THE HEIBERG GROUP, WESTERN SVERDRUP BASIN, ARCTIC ISLANDS

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Abstract

The Heiberg, a prominent formation in the eastern and central Sverdrup Basin, is given group status in the western Sverdrup. The Heiberg Group comprises five formations which, in ascending order are: Skybattle, Grosvenor Island, Maclean Strait, Lougheed Island and King Christian. These new formations are formally defined herein. The Skybattle, Maclean Strait and King Christian formations are sandstone-dominant and consist of delta front, distributary mouth bar and delta plain deposits. The sandstone-dominant units are separated from each other by shale-siltstone formations (Grosvenor Island and Lougheed Island). These argillaceous formations represent prodelta and offshore shelf deposits.

Three formal members are recognized in the King Christian Formation. The Drake Point (lowest) and Whitefish members are sandstone-dominant and are separated by the Stupart Member, which consists of shale and siltstone.

Résumé

La formation de Heiberg, formation importante dans les parties est et centrale du bassin de Sverdrup, devient un groupe dans la partie ouest du bassin. Le groupe de Heiberg comprend cinq formations soit, en ordre ascendant: Skybattle, Grosvenor Island, Maclean Strait, Lougheed Island et King Christian. Ces nouvelles formations sont décrites officiellement dans le présent rapport. Les formations de Skybattle, de Maclean Strait et de King Christian sont dominées par des grès et composées de sédiments provenant d'un front de delta, d'une flèche à l'embouchure d'un effluent et d'une plaine deltaique. Des formations de schiste-argileux et de pélite (Grosvenor Island et Lougheed Island) séparent ces unités les unes des autres. Ces formations argilleuses représentent des sédiments déposés en avant d'un delta et sur un plateau au large des côtes.

On a divisé la formation de King Christian en trois niveaux officiels. Les niveaux de Drake Point (niveau inférieur) et de Whitefish sont dominés par des grès et séparés par le niveau de Stupart, lui-même composé de schiste argileux et de pélite.

Introduction

The Heiberg Formation/Group of the Sverdrup Basin is an Upper Triassic-Lower Jurassic, sandstone-dominant interval, which occurs between two shale-siltstone formations, the Barrow below and the Jameson Bay above. The Heiberg was originally defined as a formation by Souther (1963) from exposures at Buchanan Lake on eastern Axel Heiberg Island. I have recently described the Heiberg Formation in the eastern and central Sverdrup Basin and recognized three members within it (Embry, 1982, 1983). In the western Sverdrup the Heiberg interval is still clearly recognizable, but is divisible into five units, three sandstone-dominant and two shale-siltstone dominant. Consequently, the Heiberg in this area is raised to group status and five component formations, Skybattle, Grosvenor Island, Maclean Strait, Lougheed Island and King Christian are formally named herein .

The type sections for these new formations are in the Sun Skybattle Bay C-15 well, which is located on southwestern Lougheed Island (77°14'12"N, 105°05'57"W) (Fig. 46.1). The Skybattle Bay C-15 well was spudded on April 1, 1971 and was abandoned on November 23, 1971 at a total depth of 3658 m (12 000 ft). The elevation of the K.B. is 33.5 m. Chip samples taken at 3 m intervals from these strata can be examined at the Institute of Sedimentary and Petroleum Geology in Calgary, Alberta.

Figure 46.1 illustrates the distribution of the Heiberg Group in the western Sverdrup Basin and the available control points. Surface exposures occur on northwestern Ellef Ringnes Island, Borden Island, Prince Patrick Island and Melville Island. Over most of the area the Heiberg Group is in the subsurface and it has been penetrated by 66 wells.

Previous Work

The first study of strata now included in the Heiberg Group was done by Tozer and Thorsteinsson (1964) on basin margin outcrops on Borden and Melville Islands. On Borden Island they designated 60 m of poorly exposed, ferruginous sand and sandstone as the Borden Island Formation. At the type section the strata rest unconformably on sandstone of the Upper Triassic Schei Point Formation and are overlain conformably by the Wilkie Point Formation. The Borden Island Formation was dated as Sinemurian (Early Jurassic) on the basis of an ammonite collected from the scree. Tozer and Thorsteinsson (1964) also assigned 12 m of red and green sand and sandstone, outcropping on northwestern Melville Island, to the Borden Island Formation.

The type section of the Borden Island Formation was again examined and described by Rahmani and Tan (1978). They recognized two subdivisions in the formation, a lower unit (50 m) of shale and siltstone with interbeds of argillaceous, very fine grained sandstone in the upper portion and a poorly exposed, upper unit (23 m), which was assumed to consist mainly of sandstone.

In 1967, Stott (1969) mapped Ellef Ringnes Island and referred 60 m of fine grained, quartzose sandstone, present on the northwestern portion of the island, to the Borden Island Formation. Stott (1969) collected Sinemurian ammonites from the lower portion of the formation. In this area the base of the Borden Island is not exposed and it is conformably overlain by shales of the Savik Formation.

Subsurface studies of the Heiberg Group began with Reinson (1975) who described the Borden Island Formation in two wells on Sabine Peninsula, Melville Island. He divided

