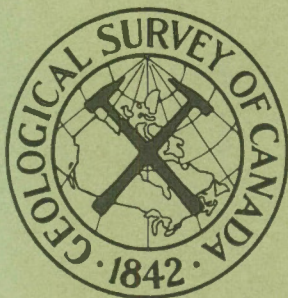
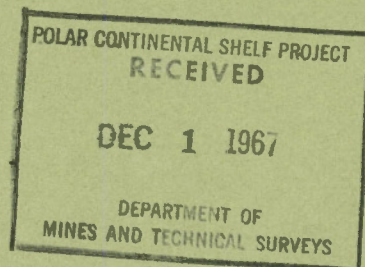


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PAPER 67-43

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VENDOM FIORD FORMATION — A NEW RED-BED UNIT  
OF PROBABLE EARLY MIDDLE DEVONIAN (EIFELIAN)  
AGE, ELLESMERE ISLAND, ARCTIC CANADA

(Report and 4 figures)

J. W. Kerr



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CONTENTS

	Page
Abstract.....	v
Introduction.....	1
Vendom Fiord Formation.....	1
Type Section.....	1
Other Sections.....	4
References.....	7

Illustrations

Figure 1.	Index map of Arctic Canada .....	facing page 1
2.	Section locations and boundaries of stratigraphic, structural provinces.....	2
3.	Vertical airphoto of type section of Vendom Fiord Formation.....	3
4.	Restored cross-section of Devonian rocks, Ellesmere Island.....	6



#### ABSTRACT

The Vendom Fiord Formation (new name) is a clastic red-bed unit of probable early Middle Devonian (Eifelian) age that occurs in the eastern side of the Franklinian miogeosyncline and on the adjacent Central Stable Region of Ellesmere Island. It is a post-tectonic formation of southeasterly derivation, that resulted from a widespread emergence near the Lower-Middle Devonian boundary. The emergence involved a westward shift of the flexure bordering the geosyncline, and a mild relative positive movement of the Bache Peninsula arch.

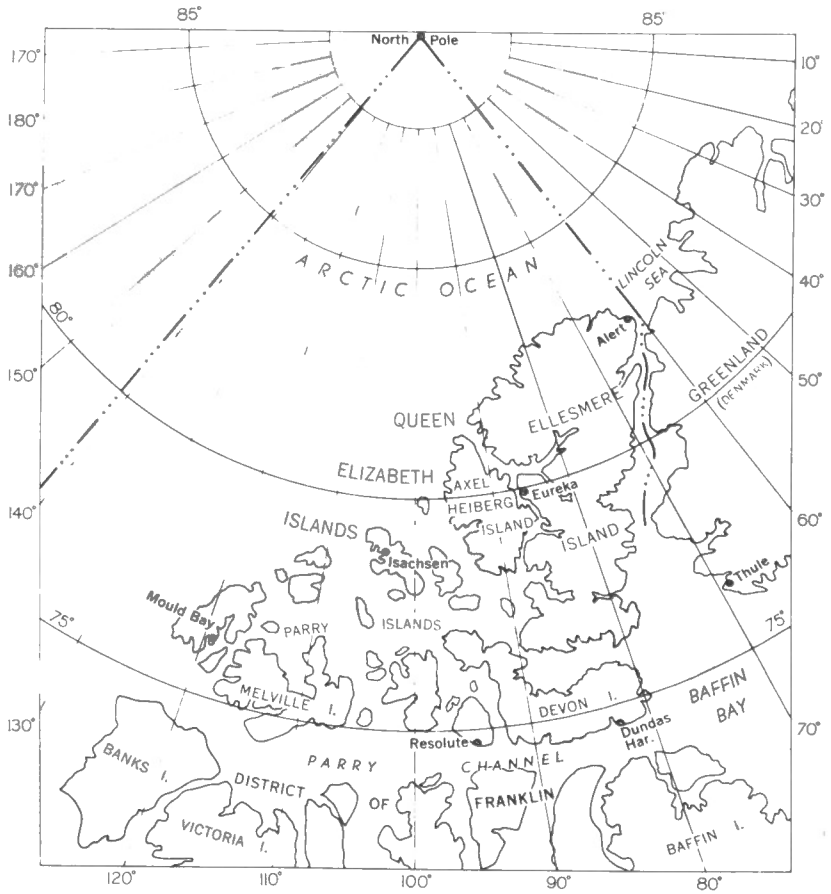


Figure 1. Index map of Arctic Canada showing Ellesmere Island.

