PERMAFROST AND ITS RELATIONSHIP TO LATE QUATERNARY HISTORY, HIGH ARCTIC ISLANDS

by

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ABSTRACT

This thesis examines the distribution of permafrost in the High Arctic Islands. Emphasis is placed upon the influence which the Late Quaternary history of the Sverdrup Basin has had upon permafrost conditions. In addition, the factors controlling the geothermal regime of the Sabine Peninsula of Melville Island are analyzed in detail. Data from a total of thirty wells are used in the study.

Permafrost thickness increases linearly with wellsite distance from both sea and elevation, and appears to be related to time since emergence. Locations situated below the inferred maximum marine limit reveal rapid initial emergence on emergence curves and a wide range of emergence dates.

Geothermal analysis of data from seven wells on the Sabine Peninsula of Melville Island suggests that permafrost thickness is influenced by the thermal properties of rock material, the submergence and/or emergence history of the Late Quaternary, regional terrestrial heat flow and present day climatic conditions. Results indicate that inland sites have permafrost thicknesses that vary by a factor of 2 in comparison to coastal sites. Laboratory measurements of the thermal conductivity of drill cuttings

for the seven wells range from 1.8 to 3.8 $Wm^{-1}K^{-1}$. These results, combined with temperature gradients, yield a heat flow of 90.4 ± 3.3 mWm^{-2}. This is of similar magnitude to predicted values in the Sverdrup Basin.

RESUME

Cette thèse examine la distribution et l'épaisseur du pergélisol dans plusieurs endroits de l'archipel arctique: Une attention particulière est accordée à l'influence de la fin du Quaternaire dans le bassin Sverdrup sur les conditions du pergélisol. De plus, les facteurs qui contrôlent le régime géothermique de la péninsule Sabine de l'Île Melville sont analysés en détails. Des données provenant de trente puits de forage sont utilisées dans cette étude.

L'épaisseur du pergélisol s'accroît de façon linéaire avec la distance du puit de forage à la mer et l'altitude. Elle semble être reliée à la période de temps écoulée depuis l'émersion, période connue grâce aux nombreuses datations qui accompagnent les courbes d'émersion locales. Les sites étudiés, sous l'altitude de la limite marine maximale déterminée d'après des courbes d'émersion, ont subi une émersion initiale rapide.

De façon générale, l'analyse géothermique de données provenant de sept puits de forage sur la péninsule Sabine et l'Île Melville suggère que l'épaisseur du pergélisol est influencée par les propriétés thermiques de la roche en place, le mode d'immersion et/ou d'émersion

postglaciaire, le flux de chaleur terrestre régional et les conditions climatiques actuelles.

Les résultats indiquent que les sites situés à l'intérieur des terres ont une épaisseur de pergélisol qui change d'un facteur de 2 comparativement aux sites côtiers. Des mesures de conductivité thermique obtenues après analyse en laboratoire des débris de forage provenant des sept puits varient de 1.8 à 3.8 $Wm^{-1}K^{-1}$. Ces résultats, liés aux gradients de température, produisent un flux de chaleur de 90.4±3.3 mWm^{-2}. Ces valeurs sont du même ordre de grandeur que celles estimées pour le bassin Sverdrup.

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CHAPTER ONE

INTRODUCTION

1.1 Aims and objectives

Proven oil and natural gas-fields in the Canadian Arctic Archipelago indicate that hydrocarbons will someday be transported to southern markets. Although difficulties still remain in various transportation schemes, their eventual implementation necessitates a proper understanding of the permafrost environment of the High Arctic. However, although many aspects of permafrost are understood in some detail, and certain areas are frequently studied, the nature and distribution of permafrost in the High Arctic is known only in general outline.

The present study focuses on the relationship between permafrost and Quaternary history in the High Arctic Islands. An attempt is made to assess the degree to which permafrost distribution, temperature and thickness are related to present climatic conditions.

The specific aim is to investigate whether permafrost thicknesses are controlled primarily by either (a) past geomorphic histories or (b) the thermal properties of rock material. With respect to (a), an obvious problem is to assess whether permafrost thicknesses below the marine limit are related to time since emergence. A second problem is to establish whether a relationship exists between permafrost thickness and distance from the present shoreline. With respect to (b), the permafrost conditions at seven wellsites on the Sabine Peninsula of eastern Melville Island are examined within the context of the geothermal controls over rock materials.

1.2 Fieldwork and study area

The study area extends from Prince Patrick Island on the west to Ellesmere Island on the northeast and from Somerset and Banks islands on the south to major portions of Borden and Ellef Ringnes islands on the north. This area possesses one of the largest geological provinces in the High Arctic Islands, better known as the Sverdrup Basin (Figure 1). Situated between 76° and 83°N, it is the northernmost region in the world experiencing oil and gas exploration.

Reconnaissance fieldwork was undertaken in May 1980 while under contract to the Earth Physics Branch, Energy, Mines and Resources. Ground observation and borehole temperature logging was undertaken at wells on