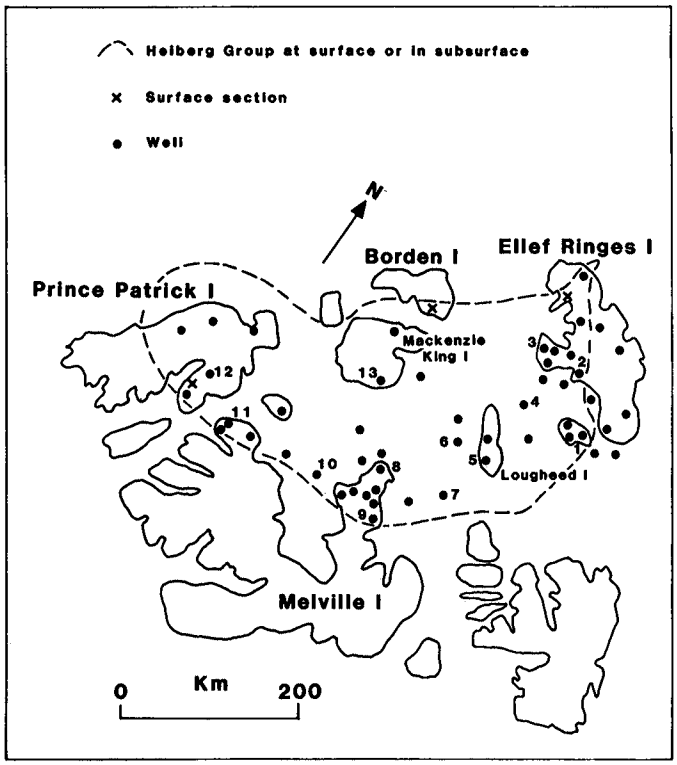

Figure 46.1. *Distribution of Heiberg Group in western Sverdrup Basin and available control points. Key to wells listed in appendix: 1. King Christian N-06; 2. Kristoffer Bay B-06; 3. Mocklin Point D-23; 4. Skate L-80; 5. Skybattle Bay C-15; 6. Whitefish 2H-63; 7. Desbarats B-73; 8. North Sabine H-49; 9. Drake Point F-16; 10. N.W. Hecla M-25; 11. Sandy Point L-46; 12. Jameson Bay C-31; 13. Cape Norem A-80.*

the formation into three units, a lower oolitic ironstone (10 m), a cyclic sandstone-siltstone (30 m), and an upper unit of interbedded shale, siltstone and glauconitic sandstone. Reinson (1975) interpreted unconformities between the units. Douglas (1977) and Douglas and Oliver (1979) described the Borden Island Formation in the Sabine Peninsula area and recognized Reinson's three informal units throughout that area.

Meneley (1977), in a review of the hydrocarbon exploration prospects in the Arctic Islands, presented a stratigraphic cross-section of the Drake Point gas field on Sabine Peninsula where the Borden Island Formation contains the main reservoir strata. He restricted the name Borden Island Formation to the lower two units of Reinson (1975) and referred to the upper glauconitic unit as the "lower Wilkie Point". Significantly, he demonstrated that a regional unconformity occurs beneath the glauconitic unit.

Henao-Londono (1977) illustrated subsurface stratigraphic correlations in the Lougheed, King Christian, and Ellef Ringnes area. In the interval now designated as Heiberg Group, he proposed four informal stratigraphic units: Heiberg (sensu stricto), Upper Triassic sandstone and shale; Borden Island, Sinemurian, sandstone-dominant unit; Lower Savik, Pliensbachian shale and siltstone; King Christian Sand, Pliensbachian to Toarcian sandstone. Henao-Londono (1977) interpreted regional unconformities beneath the Borden Island and Lower Savik units.

Balkwill and Roy (1977), and Balkwill et al. (1982) also described the subsurface stratigraphy of the King Christian and Lougheed Island areas. In both papers strata of the Heiberg Group are divided into two units: Heiberg Formation (lower member); Heiberg Formation (upper member) – Borden Island Formation (undivided). This nomenclatural scheme follows that used by Balkwill (in press) in the central Sverdrup Basin.

Present Work

The previous studies of the Heiberg Group strata were mainly of a local nature and this fact, in combination with the presence of facies changes and regional unconformities, led to a complicated and confusing stratigraphic nomenclature for the strata. For this study a regional approach has been taken and all available surface and subsurface sections have been correlated. Both the Barrow and Jameson Bay formations can be recognized over almost the entire western Sverdrup, so that the Heiberg interval can be objectively delineated and mapped in the area. As previously mentioned, the Heiberg is given group status in the area because five mappable formations can be recognized within the interval and because, in some areas, unconformities separate some of the formations.

The stratigraphic relationships of the five formations of the Heiberg Group are portrayed on Figure 46.2. The reader is referred to Embry (1982) for a more detailed stratigraphic and sedimentologic study, which includes stratigraphic cross-sections and maps for these units.

Figure 46.3 illustrates the correspondence between these new stratigraphic units and the nomenclature used by previous workers. Note that the term Borden Island, as used by previous workers, had a variety of stratigraphic meanings. Ironically, the term was applied mainly to sandstone-dominant units when in fact we now know that the type section consists predominantly of shale and siltstone. To avoid confusion the term Borden Island has been abandoned.

The tops for Heiberg Group units from 13 selected wells throughout the western Sverdrup Basin (Fig. 46.1) are listed in the appendix.

Skybattle Formation

Definition

The Skybattle Formation consists of interbedded, very fine- to fine-grained sandstone, siltstone and shale with sandstone being the dominant component. The type section is in the Sun Skybattle Bay C-15 well, between 2105 m (6905 ft) and 2159 m (7082 ft), and is 54 m thick (Fig. 46.4). The formation is named after Skybattle Bay which is 7 km south of the C-15 well.

Synonyms

1. Heiberg (sensu stricto) of Henao-Londono (1977).
2. Lower portion of Heiberg Formation (lower member) of Balkwill et al. (1982).
3. Heiberg/Blaa Mountain transition zone (informal name commonly used in petroleum industry).