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INTRODUCTION

In central and eastern Ellesmere Island (Fig. 1) the Franklinian miogeosyncline trends northeasterly and contains up to 40,000 feet of Proterozoic to Upper Devonian rocks. The boundary separating the miogeosyncline from the Central Stable Region is a flexure, delineated by a marked change in thickness of the sedimentary column. The position of the flexure in Cambrian to mid-Early Devonian time remained relatively fixed (Fig. 2). In mid-Early Devonian time the flexure changed position and thenceforth the geosyncline was restricted (Kerr, 1967a). The flexure migrated westward generally along its full length. In addition it was bulged farther westward at about 79°30'N Lat. by a mild relative elevation of the Bache Peninsula arch (Kerr, 1967b). Unconformity was produced on the Central Stable Region between Lower Devonian and probable early Middle Devonian rocks. The rocks that overlie this unconformity, and similar rocks farther west where the unconformity disappears, are red beds named as the Vendom Fiord Formation in this report.

VENDOM FIORD FORMATION

West of Irene Bay on central Ellesmere Island is an easterly dipping section 1,695 feet thick, that is here designated as the type section of the Vendom Fiord Formation (Section 25; Figs. 2 and 3). This section, resting upon the Cape Phillips Formation, was first reported by Thorsteinsson and Tozer (1957, p. 19), who considered the thickness to be about 1,800 feet. They showed also that in this vicinity the unit overlies the sharp facies change from shales of the Cape Phillips Formation eastward to carbonates of the Allen Bay and Read Bay Formations. The formation is very recessive and has a prominent reddish weathering colour with some buff and yellow-grey. The selection of the type section was made because that section is well exposed, has the base and top preserved, and has a character that is widely representative of the formation. The name Vendom Fiord was chosen because characteristic exposures of the formation occur most widely east of Vendom Fiord.

Type Section

Four units have been recognized in the type section (Fig. 3), and from base to top are as follows:

Unit 1: (70 feet thick) sandstone, quartzose, fine-grained, buff coloured, weathering yellow-grey, limy at the base; basal contact is sharp but concordant and is drawn where greenish silty shale of the Cape Phillips Formation is succeeded abruptly by sandstone; at the top gradational with overlying anhydrite.