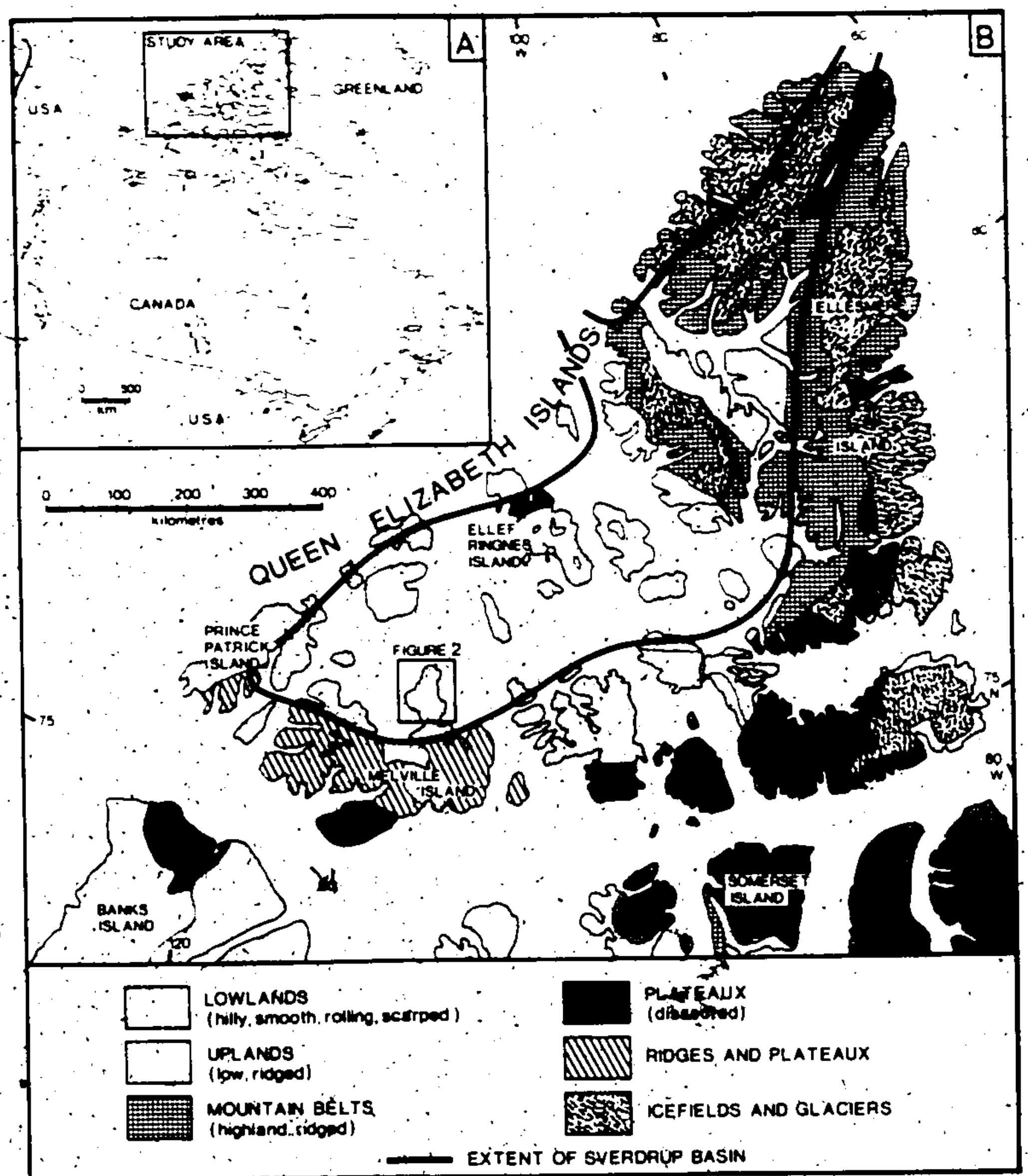


Figure 1 A. (inset) Location map of the study area. B. Physiographic regions of the High Arctic Islands. (Sources: Modified from Fortier et al., 1963; Kerr, 1974; Tozer and Thorsteinsson, 1964).

Melville, Cameron, King Christian, Cornwall, Thor, Ellef Ringnes, Cornwallis, Lougheed, Devon, Axel Heiberg and Ellesmere islands. The use of fixed and rotary wing aircraft, under contract to Polar Continental Shelf Project, permitted access to all sites. Further fieldwork in August 1981 focussed upon wellsites located on the Sabine Peninsula of Melville Island (Figure 2).

1.3 Physiography and geology

The Sverdrup Basin includes the majority of the Queen Elizabeth Islands and covers an area of approximately 323,750 km² along the northwestern margin of the Canadian Arctic Archipelago. It is a structural depression containing a thick (13,000 m) sequence of marine and nonmarine sedimentary rocks of Lower and Upper Cretaceous age, with basalt flows, gabbro dykes and sills of upper Paleozoic and Cretaceous age (Balkwill, 1978; Balkwill and Bustin, 1980; Fortier et al., 1963; Tozer and Thorsteinsson, 1964). Approximately seventy piercement domes/structures are known in the Sverdrup Basin, and are formed from evaporites of Pennsylvanian age or earlier (Thorsteinsson and Tozer, 1970).

The morphology of the Sverdrup Basin is characterized by lowlands and plateaux in the western and central portions, and uplands, lowlands, mountain belts and icefields/glaciers in the eastern portion (see Figure 1). In general physiographic surfaces are elevated since the islands have

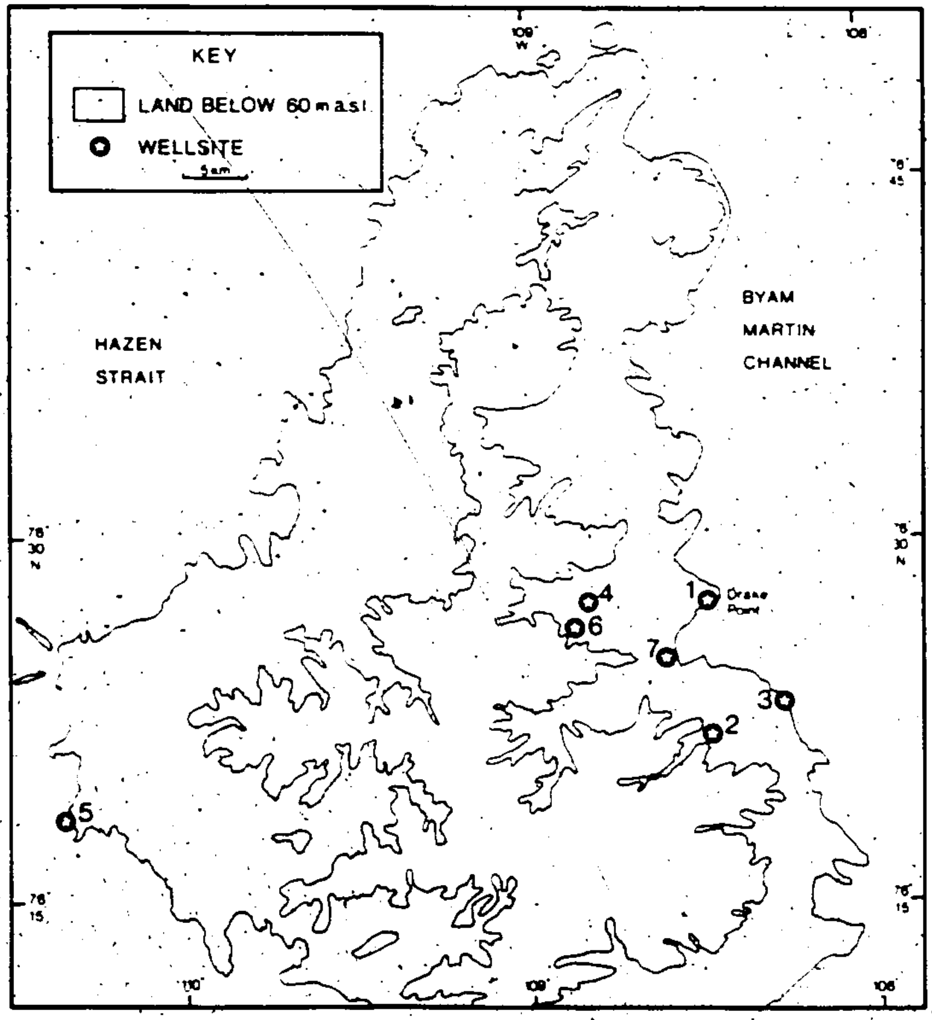


Figure 2 Site locations and approximate inferred maximum marine limit (60 m a.s.l.) on the Sabine Peninsula, eastern Melville Island, N.W.T.

1. Drake E-78
2. Drake D-73
3. Drake B-44
4. Drake D-68
5. Hecla I-69
6. Drake K-67A
7. Drake F-16

experienced recent uplift (Nassichuk, 1972; Trettin and Balkwill, 1979). South of the Sverdrup Basin, the rocks are older and give rise to the upland terrain, and plateaux, of Melville, Bathurst and Devon islands. To the north and west, the rocks are dominantly Tertiary and Quaternary in age and form extensive Arctic coastal plains.

Since lithology influences geothermal properties (Gold and Lachenbruch, 1973), the bedrock of the area is fundamental to an understanding of permafrost thermal regimes. Five major geological formations outcrop widely in the Sverdrup Basin: (a) Isachsen Formation (sandstone), (b) Christopher Formation (shale and silt), (c) Hassel Formation (sandstone), (d) Kanguk Formation (shale along with igneous intrusions and extrusions) and (e) Eureka Sound Formation (sandstone, sand and coal deposits) (Fortier et al., 1963; Kerr, 1974; Tozer and Thorsteinsson, 1964). Numerous other formations, ranging from early Paleozoic to Meosozoic in age, also occur in and adjacent to the basin. A generalized stratigraphic column is shown in Figure 3.

