful in paleocurrent studies. Plant fragments of that size commonly occur singly and are largely confined to the more strongly crossbedded units of the coarser lithofacies. This association indicates that, to a certain extent, transportation has taken place before the fragments became incorporated into the enclosing sediments.

An apparent directional relationship between the larger plant fragments and crossbedding type was observed in the Moncton Basin and at Dorchester Cape. When occurring in trough crossbedding, they were found to be preferentially oriented along the AC (longitudinal) plane direction of the confining trough unit; in planar crossbedding, they lay along the BC (cross-section) plane direction of the confining planar unit. Depending on the type of crossbedding, the larger plant fragments would thus lie either parallel or perpendicular to the current direction. Such a relationship may explain why previous workers observed a 90^{o} bimodal separation of plant-fragment azimuths where both planar and trough crossbed units occur together (LAWSON, 1962) as well as a perpendicular orientation of plant fragments and crossbedding where planar crossbed units are the predominant type (PELLETIER, 1958).

Bedding Thickness. Maximum thicknesses of crossbedded sedimentation units were recorded at each outcrop locality, averaged and plotted at

10-inch contour intervals in Figure 1. The contour pattern supports the inferred directions of sediment transport on the basis of paleocurrents. It also shows an overall relationship to the lithofacies distributions, with beds thicker than 40 inches confined to the coarser margin of the Moncton Basin, and the lesser thicknesses occurring towards the finer grained interior area.

Pebble Compositions

In an attempt to relate the direction of sediment transport to provenance, the pebble content of five conglomerates from the Moncton Basin has been analyzed.

The preliminary results confirm semi-quantitatively what is already apparent in the field, namely a marked compositional difference between the pebble components of the Hopewell and Petitcodiac conglomerates.