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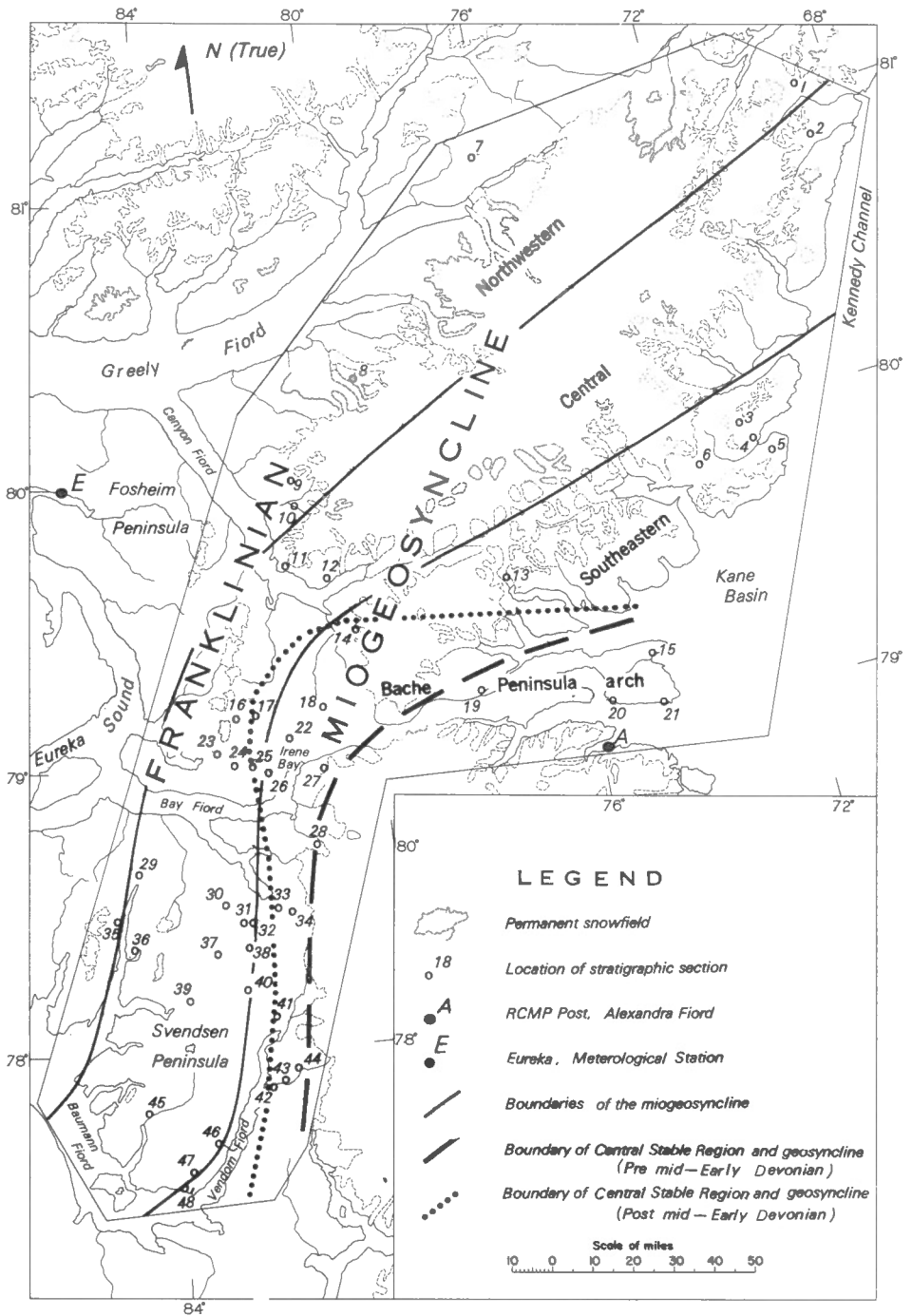


Figure 2. Central and eastern Ellesmere Island, showing the boundaries of stratigraphic, structural provinces and section locations.



Figure 3. Vertical aerial photograph of Sections 25 and 26, west of Irene Bay, Ellesmere Island. The type section of the Vendom Fiord Formation (Dv) is in Section 25. Symbols - Ob, Baumann Fiord Formation; Oe, Eleanor River Formation; Oc, Cornwallis Group undivided; Ocb, Bay Fiord Formation; Oct, Thumb Mountain Formation; Oci, Irene Bay Formation; O-Dar, Allen Bay and Read Bay Formations undivided; O-Dcp, Cape Phillips Formation; Dv, Vendom Fiord Formation; Dbl, Blue Fiord Formation; Dob, Okse Bay Formation; Kte, Eureka Sound Formation - Barbed line, thrust or reverse fault; heavy line with dot, normal fault with dot side down; jagged line, angular unconformity.

Unit 2: (65 feet thick) anhydrite, quartz sandy, mainly white, reddish weathering; gradational above and below.

Unit 3: (460 feet thick) siltstone, quartzose, dark grey-green, thin-bedded, interbedded with buff coloured quartz sandstone; all weathering yellow-grey; gradational above and below.