The geomorphology of the eastern Sverdrup Basin (i.e., Ellef Ringnes and Amund Ringnes islands, and southwestern Axel Heiberg Island) reflects strong geological control (Figure 4a). Many landscapes have formed in the sandstone, shale and siltstone rocks of the Isachsen, Christopher and Kanguk formations. Periglacial processes dominate the landscape evolution and include rill and

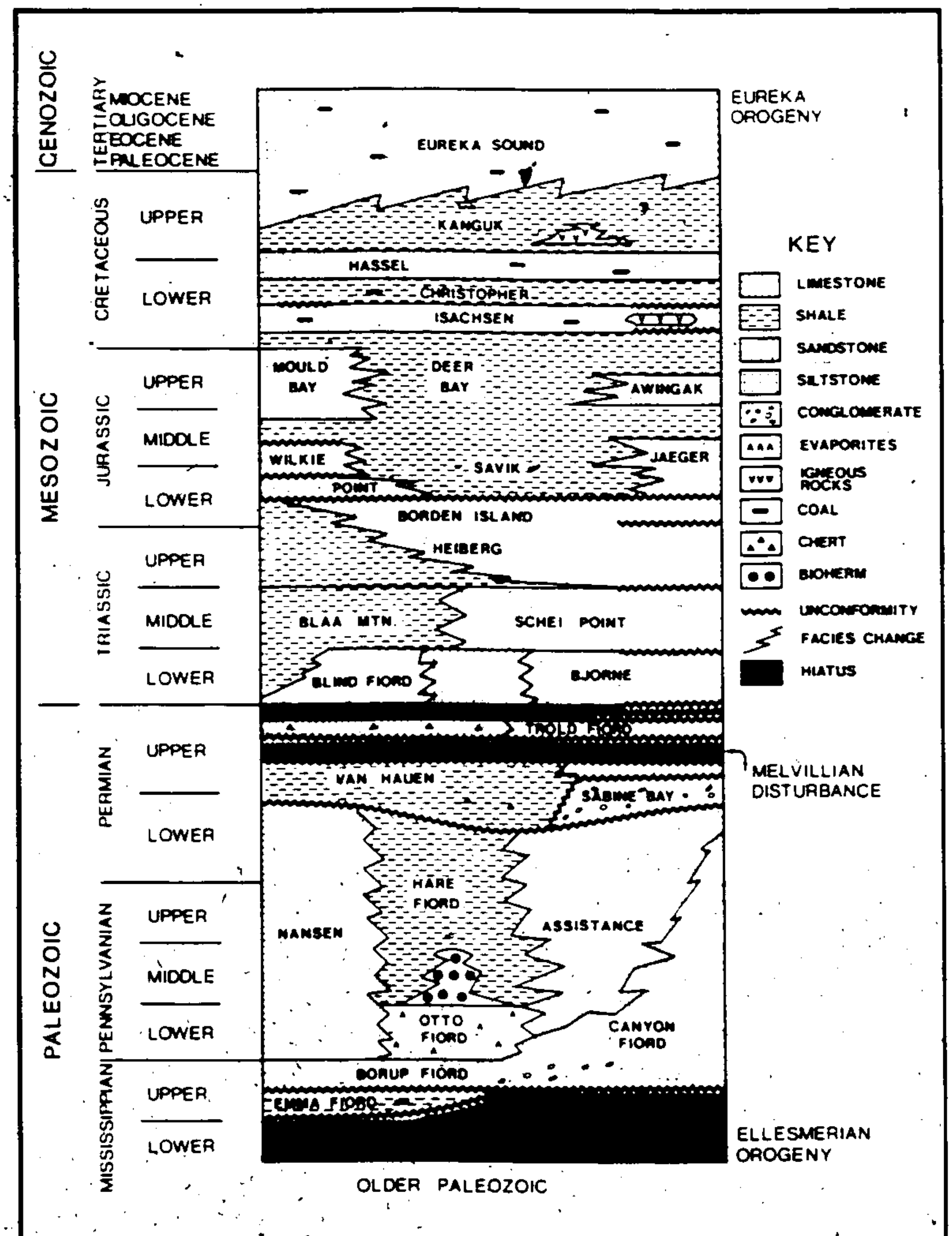


Figure 3 Stratigraphic column of the Sverdrup Basin. (Sources: Meyerhoff, 1982; Stuart, Smith and Wennekers, 1977).

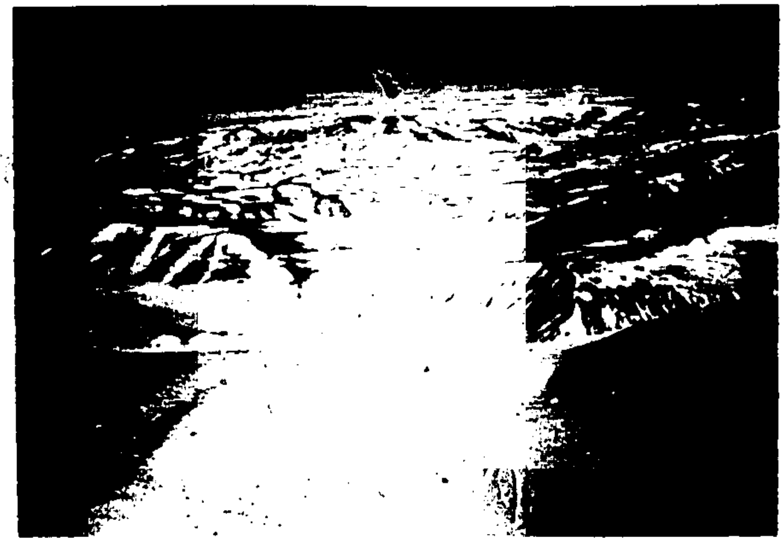
Chapitre I - Le demandeur du recours au cas d'oppression et du recours au cas de préjudice injuste

Comme pour toute action judiciaire classique, les parties au recours de l'article 210 du Companies Act 1948 ou de l'article 75 du Companies Act 1980, se composent des demandeurs, des défendeurs et des mis-en-cause.

Autant en vertu de l'article 210 du Companies Act 1948 qu'en vertu de l'article 75 du Companies Act 1980, le demandeur doit donc veiller à intenter son recours contre les personnes au sujet desquelles il demande au tribunal de prononcer une ordonnance, et veiller à mettre en cause toute personne à laquelle il entend opposer le jugement.

Pour pouvoir se porter demandeur dans le cadre du recours au cas d'oppression ou du recours au cas de préjudice injuste, il faut toutefois pouvoir réunir la qualité et l'intérêt requis pour ester en justice.