Boundaries

The Skybattle Formation conformably overlies the Barrow Formation and the contact is placed at the base of the first sandstone unit which exceeds 4 m in thickness, and above which sandstone is relatively common (Fig. 46.4). The upper contact with the Grosvenor Island Formation varies

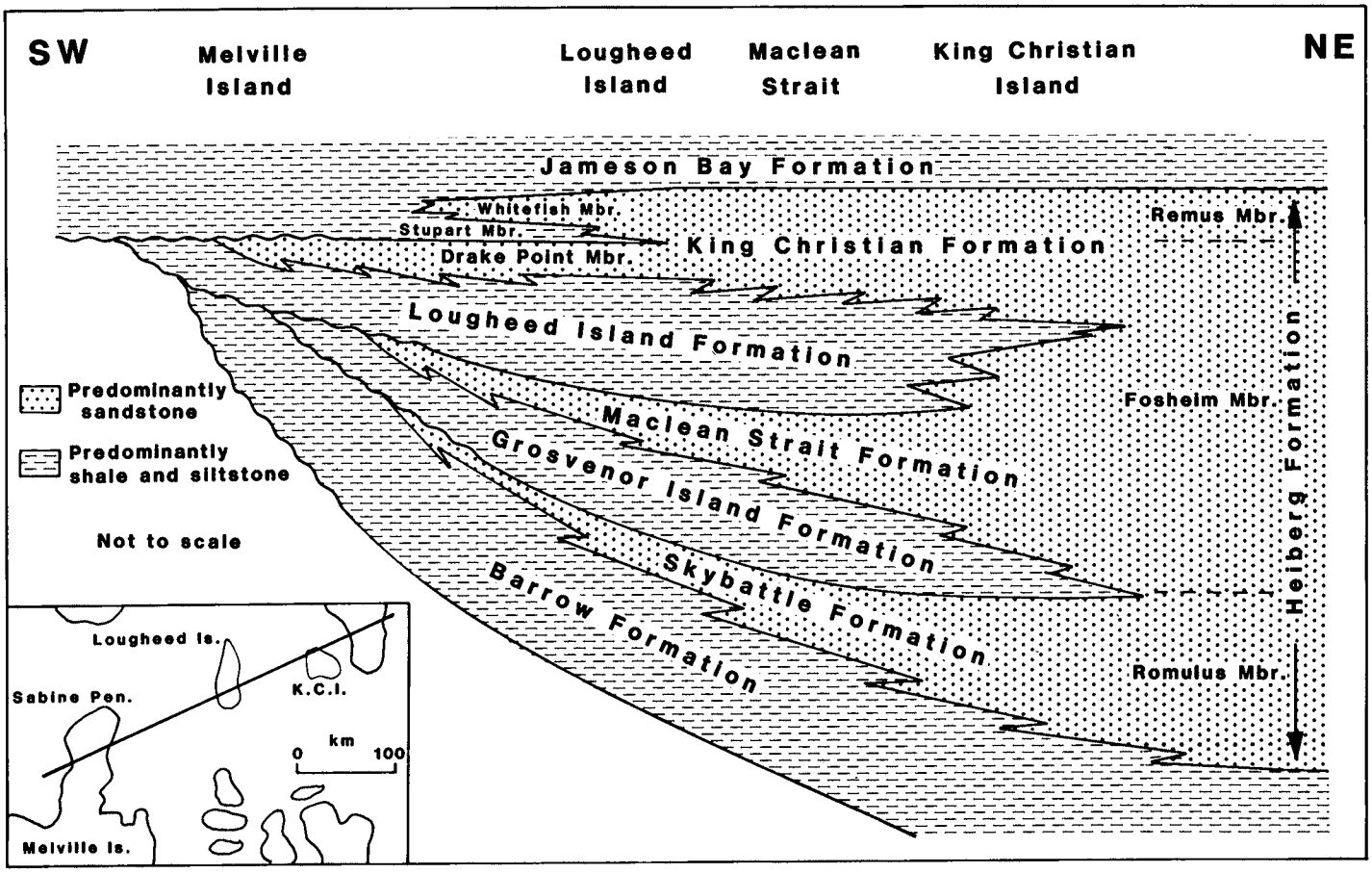

Figure 46.2. *Schematic stratigraphic cross-section, Heiberg Group, western Sverdrup Basin.*

from conformable to unconformable. The contact is placed at the top of the highest sandstone unit above which shale and siltstone become the predominant lithologies. A distinctive oolitic ironstone bed occurs directly above the contact in the Lougheed Island area.

Lithology

The formation consists of interbedded very fine- to fine-grained sandstone, siltstone and shale with the lithologies arranged in coarsening-upward cycles 10-35 m thick. Sandstone units are usually 5-15 m thick. The sandstone is quartzose with variable amounts of quartz, calcite and clay cements. Porosity ranges from 5 to 15 per cent.

Thickness and Distribution

The Skybattle Formation thins westward from King Christian Island, where it is up to 160 m thick, to a shale-out edge just west of Lougheed Island. East of King Christian Island the Skybattle merges with the Romulus Member of the Heiberg Formation (Fig. 46.2). A narrow band of Skybattle Formation may occur along the southern and northwestern margins of the basin (e.g. Jameson Bay C-31).

Age

The Skybattle Formation is dated as Norian (Late Triassic) on the basis of its intertonguing relationship with the Barrow Formation, which contains Norian pelecypods (Tozer, 1973) and palynomorphs (unpublished GSC paleontology reports).

Environment of Deposition

The lithologies, cyclicity and stratigraphic relationships of the Skybattle Formation indicate a delta front to shallow marine shelf origin for the formation (Embry, 1982).

Grosvenor Island Formation

Definition

The Grosvenor Island Formation consists mainly of shale and siltstone and is the lower of two shale-siltstone units which occur in the Heiberg Group. The type section is in the Sun Skybattle Bay C-15 well, between 2081 m (6828 ft) and 2105 m (6905 ft), and is 24 m thick (Fig. 46.4). The member is named after Grosvenor Island which lies 15 km south of Lougheed Island.

Synonyms

1. Oolitic ironstone unit, Borden Island Formation (Reinson, 1975).
2. Unit A, Borden Island Formation (Douglas, 1977; Douglas and Oliver, 1979).
3. Basal portion of Borden Island unit, in Panarctic Pat Bay A-72 well (Henao-Londono, 1977).
4. Uppermost Heiberg Formation (lower member) (Balkwill and Roy, 1977; Balkwill et al., 1982).