Unit 4: (1, 100 feet thick) sandstone, quartzose, anhydritic, fine-grained, siltstone interbeds, varicoloured, predominantly red and green fresh and weathering colours; gradational at base; near top are buff dolomite interbeds; gradational with dolomite of the overlying Blue Fiord Formation.

No fossils have been found in the type section or in any other section of the Vendom Fiord Formation. The age of the type section is deduced from certain stratigraphic relationships described in the following paragraphs.

The uppermost 185 feet of the underlying Cape Phillips Formation is mainly shaly siltstone with four coquinal limestone interbeds, each of 5 to 15 feet thickness. The limestones contain prolific brachiopod faunas which are under study by Boucot and Johnson; graptolites from the intervening silty shales are under study by Thorsteinsson and Kerr. Only preliminary investigations have been made on the faunas from this succession but are sufficient to indicate that it is Early Devonian, and perhaps in the upper part as young as late Early Devonian (Emsian). The contact with the underlying Cape Phillips Formation is abrupt but shows no evidence of a sedimentary break. From the fact that a widespread erosional break occurs at the base of the Vendom Fiord Formation to the north and southeast (see below), the contact may represent a disconformity. The Vendom Fiord Formation must be Early Devonian or younger, and probably younger.

Overlying the Vendom Fiord Formation is a bluff-forming dolomite assigned to the Blue Fiord Formation on stratigraphic grounds. At its type section, one hundred and twenty-five miles southwest of Irene Bay, the Blue Fiord Formation is limestone and regarded as early mid-Devonian in (Eifelian) age (McLaren, 1963, p. 322). The lower part of the type section of the Blue Fiord Formation grades northward into limy shales, while the upper part grades northward into the dolomite of the Irene Bay area. The Blue Fiord Formation at Irene Bay is thus presumably of Eifelian age. From the fact that the type section of the Vendom Fiord Formation is gradational with the Eifelian Blue Fiord Formation, and rests with possible disconformity upon Lower Devonian (possibly Emsian) rocks of the Cape Phillips Formation, it is of probable early middle Devonian (Eifelian) age.

#### Other Sections

South of the type section the Vendom Fiord Formation is present on that region that was part of the Central Stable Region during its deposition, and also along the easternmost margin of the miogeosyncline. It is absent from Section 33 where the Blue Fiord Formation rests concordantly but probably with erosional break upon the Allen Bay Formation. In Section 34 the formation is 800 feet thick, comprising varicoloured quartz sandstone. It rests sharply but concordantly upon the Allen Bay Formation and is truncated by the Eureka Sound Formation.

At the head of Vendom Fiord (Section 41) the Vendom Fiord Formation is 1,300 feet thick; it rests unconformably upon the Read Bay Formation and is overlain sharply but gradationally by the Blue Fiord Formation (Fig. 4). At the base it contains 30 feet of coarse, reddish weathering conglomerate, with pebbles of red quartz sandstone, grey sandy dolomite, and grey dolomite. The conglomerate passes upward gradationally into a brightly coloured succession including reddish weathering quartz sandstone, anhydritic quartz sandstone, grey-green and grey-brown quartz sandstone and siltstone, and minor sandy limestone. The interval is marked by its recessive nature and reddish weathering colour. Along strike to the north, gypsum-anhydrite is considerably more important.

The age of the Vendom Fiord Formation at the head of the Vendom Fiord (Section 41) is deduced from stratigraphic relations. The Read Bay Formation, which underlies it with probable angular unconformity, is 2,160 feet thick, and the youngest fossils in it occur at a height of 810 feet above the base (GSC loc. 51946; identified by B.S. Norford), and include *Atrypella* sp., and *Favosites* sp., of Ludlow age. Traced west of Section 41, the upper parts of the Vendom Fiord Formation grade into lower parts of the Blue Fiord Formation (Fig. 4). It is likely that the Blue Fiord Formation here is no younger than the type section of the Blue Fiord Formation (McLaren, 1963), which is of Eifelian age. The age of the Vendom Fiord Formation at the head of Vendom Fiord therefore is bracketed by Ludlow and Eifelian, but being conformable with the Blue Fiord Formation, it is most probably Eifelian.