(a)



(b)

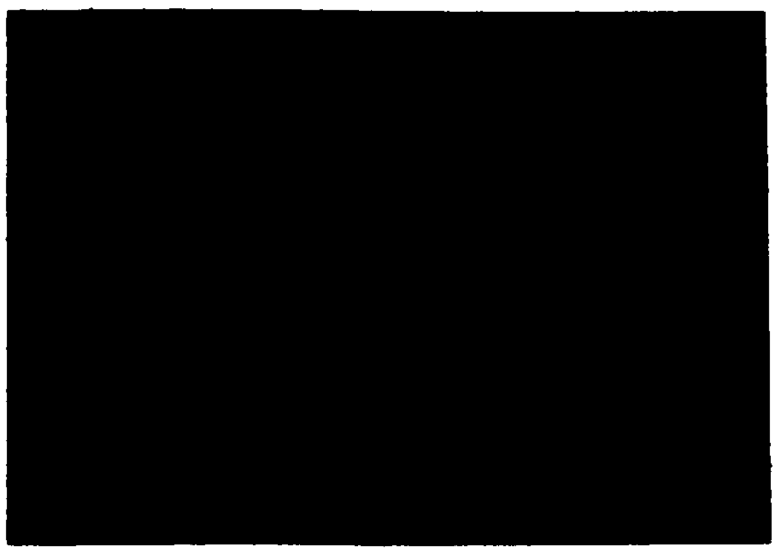


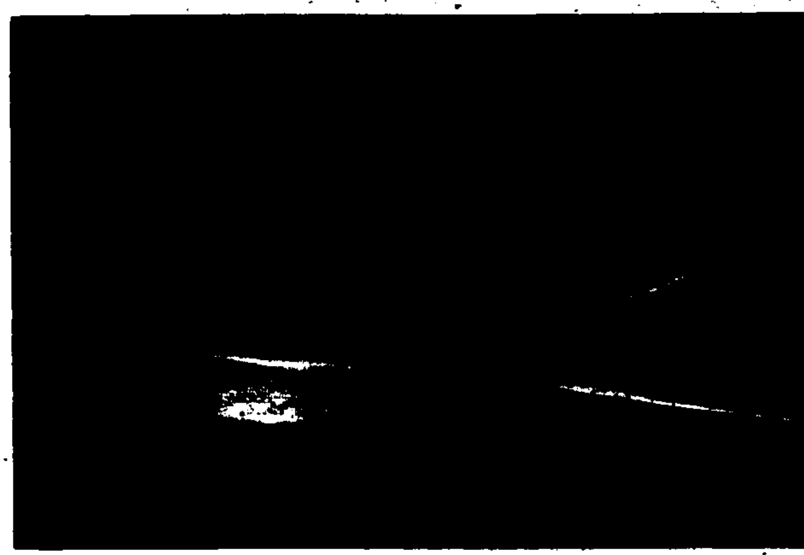
Figure 4 Examples of geology and terrain conditions, Sverdrup Basin. (a) Topography near Kristoffer Bay B-06 wellsite, Ellef Ringnes Island, showing dissected scarp and vale topography, May 13, 1980. (b) Piercement dome surrounded by surging glacier on Axel Heiberg Island, May 14, 1980.

sheetwash, earthflows, thermal contraction cracking and slope failures confined to the active layer (Hodgson, 1982; Lamothe and St-Onge, 1961; St-Onge, 1965). The topography of Axel Heiberg and Ellesmere islands is characterized by similar features and processes but in addition possesses icefields and glaciers (Figure 4b).

Extensive areas of the western and central Sverdrup Basin are underlain by Christopher shale and typically form low plains mantled with silty, clayey residual/colluvial soils. These surfaces are dissected by intricate networks of small ephemeral streams and braided channels. Slope failures are frequent, and most widespread below the marine limit (see Figure 7b). By contrast, the sandstone and shale of the Isachsen, Hassel, Kanguk and Eureka Sound formations produce distinct scarps, cuestas and badland topography (Figure 5a). The Bjorne Formation also produces distinct structurally controlled landforms (Figure 5b). Periglacial processes include thermal contraction cracking, solifluction, slopewash and physical (i.e., frost) weathering, in addition to extensive gullying and rill action, and numerous thaw-flow slides (Barnett et al., 1975; 1977; Barnett and Forbes, 1973; Barnett and Kuc, 1972; EBA Engineering Consultants Ltd., 1979; Stangl et al., 1982).

Although only a few moraine systems have been identified on the Queen Elizabeth Islands, there is a general absence of fresh glacial and depositional landforms. However, this does not preclude the assumption of a

(a)



(b)

Figure 5 Examples of geology and terrain conditions associated with shales and sandstones in the Sverdrup Basin. (a) Typical badland terrain in sandstone of the Isachsen Formation, Hoodoo Dome, southern Ellef Ringnes Island. (Photograph: H. M. French, July 4, 1981). (b) Escarpment formed in sandstone on eastern Melville Island, August 22, 1981.

Late Pleistocene ice sheet (Blake, 1970; Craig and Fyles, 1960; Denton and Hughes, 1981; England, 1976a; 1976b). In addition, stratigraphic evidence is ambiguous and knowledge of the Late Quaternary history of the Queen Elizabeth Islands is relatively new (Hodgson, 1982; Hodgson et al., in press). Most islands possess evidence of marine submergence, and isostatic recovery. Raised beaches act as useful indicators of marine limits and facilitate the identification of different types of surficial materials and/or landforms above and below such features.

The possibility of several different ice sheets during the Quaternary (i.e., Innuitian Ice Sheet, Franklin Ice Complex, Laurentide Ice Sheet), and numerous periods of submergence and emergence, may be appropriate concepts leading to a greater understanding of permafrost and terrain conditions.

1.4 Climate

The climatic environments of the Queen Elizabeth Islands include the barren polar deserts of Prince Patrick, Mackenzie King and Ellef Ringnes islands, the polar semi-deserts of Cameron and King Christian islands, the intermixing of tundra and polar deserts of southern Melville Island and the ice-cap environments of Axel Heiberg, Ellesmere and Devon islands. Five meteorological stations in the Queen Elizabeth Islands provide approximate climatic conditions (Table 1).

Table 1

Climatic Data for Stations in the High Arctic Islands.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	X
Resolute Bay (1951-1981)													
Temperature (°C)	-32.2	-33.6	-31.2	-22.6	-10.5	-0.2	4.3	2.8	-4.9	-14.8	-24.4	-29.2	-16.4
Precipitation (mm)	2.5	2.8	2.5	6.1	7.4	11.4	21.3	33.9	15.5	16.2	5.6	5.1	10.9
Wind Direction	NW	E	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
Rea Point (1969-1981)[a]													
Temperature (°C)	-30.4	-33.4	-31.6	-24.1	-10.5	0.0	4.3	1.4	-6.3	-17.6	-26.5	-30.6	-17.1
Precipitation (mm)	1.6	0.4	1.3	1.9	2.8	3.4	4.4	15.3	8.1	9.7	3.7	2.5	4.6
Wind Direction	NW	NW	NW	NW	NNW	N	NNW	N	N	WNW	WNW	NW	NW
Mould Bay (1951-1981)													
Temperature (°C)	-33.2	-32.4	-32.8	-24.6	-11.3	-0.4	3.8	2.3	-6.7	-17.9	-26.7	-31.2	-17.6
Precipitation (mm)	3.1	3.4	2.2	5.5	6.9	6.7	14.3	22.4	14.9	9.8	4.1	3.7	8.1
Wind Direction	NW	NW	N	NW	NW	NW	NW	NW	NW	N	NW	NW	NW
Isachsen (1951-1978)[b]													
Temperature (°C)	-34.6	-36.6	-34.6	-26.3	-12.3	-1.2	2.9	0.7	-9.1	-19.6	-28.5	-33.0	-19.4
Precipitation (mm)	4.4	3.1	3.6	5.3	11.6	12.4	19.1	22.1	17.9	12.2	4.7	2.9	9.9
Wind Direction	NW	N	N	N	N	N	NW	N	N	N	N	N	N
Eureka (1951-1981)													
Temperature (°C)	-36.4	-38.1	-37.5	-25.4	-10.9	1.6	5.4	3.0	-8.9	-22.2	-31.8	-34.7	-19.7
Precipitation (mm)	3.2	2.6	2.4	3.0	3.5	6.1	10.4	12.5	9.4	6.0	2.4	2.8	5.4
Wind Direction	E	E	E	SE	SE	W	W	W	SE	SE	E	E	E

[a]Wind data was available up to June 1977.

[b]Weather station has been abandoned since March 1978.