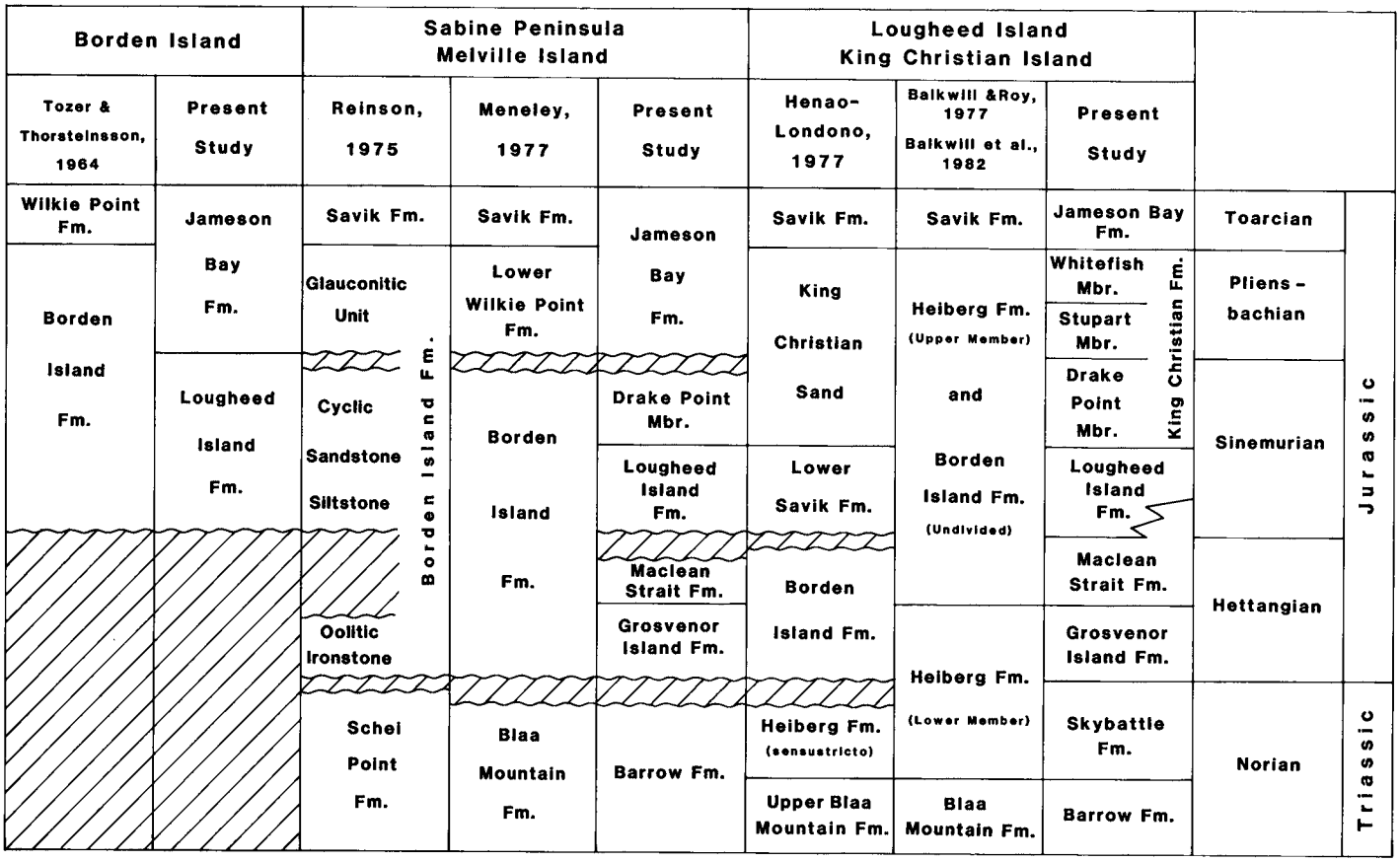

Figure 46.3. *Past and present stratigraphic nomenclature for Heiberg Group, western Sverdrup Basin.*

Boundaries

The Grosvenor Island Formation rests on the Skybattle Formation with the contact varying from conformable to unconformable (Fig. 46.2). The upper contact with the Maclean Strait Formation is conformable and is placed at the base of the first sandstone unit greater than 4 m in thickness and above which sandstone is the predominant lithology. On the basin margin the Grosvenor Island is bounded by unconformities (Fig. 46.2).

Lithology

The Grosvenor Island consists mainly of shale and siltstone with thin, very fine grained sandstone units near the top of the formation. Overall, the formation coarsens upward into the overlying sandstone-dominant Maclean Strait Formation. In the King Christian – Ellef Ringnes area the shales are medium grey and silty. Westward, red shales occur in the lower portion of the formation and on northwestern Melville Island such shales comprise almost all of the formation. In the Lougheed Island area and westward an oolitic ironstone unit occurs at the base of the formation and is up to 10 m thick on Sabine Peninsula.

Thickness and Distribution

The formation is present over most of the western Sverdrup Basin, being absent only on the extreme margins of the basin, where it is overstepped by the Lougheed Island Formation (Fig. 46.2). East of King Christian Island The Grosvenor Island Formation merges with the Romulus Member of the Heiberg Formation (Fig. 46.2). The greatest recorded thickness of the formation is 120 m (western Ellef Ringnes Island), but it is less than 50 m thick over much of its extent.

Age

The Grosvenor Island Formation is dated as Hettangian by palynomorphs (unpublished GSC paleontology report).

Environment of Deposition

The lithologies, fossil contact (dinoflagellates), and stratigraphic relationships suggest an offshore shelf environment of deposition for the formation. The basal oolitic ironstone unit is interpreted to be a shallow, shelf deposit, which formed when clastic supply to the western Sverdrup was drastically reduced due to an earliest Jurassic transgression (Embry, 1982).

Maclean Strait Formation

Definition

The Maclean Strait Formation consists of interbedded, very fine- to coarse-grained sandstone, siltstone and shale with sandstone the dominant lithology. The type section is in the Sun Skybattle Bay C-15 well, between 2043 m (6702 ft) and 2081 m (6828 ft), and is 38 m thick (Fig. 46.4). The name is taken from Maclean Strait, which separates Lougheed Island from King Christian and Ellef Ringnes islands.