At Section 44 the Vendom Fiord Formation is 600 feet thick and the top is not preserved. There are no faunal grounds for dating this section but it was walked out into Section 41 over discontinuous exposures. It consists mainly of dark green and dark red quartzose siltstone and sandstone resting sharply and with probable unconformity upon sandy dolomite assigned to the Read Bay Formation (Fig. 4).

North of the type section (Fig. 2) three sections of the Vendom Fiord Formation were examined, and at each the formation rests with slight angular unconformity upon underlying beds. This unconformity probably diminishes and disappears westward (Kerr, 1967a, Fig. 3). At Section 22 the Vendom Fiord Formation is 850 feet thick and lies with angular unconformity upon the Allen Bay Formation and grading sharply upward to dolomite of the Blue Fiord Formation. At Section 18 northeast of Irene Bay, the Vendom Fiord Formation is 1,300 feet thick, and markedly recessive. It rests with regional angular unconformity upon the Read Bay Formation. At the base is 175 feet of resistant dolomite boulder conglomerate interbedded with reddish weathering dolomitic quartz sandstone, the entire interval weathering pinkish. This unit is overlain by 1,125 feet of quartz sandstone, medium-grained, thin-bedded, recessive, mainly dark green and dark red; anhydrite is present throughout but is most abundant at the base where it forms interbeds and nodules; the overall weathering colour is deep red. The top is sharply gradational with the Blue Fiord Formation which here is dolomite and very thin. Dating of this section is based as follows. The formation overlies with unconformity the Read Bay Formation, which is 935 feet thick and yields fossils at a height of 570 feet (GSC loc. 51950; identified by B.S. Norford). The fossils include an ostracod, a meristellid brachiopod, solitary corals, cf. *Cystiphyllum* sp., and *Syringopora* sp., which are probably Silurian, Wenlock or Ludlow. The Vendom Formation is overlain gradationally by the Blue Fiord Formation, which here is very thin (145 feet) and yielded no fossils.