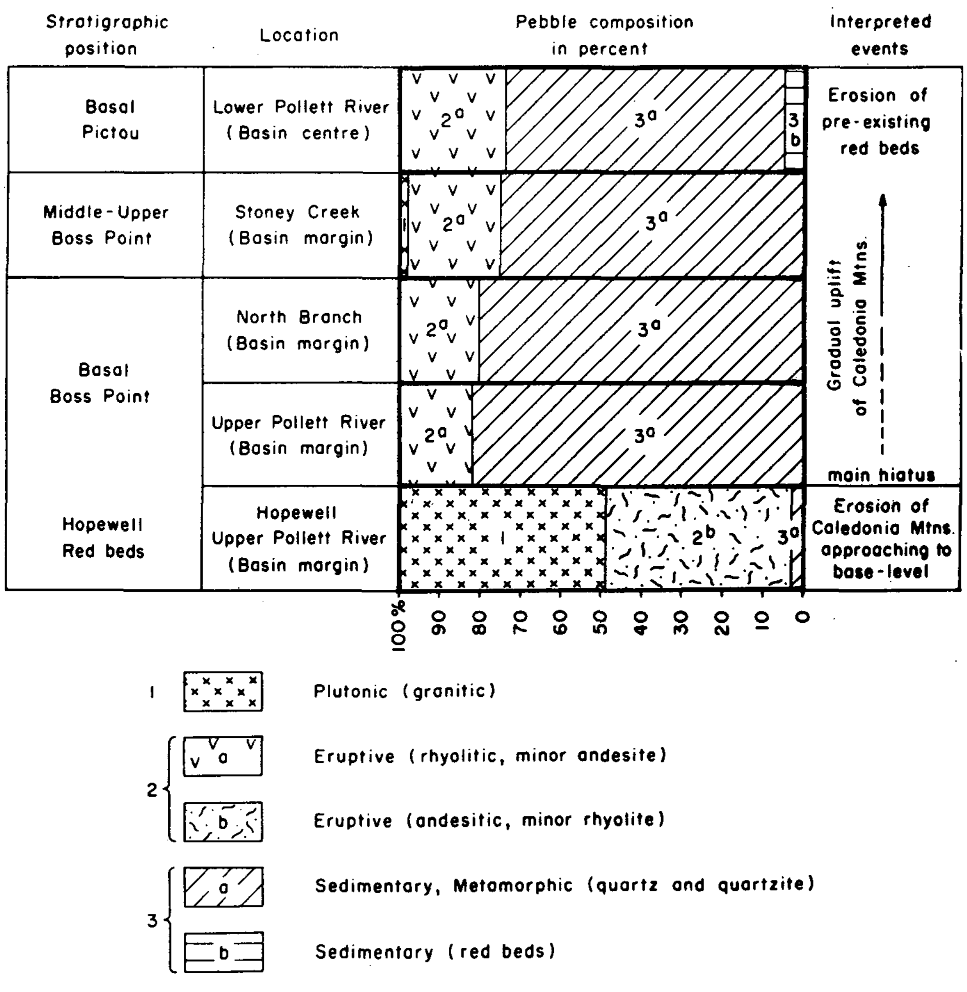

Figure 2. Composite chronological section illustrating pebble contents of Hopewell, Boss Point and Pictou conglomerates in the Moncton Basin, N.B.

The Hopewell conglomerate has a bimodal distribution of unstable components (Figure 2), implying a genetic affinity to the bulk composition of the Caledonia Mountains. In contrast the Petitcodiac conglomerates have a unimodal distribution of stable components that does not show this genetic affinity, but indicates a more distant metamorphic-sedimentary source terrain.

Summary of Results

The azimuth of overall transport direction in the southwestern part of the Moncton Basin is 38°, with a more easterly deflection to 62° beyond the northeastern limits of the Caledonia Mountains. The initial results of this investigation are presented in Figure 1. From the available information, the inference points to paleocurrents originating from the flanks of the Caledonia Mountains, while at the same time the Kingston Uplift appears to have only been a minor area of origin.

The Petitcodiac conglomerates, however, are not provenantly related to the Caledonia Mountains, but have a more distant source terrain.