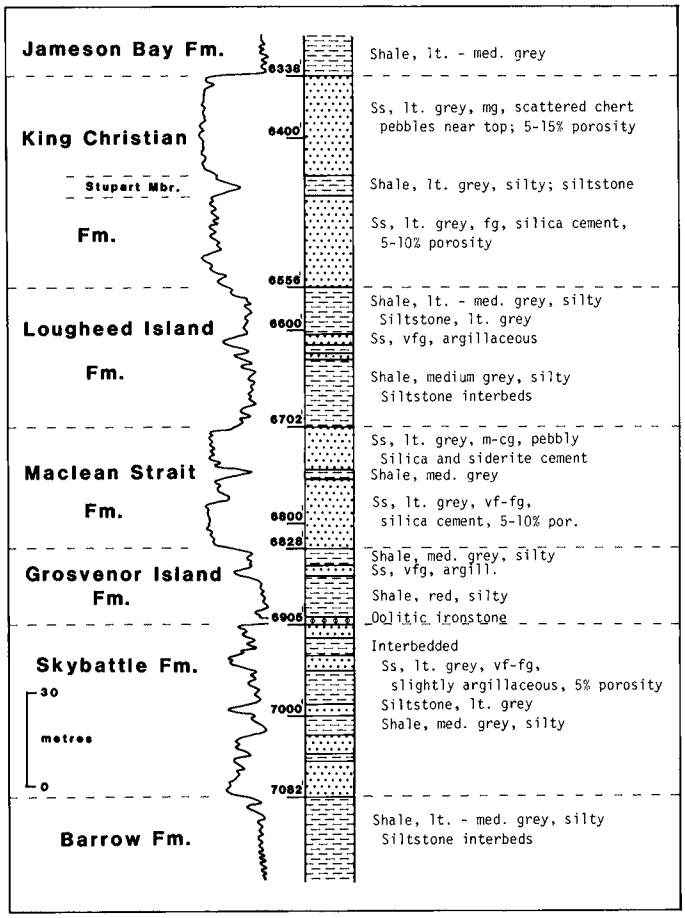

Figure 46.4. *Lithology (from samples) and gamma ray curve for type sections of Skybattle, Grosvenor Island, Maclean Strait, Lougheed Island and King Christian formations, and Stupart Member; Skybattle Bay C-15 well.*

Synonyms

1. Lowermost portion of Unit B, Borden Island Formation, North Sabine H-49 well (Douglas, 1977; Douglas and Oliver, 1979).
2. Various portions of Borden Island unit of Henao-Londono (1977).
3. Lower portion of the Heiberg Formation (upper member) – Borden Island Formation (undivided) (Balkwill and Roy, 1977; Balkwill et al., 1982).

Boundaries

The Maclean Strait Formation gradationally overlies the Grosvenor Island Formation. Over most of its extent the Maclean Strait is conformably overlain by the Lougheed Island Formation, with the contact placed at the top of the uppermost sandstone unit above which shale and siltstone predominate. On the basin margins the contact becomes unconformable and the Lougheed Island oversteps the Maclean Strait (Fig. 46.2).

Lithology

In the King Christian – Ellef Ringnes area the Maclean Strait Formation consists of three lithologic intervals: a lower interval of interbedded, very fine- to fine-grained sandstone, siltstone and shale with the lithologies arranged in coarsening-upward cycles; a middle interval of massive, fine- to coarse-grained sandstone with rare interbeds of carbonaceous siltstone and shale; and an upper interval of interbedded, fine- to coarse-grained sandstone, siltstone and shale also arranged in coarsening-upward cycles. To the west, in the Lougheed Island area, the entire formation consists of coarsening-upward cycles. The sandstones are quartzose, with varying amounts of quartz, calcite and clay cement. Porosity ranges from 5 to 15 per cent.

Thickness and Distribution

The Maclean Strait Formation thins westward from a maximum of 370 m on western Ellef Ringnes Island to a shale-out edge west of Lougheed Island. Eastwards it merges with the Fosheim Member of the Heiberg Formation (Fig. 46.2). A narrow band of Maclean Strait Formation may occur along the southwestern and northwestern basin margins.

Age

The age of the Maclean Strait Formation ranges from Hettangian to Sinemurian. In the King Christian – Ellef Ringnes area the lower two intervals of the formation are dated as Hettangian on the basis of their stratigraphic equivalence with the Grosvenor Island Formation. The upper interval is dated as Sinemurian on the basis of its intertonguing relationship with the Lougheed Island Formation, which contains Sinemurian palynomorphs and ammonites. In the Lougheed Island area the formation is considered to be almost entirely Hettangian on the basis of stratigraphic relationships.

Environment of Deposition

The Maclean Strait Formation is of deltaic origin, with the coarsening-upward cycles originating as delta front sediments and the massive, continuous sandstone intervals as distributary channel and distributary mouth bar deposits (Embry, 1982).

Lougheed Island Formation

Definition

The Lougheed Island Formation mainly consists of shale and siltstone, with interbeds of very fine grained sandstone in the upper portion. The type section is in the Sun Skybattle Bay C-15 well, between 1998 m (6556 ft) and 2043 m (6702 ft), and is 45 m thick (Fig. 46.4). The name is taken from Lougheed Island on which the C-15 well was drilled.

Synonyms

1. Lower portion of type Borden Island Formation (Rahmani and Tan, 1978).
2. Lower portion of the cyclic sandstone-siltstone unit, Borden Island Formation (Reinson, 1975).
3. Lower portion of unit B, Borden Island Formation (Douglas, 1977; Douglas and Oliver, 1979).
4. Lower Savik unit (Henao-Londono, 1977).
5. Middle portion of the Heiberg Formation (upper member) – Borden Island Formation (undivided) Balkwill et al., 1982).