Source: Atmospheric Environment Service Monthly Records, 1951-1981; Maxwell, 1980; Thompson, 1967.

Mean daily maximum temperatures range from 6.0°C to 8.7°C in the summer, while mean daily minimum temperatures can be as low as -60°C in the winter. Mean annual daily temperatures vary from -15°C on Banks Island to more than -17.5°C in the central Sverdrup Basin (Figure 6). Precipitation of the order of 90 mm to 100 mm per annum suggests that the Arctic Archipelago is arid. Half of the total precipitation usually occurs either in the summer as rain and drizzle, or as freezing rain in the autumn.

Dominant wind directions for the Resolute Bay, Rea Point, Mould Bay and Isachsen meteorological stations are predominantly from the north and northwest, in contrast to prevailing easterly winds in the winter and northwesterly winds in the summer for Eureka. Snow cover exists from late-August through mid-June in central and western Sverdrup Basin, whereas the mountainous eastern islands experience a more extended period. In the winter, exposed ground surfaces are nearly free of snow, and deep accumulations occur only on leeward slopes and in depressions. The heaviest snowfall at most locations occur in the months of September and October. Both snow cover and rainfall vary from island to island in response to regional and local conditions.

Present climatic conditions are of particular interest to this study since they influence the upper boundary of permafrost and, in combination with past climate and geothermal heat, can influence permafrost thickness.

La décision dans l'affaire Re JN2 Ltd. constitue un précédent important qui sera certainement utile aux actionnaires qui sont victimes d'oppression ou de préjudice injuste, s'ils sont également propriétaires d'une fraction importante des actions de la société.

Selon l'arrêt Charles Forte Investments Ltd. v. Amanda,[36] le sort des actionnaires qui ne sont propriétaires que d'une fraction infime des actions de la société, semble toutefois fort différent. Dans cet arrêt, la Cour d'appel discute des recours de l'actionnaire-vendeur lorsque les administrateurs d'une société à caractète fermé refusent d'inscrire au registre des actionnaires le nom du cessionnaire auquel l'actionnaire-vendeur a cédé ses actions.

Or, la Cour d'appel décide à l'unanimité dans cet arrêt que l'actionnaire peut employer la procédure de l'article 116 du Companies Act 1948 pour obtenir la rectification du registre ou décider de poursuivre les administrateurs en dommages-intérêts pour leur refus arbitraire d'inscrire le cessionnaire des actions au registre des actionnaires, mais qu'il ne peut aucunement demander, pour ce seul motif, la liquidation et la dissolution de la société à caractère fermé.[37] La décision des juges britanniques pourrait cependant être toute autre si, à ce premier motif fondé sur le

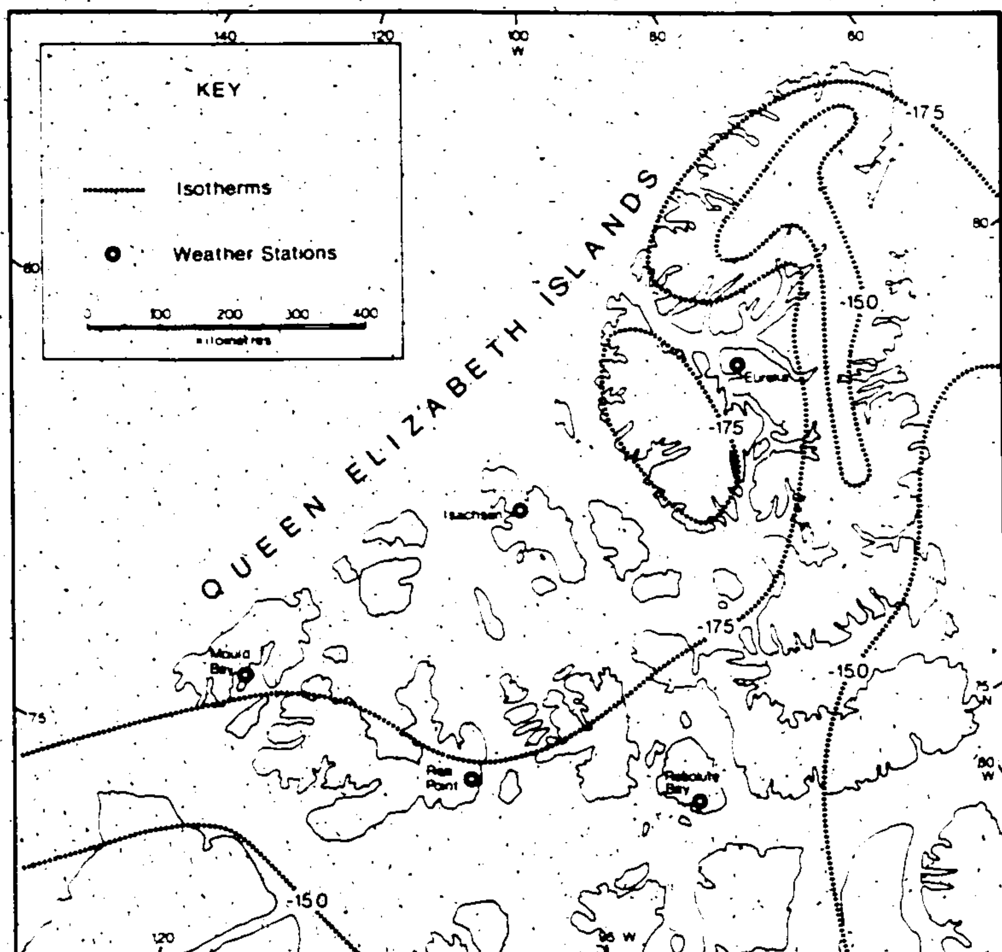


Figure 6 Map showing isotherms of mean annual daily temperatures (1941-1970), Queen Elizabeth Island, N.W.T. (Source: Maxwell, 1980).

1.5 Permafrost

The Queen Elizabeth Islands lie within the zone of continuous permafrost (Brown, 1970; 1972; 1978a). Distinctive periglacial processes indicate the presence of perennially frozen ground. Thermal contraction cracks (Figure 7a), thaw-flow (i.e., ground ice) slides (Figure 7b) and thermokarst gullies have all been observed on several islands within the study area.

The variability of permafrost thickness throughout the islands may reflect differences in thermal properties of rock materials, and surface temperature histories. Other factors may also be locally important (see Chapter 2). In the study area, mean annual ground surface temperatures range from -15°C to -20°C and are generally a few degrees above the mean annual air temperature (-17.1°C to -19.7°C). Ground temperature data for the High Arctic indicate permafrost thicknesses in the range of 143 m to 726 m (Taylor and Judge, 1974; Taylor et al., 1982). Geothermal gradients also exhibit considerable variability, and range from 30 mKm^{-1} to 60 mKm^{-1}.

Offshore permafrost exists along most Arctic coasts (Baranov, 1964; Grigor'yev, 1976; 1978; Hunter et al., 1976; Judge, 1974b; 1977; Lewellen, 1973; Mackay, 1972; Molochushkin, 1978; Neave et al., 1979; Osterkamp and Harrison, 1982; Vigdorchik, 1980a; 1980b). Submergence by either coastal retreat or past sea level fluctuations has been responsible for its occurrence.