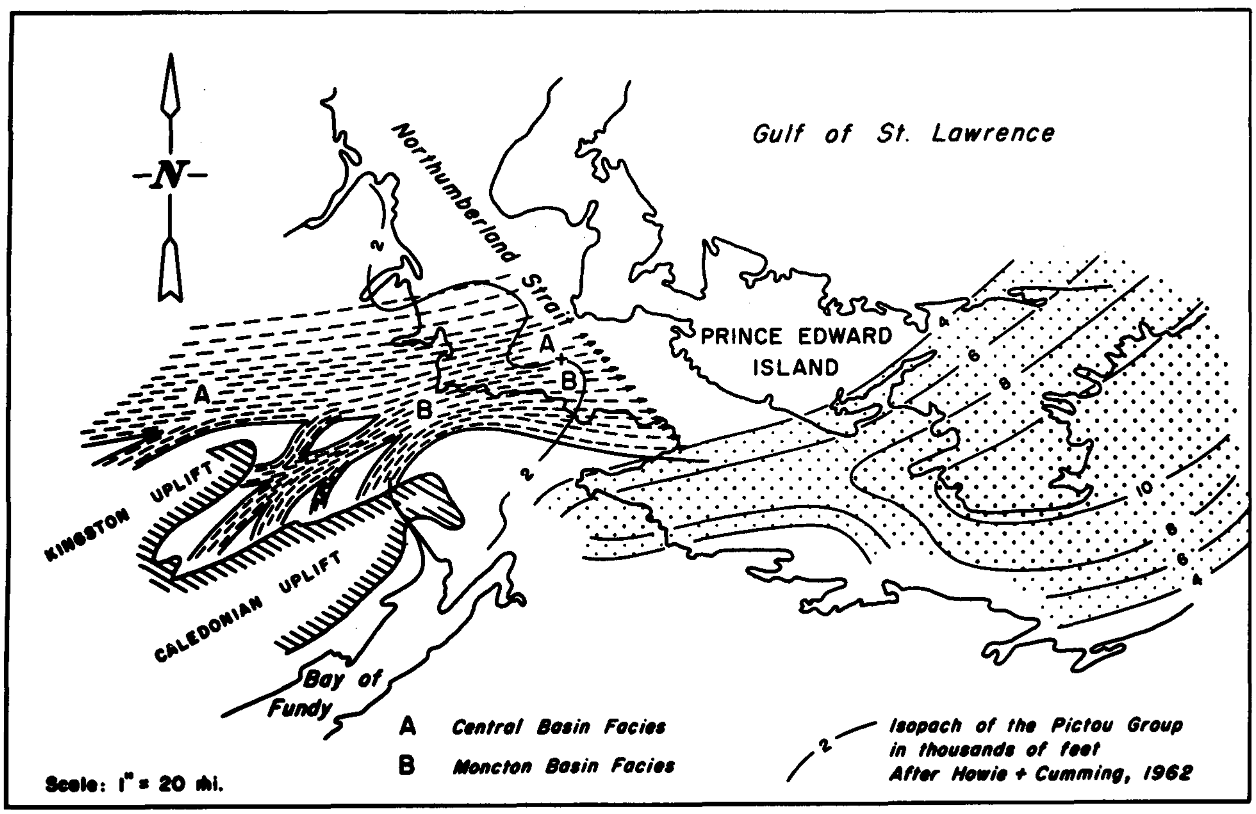

Figure 3. Map illustrating the general direction of sediment transport during Upper Pennsylvanian time towards a deep trough lying to the east of the Moncton Basin.

The interpreted transport directions are presented in Figure 3 and may be summarized as follows:

"A" A major source from the Central Basin with an east-northeasterly direction of sediment transport.

"B" A lesser source from the Moncton Basin with a north-easterly direction of sediment transport.

"A+B" At their confluence, the overall easterly direction of sediment transport is apparently governed by a steepening paleoslope towards the deepest part of the Carboniferous Basin between Prince Edward Island and Cape Breton (HOWIE and CUMMING, 1963).

It is interesting to note that a similar transport pattern, almost a mirror image of "B", was mapped in the Boss Point Formation by LAWSON (1962) for the area southeast of the Caledonia Mountains (the western part of the Cumberland Basin). The inference that the Moncton Basin fed into this latter area (LAMING and LAWSON, 1963) may be doubted.

The following sequence of events is tentatively proposed on the basis of the available information:

A large, relative shallow sedimentary basin persisted over most of southeastern New Brunswick and adjacent areas during early Petit-codiac time. The initial derivation of the sedimentary material is not known, but pebble compositions suggest a metamorphic sedimentary source such as the Lower Palaeozoic geosynclinal terrain of western New Brunswick.

The Caledonia Mountains themselves appear to have been at least partly covered by Lower Petitcodiac sediments, as paleocurrents in the coarser beds show derivation from that area.

It is inferred that a gradual uplift of the Caledonia Mountains during early Middle Petitcodiac time resulted in extensive erosion of its sedimentary cover. Re-deposition of sediments was subsequently restricted to the more confined Moncton Basin, with a general northeasterly direction of sedimentary transport. Tilting of Lower Petitcodiac strata along the basin margin has been observed in several localities, supporting this aspect of the inferred sequence of events.

A full-scale report on this phase of the investigation is in preparation. The project is currently being extended to the southwestern portion of the Central Basin; and it is hoped to cover the area south of the Saint John River by the end of the season.

References cited

CARR, P.A., 1961, Geology and hydrology of the Moncton map-area, New Brunswick, Canada: Ph.D. thesis, Univ. of Illinois, Urbana, Illinois.

GUSSOW, W.C., 1953, Carboniferous stratigraphy and structural geology of New Brunswick, Canada: Bull. A.A.P.G., V. 37, no. 7, p. 1713-1816.

LAMING, D.J.C., and LAWSON, D.E., 1963, Sedimentary facies and paleocurrents in the Boss Point Formation, southeastern New Brunswick: Bull. A.A.P.G., v. 47, no. 2, p. 361.

LAWSON, D.E., 1962, Sedimentology of the Boss Point Formation in southeastern New Brunswick: M.Sc. thesis, Univ. of N.B., Fredericton, N.B.

NORMAN, G.W.H., 1941, Moncton sheet, G.S.A. map 646A, Descriptive Notes.

PELLETIER, B.R., 1958, Pocono paleocurrents in Pennsylvania and Maryland: Bull. G.S.A., v. 69, p. 1033-1069.

POTTER, P.A., and PETTIJOHN, F.J., 1963, Paleocurrents and basin analysis: Academic Press Inc., New York.

WRIGHT, W.J., 1922, Geology of the Moncton map-area: G.S.C. Mem. 129.