Boundaries

The Lougheed Island Formation both conformably and unconformably overlies the Maclean Strait Formation (Fig. 46.2). On the basin margins the Lougheed Island

Formation unconformably overlies various stratigraphic units of Triassic to Early Jurassic age and a basal conglomerate or oolitic ironstone unit commonly occurs directly above the unconformity. The Lougheed Island Formation is conformably overlain by the King Christian Formation and the contact is drawn at the base of the first sandstone unit greater than 4 m in thickness, above which sandstone is the dominant lithology.

Thickness and Distribution

The Lougheed Island Formation occurs over the entire western Sverdrup Basin, except for the extreme southwest margin where it is overstepped by the Jameson Bay Formation (Fig. 46.2). The Lougheed Island is very thin (5 m) and silty along its eastern margin, thickens rapidly westward, mainly at the expense of the underlying Maclean Strait Formation, to a maximum recorded thickness of 140 m on western Ellef Ringnes Island, and then gradually thins westward toward the basin margins.

Age

The age of the Lougheed Island Formation is Sinemurian, on the basis of ammonites (Rahmani and Tan, 1978; unpublished paleontology report) and palynomorphs (Tan, 1979). This age assignment is corroborated by the occurrence of Sinemurian ammonites in basal King Christian Formation strata (Stott, 1969), which are stratigraphically equivalent to Lougheed Island strata farther west.

Environment of Deposition

The Lougheed Island Formation is interpreted as representing prodelta and offshore shelf deposits, on the basis of lithology, fossil content and stratigraphic relationships (Embry, 1982).

King Christian Formation

Definition

The King Christian Formation consists of interbedded very fine- to coarse-grained sandstone, siltstone, shale and minor coal. Sandstone is the dominant lithology. The type section is in Sun Skybattle Bay C-15 well, between 1932 m (6338 ft) and 1998 m (6556 ft), and is 66 m thick (Fig. 46.4). The formation is named after King Christian Island, which lies 100 km northwest of the C-15 well.

Synonyms

1. Borden Island Formation (Stott, 1969).
2. Upper portion of the cyclic sandstone-siltstone unit, Borden Island Formation (Reinson, 1975).
3. Upper portion of unit B, Borden Island Formation (Douglas, 1977; Douglas and Oliver, 1979).
4. King Christian sand (Henao-Londono, 1977).
5. Upper portion of the Heiberg Formation (upper member) – Borden Island Formation (undivided) (Balkwill and Roy, 1977; Balkwill et al., 1982).

Boundaries

The King Christian Formation conformably overlies the Lougheed Island Formation. The upper contact with the Jameson Bay Formation is conformable over much of the area, but becomes unconformable on the southwestern basin margin where the Jameson Bay oversteps the King Christian. The contact is placed at the top of the uppermost sandstone unit, above which siltstone and shale become the predominant lithologies.

Lithology

East of Lougheed Island the King Christian Formation consists of a lower interval of interbedded, very fine- to fine-grained sandstone, siltstone and shale, arranged in coarsening-upward cycles; a middle interval of fine- to coarse-grained sandstone with thin intervals of carbonaceous siltstone, shale and coal; and an upper interval of fine- to coarse-grained sandstone which is commonly pebbly and glauconitic. The sandstones are quartzose with chert the dominant pebble type. Quartz, calcite, and clay cements occur throughout, and sideritic cement is common in the uppermost portion of the formation. Porosity ranges from 5 to 25 per cent.

On Lougheed Island and westward the King Christian has been subdivided into three formal members, Drake Point, Stupart and Whitefish, which are formally named and described herein.

Thickness and Distribution

The King Christian Formation is thickest (180 m) on western Ellef Ringnes Island. Westwards the formation gradually thins by facies change into shale and siltstone of the Lougheed Island Formation and finally disappears at a poorly-defined shale-out edge between Lougheed and Mackenzie King islands. A band of the Drake Point Member extends along the southwestern margin of the basin.

Age

The King Christian Formation is Sinemurian and Pliensbachian in age. Both Early and Late Sinemurian ammonites have been collected from the formation (Stott, 1969; Frebold, 1975). The upper portion of the formation (Whitefish Member) is laterally equivalent to the basal strata of the Jameson Bay Formation, which have yielded Late Pliensbachian ammonites (Frebold, 1975).

Environment of Deposition

The King Christian Formation is interpreted to be deltaic in origin with the lower portion representing delta front deposits, the middle portion distributary mouth bar and delta plain deposits, and the upper portion delta-destructional deposits (Embry, 1982).

Drake Point Member

Definition

The Drake Point Member of the King Christian Formation mainly consists of very fine- to medium-grained sandstone with minor interbeds of siltstone and shale. The type section is in the Panarctic Drake Point F-16 well, which is located on Sabine Peninsula (76°25'15"N, 108°35'39"W) (Fig. 46.1). The Drake Point F-16 well was spudded on May 10, 1972, and was completed on June 16, 1972 at a total depth of 1478 m. The elevation of the K.B. is 33 m. The member occurs between 1093 m (3586 ft) and 1114 m (3654 ft), and is 21 m thick (Fig. 46.5). It is named after Drake Point, which is on the east coast of Sabine Peninsula, 4 km north of the F-16 well.

Synonyms

1. Upper portion of the cyclic sandstone-siltstone unit, Borden Island Formation (Reinson, 1975).
2. Upper portion of unit b, Borden Island Formation (Douglas, 1977; Douglas and Oliver, 1979).
3. Upper portion of Borden Island Formation, Sabine Peninsula (Meneley, 1977; Henao-Londono, 1977).
4. Lower portion of the King Christian sand, Pat Bay A-72 well (Henao-Londono, 1977).