(a)

(b)

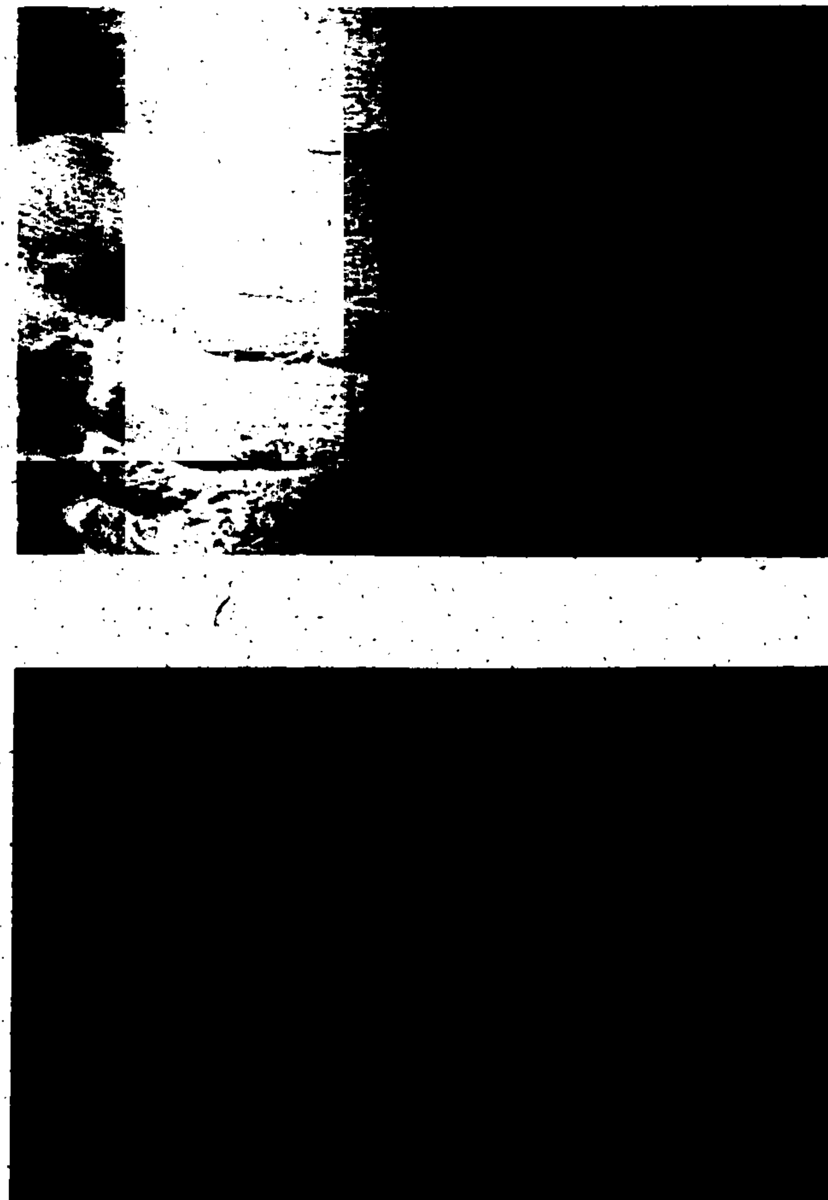


Figure 7 Examples of geomorphic permafrost-related processes within the Sverdrup Basin. (a) Aerial view of thermal contraction crack polygons, east-central Ellef Ringnes Island. Each measures approximately 30 metres in dimensions. They are highlighted by snow lying in the fissures. Some may be underlain by ice. May 15, 1980. (b) Thaw flow slide occurring in Christopher shale next to Drake D-73 wellsite, Sabine Peninsula, eastern Melville Island, August 21, 1981.

According to Judge (1974b), equilibrium offshore permafrost is widespread throughout the Arctic Islands and Beaufort Sea. Submerged areas which underwent isostatic depression possess shallow permafrost thicknesses. Most submerged areas have been either glaciated or exposed to cold periglacial conditions in recent geologic time. Subsequently, their ground surface temperatures have been highly modified by past climatic conditions. This results in thickening and thinning of permafrost, respectively (Hunter et al., 1976). Thus, submergence may lead to warmer ground temperatures and degradation of permafrost (Judge, 1974b).

CHAPTER TWO

LITERATURE REVIEW

This section of the thesis discusses: (a) the Quaternary history of the High Arctic and its effect upon subsurface temperatures, and (b) the thermal controls over permafrost temperatures and thicknesses.

2.1 Evidence for glaciation

2.1.1 Concepts

The existence of ice sheets over the High Arctic Islands has been proposed at different times by Blake (1970; 1972; 1974; 1976), Boulton (1979), Craig and Fyles (1960), England (1974a; 1976a; 1976b), England and Bradley (1978), Fyles (1965), Hodgson (1977; 1981; 1982), Ives (1978), Mayewski et al. (1981), Paterson (1977), Sugden (1977) and Tozer and Thorsteinsson (1964). Discussion centres upon the number of glaciations and the extent of the ice cover. Although the northern extent of the Laurentide Ice Sheet is relatively well known (e.g., Dyke et al., 1982; Prest et al., 1968), evidence suggests that ice sheets may have been present during earlier periods of the Quaternary as well.

With respect to the Sverdrup Basin and Queen Elizabeth Islands, two main concepts exist. The first involves a late Wisconsin Franklin Ice Complex over the Queen Elizabeth Islands (England, 1976a; 1976b), this being an approximate northern extension of the Laurentide Ice Sheet (Ives, 1978; Sugden, 1977), and the extension of the Greenland Ice Sheet onto Ellesmere Island (England, 1974a; 1976a; 1976b; England and Bradley, 1978; Paterson, 1977). The second refers to a separate Innuitian Ice Sheet over the High Arctic Islands and its coalescence with the Laurentide and Greenland Ice Sheets (Blake, 1970; 1972; 1974; 1975; 1976). Both concepts have received wide attention in the literature in the last decade. The directions of ice flow and limits of the Franklin Ice Complex, the Innuitian and Laurentide ice sheets are indicated in Figure 8.

The concept of the Innuitian Ice Sheet evolves from the fact that, (a) radiocarbon dating of Holocene shells indicates a decrease in age from the western islands to the east central region (e.g., Norwegian Bay); and (b) patterns of Holocene emergence indicate isostatic recovery from an ice load. The suggestion of a High Arctic ice cap (Innuitian Ice Sheet) with an axis extending from central Ellesmere Island to eastern Bathurst Island opens the possibility that submergence, as well as decreasing elevations of the marine limit may have been the result of glacio-isostasy associated with the Innuitian Ice Sheet rather than with either the Laurentide or Greenland Ice Sheets (Blake, 1974; 1976; McLaren and Barnett, 1978).