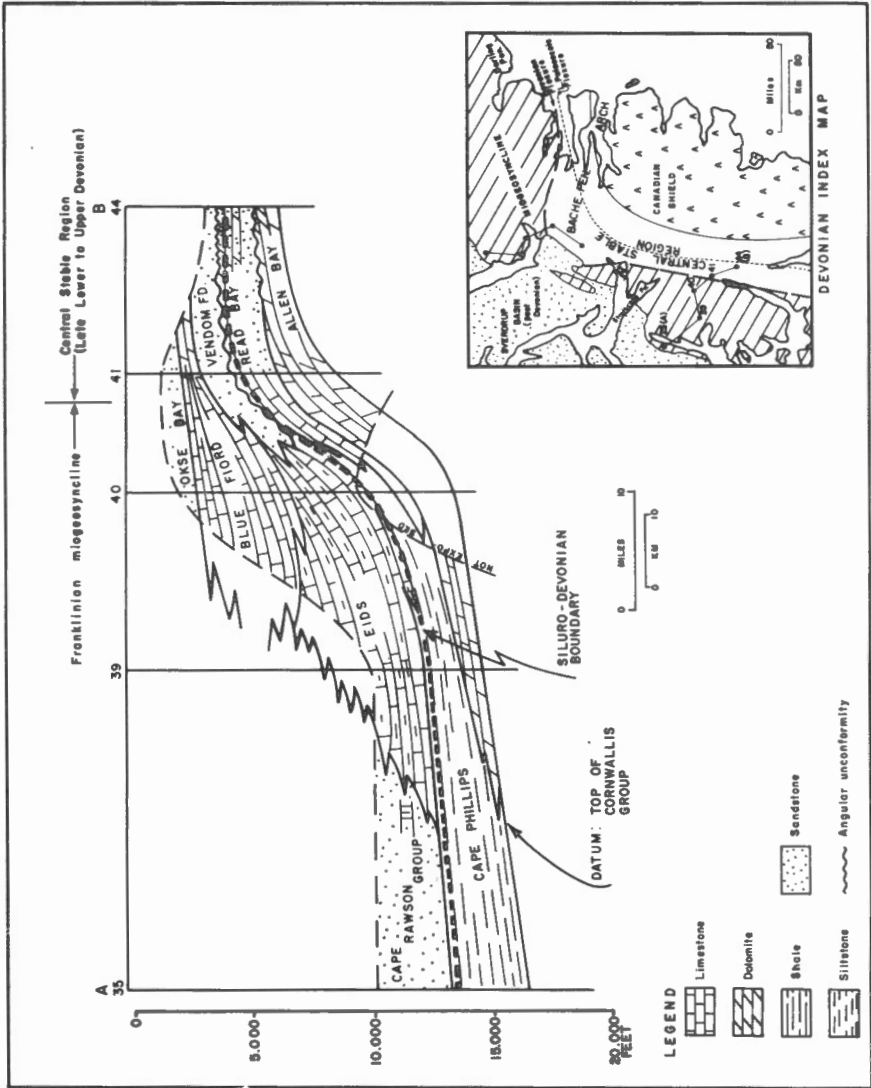


Figure 4. Restored cross-section of Devonian rocks, Ellesmere Island.

From stratigraphic grounds its base is no older than the type section of the Blue Fiord Formation (McLaren, 1963) and is probably equivalent in age to a middle or upper part. The age of the Vendom Fiord Formation in Section 18 then is bracketed by a possible Wenlock or Ludlow age, and a probable Eifelian age. It is most probably Eifelian.

At Section 14 the Vendom Fiord Formation is 1,125 feet thick. At the base, resting with angular unconformity upon rocks assigned to the Cape Rawson Group, is boulder conglomerate 110 feet thick. The boulders are up to 4 inches in diameter, composed of dolomite, red quartz sandstone, and green quartz sandstone; the matrix is red silty dolomite in the lower part, light grey dolomite in the upper part. The conglomerate is overlain sharply by 1,015 feet of sandstone, quartzose, fine grained, deep red, in places greenish, entirely recessive. At the top are minor calcareous interbeds where the formation grades rapidly to dolomite of the overlying Blue Fiord Formation. No fossils were found in this section that would aid in dating the Vendom Fiord Formation, however, the Vendom Fiord Formation truncates the Eids Formation and Cape Rawson Group. Both of these formations here are at least in part of probable Early Devonian age, because they grade into and overlies the Read Bay Formation. The Read Bay Formation at Section 14 is definitely younger than the possibly Wenlock or Ludlow fossils at Section 18 (see above). It is probably Lower Devonian, as it has been shown to be at Darling Peninsula and is inferred to be at Irene Bay (Kerr, 1967c).

South of Bay Fiord (Fig. 2) the Vendom Fiord Formation occurs in a belt on the western part of the Central Stable Region, where it rests upon an angular unconformity, is mainly a red-bed unit, and contains some anhydrite. Farther west, on the eastern margin of the miogeosyncline, the unconformity diminishes and the red colour disappears, as the formation grades westward to mainly limy shale and siltstone of the Eids Formation. Between Bay Fiord and Canyon Fiord the formation has a similar relation to the Central Stable Region and the Eids Formation, but there both the region of unconformity and the distribution of red beds, are bulged westward.

The Vendom Fiord Formation is a red-bed unit of probable early Middle Devonian (Eifelian) age that lies unconformably on rocks of Early Devonian age. It is a post-tectonic formation that indicates a widespread emergence of central Ellesmere Island in latest Early to early Middle Devonian time. This emergence coincided with a westward shift of the flexure separating the Central Stable Region from the Franklinian miogeosyncline, and with a mild relative positive movement of the Bache Peninsula arch (Kerr, 1967a). It also coincides in age with a similar emergence of the Cornwallis fold belt on Bathurst and Cornwallis Islands (Kerr and Christie, 1965).

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