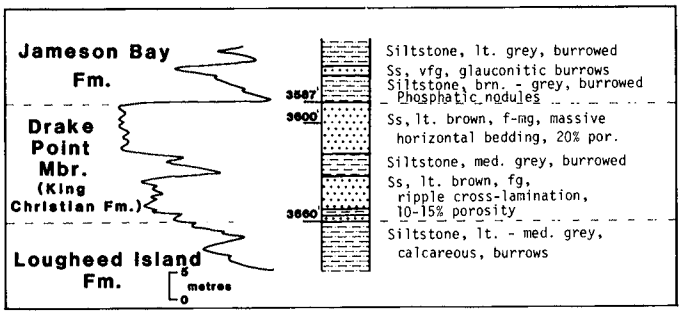

Figure 46.5. Lithology (from core) and gamma ray curve for type section of Drake Point Member of the King Christian Formation; Drake Point F-16 well.

Boundaries

The Drake Point Member conformably overlies the Lougheed Island Formation. The member is overlain by either the Stupart Member of the King Christian Formation or the Jameson Bay Formation, with the contact placed at the top of the uppermost sandstone, above which shale and siltstone become predominant. This contact is conformable except on the southwestern basin margin where the Jameson Bay Formation disconformably overlies the Drake Point Member.

Lithology

In the Lougheed Island - Sabine Peninsula area, the Drake Point Member consists of coarsening-upward cycles of very fine- to medium-grained sandstone, siltstone and shale. In the lower portion of the cycles, sandstone units are commonly argillaceous and highly burrowed, but are clay-free and horizontally bedded to massive in the upper portion. Sandstone dominates the member and the shale-siltstone units are thin. The sandstones are quartzose and porosity ranges from 10 to 25 per cent. Westwards, in the Prince Patrick area, the Drake Point Member mainly consists of very fine- to fine-grained, glauconitic, burrowed sandstone with porosity ranging from 5 to 12 per cent.

Distribution and Thickness

In the Lougheed Island area the member is up to 29 m thick. Eastwards it merges with the lower portion of the undivided King Christian Formation. A shale-out edge for the member occurs a few kilometers west of Lougheed Island. The member also occurs along the southwestern margin of the Sverdrup Basin, between Sabine Peninsula and Prince Patrick Island, where it is up to 40 m thick.

Age

Ammonites from outcrops of the member on Prince Patrick Island indicate a Sinemurian age (Frebold, 1975).

Environment of Deposition

The Drake Point Member is of delta front origin in the Lougheed Island area and of beach to nearshore shelf origin along the southwestern basin margin (Embry, 1982).

Stupart Member

Definition

The Stupart Member of the King Christian Formation mainly consists of grey siltstone and shale. The type section is in the Sun Skybattle Bay C-15 well, between 1963 (6440 ft) and 1969 m (6460 ft), and is 6 m thick (Fig. 46.4). The member is named after Stupart Island which lies 1 km south of Lougheed Island.

Synonyms

This stratigraphic unit was not recognized as a significant unit by previous workers and was included within various sandstone-dominant units such as the King Christian sand (Henao-Londono, 1977) and the Heiberg Formation (upper member) – Borden Island Formation (undivided) (Balkwill et al., 1982).

Boundaries

The Stupart Member conformably overlies the Drake Point Member as described above. West of Lougheed Island, where the Drake Point is no longer recognizable, the Stupart Member conformably overlies the Lougheed Island Formation. The contact is placed at the base of a clay-rich shale unit, which rests on argillaceous sandstone or siltstone of the uppermost Lougheed Island Formation. The Stupart Member is conformably overlain by the Whitefish Member of the King Christian Formation. The contact is placed at the base of the first sandstone unit greater than 4 m in thickness, above which sandstone is the dominant lithology.

Lithology

The member consists of interbedded, medium grey, silty shale and light to medium grey siltstone.

Thickness and Distribution

The member has been recognized in the Lougheed Island area and east of Sabine Peninsula. The maximum recorded thickness is 10 m. To the west it loses its identity when the overlying Whitefish sandstone shales out and it merges with the basal Jameson Bay Formation. It thins eastward, becomes more arenaceous, and grades laterally into the lower portion of the undivided King Christian Formation.

Age

The Stupart Member is assigned a Pliensbachian age on the basis of its stratigraphic equivalence with the basal Jameson Bay Formation, which contains Pliensbachian ammonites (Frebold, 1975) and palynomorphs (unpublished GSC paleontology reports).

Environment of Deposition

The lithologies and stratigraphic relationships suggest an offshore, shelf environment of deposition for the member (Embry, 1982).

Whitefish Member

Definition

The Whitefish Member is the uppermost member of the King Christian Formation and mainly consists of very fine- to medium-grained sandstone. The type section is in the Whitefish 2H-63 well, which is in the offshore area west of Lougheed Island (77°12'24"N, 106°53'26"W) (Fig. 46.1). The Whitefish 2H-63 well was spudded on December 3, 1979, and was completed on May 15, 1980 at a total depth of 3003 m. The K.B. of the well is 9.8 m. The member occurs between 2076 m and 2107 m and is 31 m thick (Fig. 46.6). The name is taken from the well in which the type section occurs.

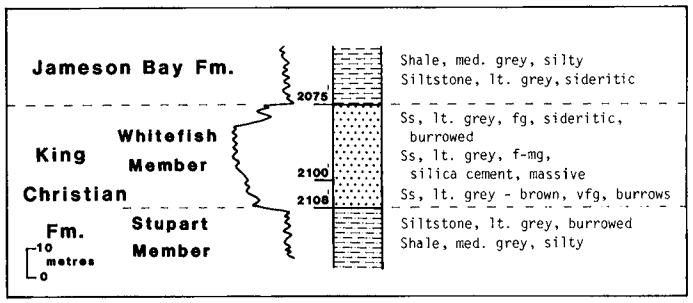

Figure 46.6. *Lithology (from core) and gamma ray curve for type section of Whitefish Member of the King Christian Formation; Whitefish 2H-63 well.*

Synonyms

1. Upper portion of the King Christian sand in Pat Bay A-72 well (Henao-Londono, 1977).
2. Upper portion of Heiberg Formation (upper member) – Borden Island Formation (undivided) (Balkwill et al., 1982).