Indirect evidence of glaciation is provided by the presence of raised beaches and other features of marine

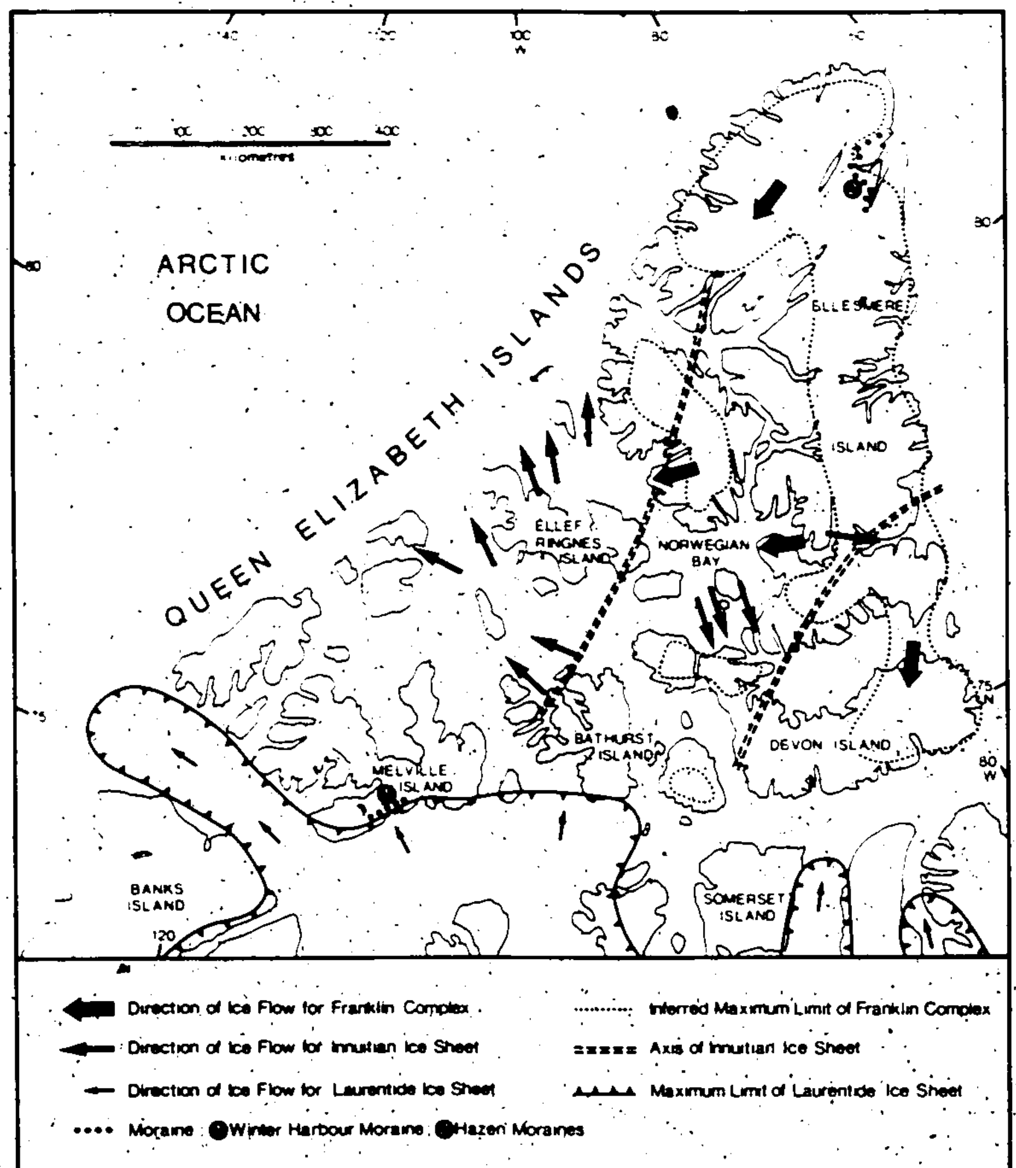


Figure 8 Map showing extent of various ice sheets hypothesized for the Queen Elizabeth Islands. (Source: modified from Andrews, 1968a; 1968b; Blake, 1970, Denton and Hughes, 1981; Peltier and Andrews, 1976).

origin found in southern Ellesmere Island (Blake, 1975), the trough-like form of inter-island channels (Horn, 1963), and various striae, rock basins, esker-like ridges, drumlinoid features, dispersed morainal deposits and striated erratics observed on Ellef Ringnes, Amund Ringnes, Lougheed, King Christian, Cornwall and adjacent islands (Balkwill et al., 1974; Hodgson, 1977; 1981; 1982; St-Onge, 1965). The Winter Harbour Moraine on the south coast of Melville Island forms part of such evidence and probably marks the maximum northward advance of the Laurentide Ice Sheet. Blake (1974), Hodgson (1981) and Mayewski et al. (1981) emphasized that only indirect evidence exists to support a cover of glacier ice over the western Sverdrup and adjacent islands during the maximum extent of the Laurentide Ice Sheet. On the other hand, direct evidence in the form of drift and till patches on Lougheed, eastern Melville and northwestern Bathurst islands is reported by Barnett et al. (1977) and Edlund (1980), and on Bathurst, Helena, Amund Ringnes, Cornwall, and southern Melville islands by Blake (1964) and Hodgson (1982).

Fyles (1965) suggests that local ice caps on western Melville Island may have been a factor in the rate of postglacial emergence. This led researchers to believe that there was no evidence for a continental ice cover over the High Arctic Islands (Vincent, 1982). Both Hodgson (1977) and Vincent (1982) note that although glacial sediments and erosional features are uncommon in the western Queen Elizabeth Islands (particularly Melville, Prince Patrick and Ellef Ringnes islands) they are nevertheless present. The possibility of a cold-based ice sheet (frozen to its bed) has been proposed (Hodgson, 1977; McLaren and Barnett, 1978; Sugden, 1977). Hodgson (1978), following Fyles (1965), considers that local ice caps on Bathurst, Devon, Axel Heiberg and Ellesmere islands were factors in the rate of emergence (Mayewski et al., 1981).

England (1974a; 1974b; 1976a; 1976b; 1978), and England and Bradley (1978) suggest that the Innuitian ice complex may have resulted from an extended section of the Greenland Ice Sheet. The concept of a series of smaller ice caps on the Queen Elizabeth Islands during late Wisconsin time was named the Franklin Ice Complex. Radiocarbon dates (Blake, 1972; Lyons and Mielke, 1973) and emergence records (Andrews, 1968a; 1968b; Hattersley-Smith and Long, 1967; Walcott, 1970; 1972a) from northeastern Ellesmere Island, together with local and regional isobases (Blake, 1975; England, 1976a; Walcott, 1970; 1972a) support the advance of the Greenland Ice Sheet onto northeastern Ellesmere Island.

An upward displacement trend in the pattern of postglacial isobases extends from northeastern Ellesmere Island and northwestern Greenland towards Greenland (Mayewski et al., 1981). The isobases parallel both present topography of the Greenland Ice Sheet and the Hazen Moraines

(Figure 9). As a result, England (1978) believes that the ice load of the Greenland Ice Sheet exceeded that of the Ellesmere ice caps and suggests a late Wisconsin ice advance to northeastern Ellesmere Island.

The presence of moraine systems, erratics located above inferred marine limit and glacio-fluvial terraces, have led Bradley and England (1977), and England (1978) to identify four weathering zones on eastern Ellesmere Island and subsequently, to modify the Franklin Ice Complex theory. The revised model includes different types of glacial deposits from those which only represented a standstill or readvance (i.e., Hazen Moraines).

Ice lobes in various channels are thought to have caused coastal depression of adjacent land areas. For instance, Blake (1972) believes that an ice lobe from the Laurentide Ice Sheet entered Byam Martin Channel between eastern Melville Island and Bathurst Island, while England (1978) delimits two lobes which flowed over Judge Daly Promontory and entered Kennedy Channel.

Different types of deposits and features linked with the late Wisconsin glaciation have been described. Fyles (1965) mentioned that erratics on many of the High Arctic Islands (e.g., Lougheed Island) may have been derived from southern islands (e.g., Bathurst Island), suggesting the influence of north-flowing glacier ice.

Many researchers question the origin of various till-like deposits and their implications for the extent juge Blade a décidé qu'un actionnaire failli n'a pas la qualité requise pour agir dans toute procédure afférente à la liquidation et à la dissolution de la société dont il est actionnaire et, qu'en vertu de l'alinéa 216a) du Companies Act 1948, seul le syndic à la faillite de cet actionnaire peut représenter celui-ci et agir en son nom dans de telles procédures, alors que le syndic devient un "contributory" pour ces fins.