Boundaries

The Whitefish Member conformably overlies the Stupart Member. The upper contact with the Jameson Bay Formation is also conformable and is placed at the top of the uppermost sandstone unit, above which shale and siltstone are predominant.

Lithology

The lower portion of the Whitefish Member consists of very fine grained, bioturbated sandstone, which contains shale-siltstone partings. The main upper portion is fine- to medium-grained sandstone which is usually massive in appearance. The uppermost sandstones are commonly glauconitic, burrowed and slightly argillaceous. Sandstones are quartzose with silica and clay cements. Porosity ranges from 7 to 20 per cent.

Thickness and Distribution

The Whitefish Member is recognized on Lougheed Island and offshore to the west and southwest. Recorded thicknesses range between 20 m and 45 m. The member shales-out between Lougheed Island and Mackenzie King Island to the west and between Lougheed Island and Sabine Peninsula to the southwest.

Age

The Whitefish Member is dated as Pliensbachian on the basis of its lateral equivalence with the basal Jameson Bay Formation (Fig. 46.2), which contains Pliensbachian ammonites (Frebold, 1979).

Environment of Deposition

The Whitefish Member is interpreted to be of deltaic origin with the lower strata consisting of delta front deposits, the massive upper portion being of distributary mouth bar origin, and the uppermost glauconitic sandstones representing delta destructional deposits.

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Appendix

Selected well tops, Heiberg Group, western Sverdrup Basin. Location of wells shown on Figure 46.1.

Panarctic King Christian N-06		
King Christian Formation	613 m	(2010 ft)
Lougheed Island Formation	703 m	(2305 ft)
Maclean Strait Formation	716 m	(2350 ft)
Grosvenor Island Formation	956 m	(3136 ft)
Skybattle Formation	971 m	(3186 ft)
Barrow Formation	1103 m	(3260 ft)
Panarctic Kristoffer Bay B-06		
King Christian Formation	1418 m	(4652 ft)
Lougheed Island Formation	1559 m	(5115 ft)
Maclean Strait Formation	1588 m	(5210 ft)
Grosvenor Island Formation	1863 m	(6112 ft)
Skybattle Formation	1976 m	(6482 ft)
Barrow Formation	2039 m	(6688 ft)
Panarctic Mocklin Point D-23		
King Christian Formation	1567 m	(5140 ft)
Lougheed Island Formation	1713 m	(5620 ft)
Maclean Strait Formation	1853 m	(6080 ft)
Grosvenor Island Formation	1955 m	(6414 ft)
Skybattle Formation	2047 m	(6715 ft)
Barrow Formation	2141 m	(7025 ft)
Panarctic AIEG Skate L-80		
King Christian Formation	867 m	(2844 ft)
Lougheed Island Formation	983 m	(3225 ft)
Maclean Strait Formation	1102 m	(3615 ft)
Grosvenor Island Formation	1141 m	(3743 ft)
Skybattle Formation	1188 m	(3898 ft)
Barrow Formation	1267 m	(4157 ft)
Sun Skybattle Bay C-15		
Whitefish Member	1932 m	(6338 ft)
Stupart Member	1963 m	(6440 ft)
Drake Point Member	1969 m	(6460 ft)
Lougheed Island Formation	1998 m	(6556 ft)
Maclean Strait Formation	2043 m	(6702 ft)
Grosvenor Island Formation	2081 m	(6828 ft)
Skybattle Formation	2105 m	(6905 ft)
Barrow Formation	2159 m	(7082 ft)
Panarctic AIEG Whitefish 2H-63		
Whitefish Member	2076 m	(6811 ft)
Stupart Member	2107 m	(6913 ft)
Lougheed Island Formation	2129 m	(6985 ft)
Maclean Strait Formation	2175 m	(7136 ft)
Grosvenor Island Formation	2213 m	(7260 ft)
Barrow Formation	2222 m	(7290 ft)
Panarctic Desbarats B-73		
Whitefish Member	505 m	(1657 ft)
Stupart Member	525 m	(1722 ft)
Drake Point Member	535 m	(1755 ft)
Lougheed Island Formation	552 m	(1811 ft)
Grosvenor Island Formation	561 m	(1841 ft)
Barrow Formation	567 m	(1860 ft)
Panarctic North Sabine H-49		
Drake Point Member	3014 m	(9887 ft)
Lougheed Island Formation	3038 m	(9968 ft)
Maclean Strait Formation	3062 m	(10 047 ft)
Grosvenor Island Formation	3072 m	(10 080 ft)
Barrow Formation	3092 m	(10 145 ft)
Panarctic Drake Point F-16		
Drake Point Member	1093 m	(3586 m)
Lougheed Island Formation	1114 m	(3654 ft)
Grosvenor Island Formation	1124 m	(3688 ft)
Barrow Formation	1132 m	(3715 ft)
Panarctic N.W. Hecla M-25		
Drake Point Member	1020 m	(3346 ft)
Lougheed Island Formation	1046 m	(3432 ft)
Grosvenor Island Formation	1065 m	(3493 ft)
Barrow Formation	1073 m	(3520 ft)
Panarctic Sandy Point L-46		
Drake Point Member	707 m	(2320 ft)
Lougheed Island Formation	719 m	(2360 ft)
Grosvenor Island Formation	732 m	(2400 ft)
Barrow Formation	760 m	(2494 ft)
Elf Jameson Bay C-31		
Drake Point Member	855 m	(2805 ft)
Lougheed Island Formation	895 m	(2937 ft)
Grosvenor Island Formation	940 m	(3083 ft)
Skybattle Formation	981 m	(3220 ft)
Barrow Formation	992 m	(3255 ft)
Elf Cape Norem A-80		
Lougheed Island Formation	1467 m	(4812 ft)
Grosvenor Island Formation	1563 m	(5130 ft)
Skybattle Formation	1591 m	(5220 ft)
Barrow Formation	1599 m	(5246 ft)