Le sous-alinéa 224(1)a)(ii) du Companies Act 1948 précise toutefois qu'hormis les exceptions prévues, un "contributory" doit avoir été inscrit au registre des actionnaires pendant au moins six mois, au cours de la période de dix-huit mois qui précède la demande de liquidation et de dissolution de la société, pour pouvoir demander la liquidation et la dissolution de cette société.

Il découle de ce qui précède qu'en cas de faillite d'un actionnaire, celui-ci n'a pas la qualité requise pour demander la liquidation et la dissolution de la société dont il est actionnaire. D'autre part, le syndic à la faillite de cet actionnaire devra avoir été inscrit au registre des actionnaires de la société depuis au moins six mois avant de pouvoir intenter le recours de l'alinéa 222f) du Companies Act 1948.

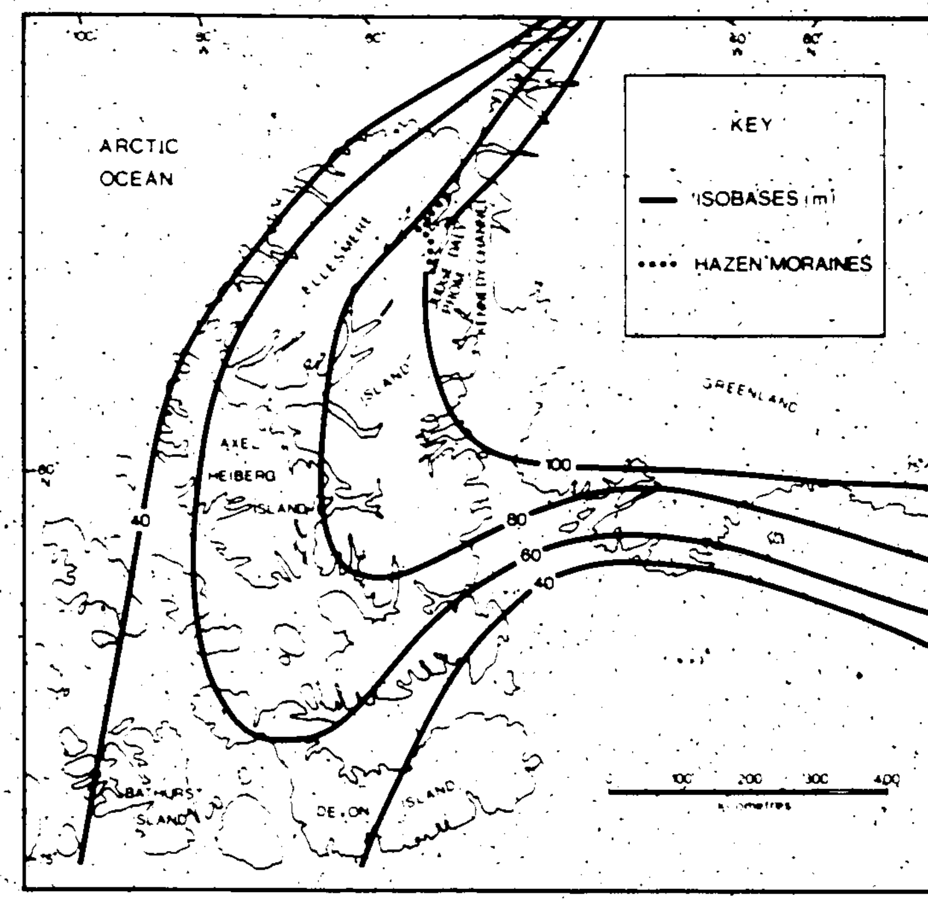


Figure 9 Hypothetical regional isobases in northern Greenland and Ellesmere Island for 7,500 years BP. Numbers are elevations in metres above present sea level. (Source: England; 1976a; 1976b).

Arctic Islands. Both Pleistocene marine submergence and Holocene coastal emergence indicate that ice must have been present in the Sverdrup Basin at some point in time.

The amount and rate of emergence in Late Quaternary and Holocene times varies regionally relative to the centre of the ice sheet, the configuration of the ice margin and the rate of unloading. According to Farrell and Clark (1976), postglacial emergence of glaciated areas is the result of three responses: (a) reduction and removal of the gravitational attraction of the ocean by the ice sheet, (b) elastic recovery of the crust from isostatic depression and (c) delayed recovery as viscous crustal material returns to its former position beneath the glaciated area.

Numerous researchers (Andrews, 1968a; 1968b; 1970a; 1970b; 1972; 1973; Blake, 1970; 1972; 1975; 1979; Bradley and England, 1977; Daly, 1925; England, 1976a; 1976b; England and Bradley, 1978; Farrand, 1962; Hattersley-Smith and Long, 1967; Henoch, 1964; Ives, 1963; 1964; Paterson, 1977; Sim, 1960; 1961; Walcott, 1972a) have postulated on the centre of postglacial emergence over the High Arctic Islands. All have recognized marine features as indicators of relative changes between land and sea. Craig and Fyles (1960), following Washburn (1947), suggested that all raised marine features in the western Queen Elizabeth Islands were late Wisconsin or Holocene in age. Since then, radiocarbon dating has led to a greater understanding

Le professeur Broadhurst s'appuie sur le paragraphe 26(2) du Companies Act 1948 pour soutenir, avons-nous dit, que seules les personnes dont le nom est inscrit au registre des actionnaires, ont la qualité requise pour se porter en demande du recours de l'article 210 du Companies Act 1948, ce qui exclut également le syndic à la faillite d'un actionnaire, si le nom du syndic ne figure pas au registre des actionnaires.[59]

Le professeur Gower émet également des réserves sur le droit du syndic à la faillite d'un actionnaire, d'intenter un recours fondé sur l'article 210 du Companies Act 1948, si le nom du syndic n'est pas inscrit au registre des actionnaires,[60] réserves dont le rapport Jenkins se fait l'écho.[61]

Quant au failli, sa situation est la même que pour le recours de l'alinéa 222f) du Companies Act 1948. Puisque l'alinéa 224a) du Companies Act 1948 et l'arrêt Re Wolverhampton Steel & Iron Co. Ltd. enlèvent à l'actionnaire failli la qualité requise pour demander la liquidation et la dissolution de la société dont il est actionnaire, il s'ensuit que les faits ne justifiaient pas la liquidation et la dissolution de la société en cause à la demande de l'actionnaire failli et, par voie of sea level fluctuations. Average rates of postglacial uplift, rates of recovery at specific times and isobases of uplift have been useful in the approximation (given the elevation and age of a marine limit) of postglacial uplift.

In areas where no radiocarbon dates are available, postglacial uplift may be estimated from uplift models established by Brotchie and Silvester (1969), Peltier and Andrews (1976) and Walcott (1972a). These models take into consideration any spatially concentrated, locally distributed or global loadings, in addition to elastic and viscous crustal responses.

The regional isobases of the eastern Queen Elizabeth Islands and northern Greenland (see Figure 9) indicate maximum uplift occurring in a ridge extending from southwestern Greenland into the High Arctic Islands. Andrews (1970a) compiled a series of maps estimating relative and residual postglacial uplift for northern Canada. Figure 10 illustrates four different average rates of uplift in the Arctic Islands. Over the last 6,000 years BP, an estimated 60 m of emergence has occurred. Average rates of uplift are greatest (2.0 m $100a^{-1}$) in west-central Ellesmere Island. Maximum average rates of uplift of 0.7 m $100a^{-1}$ at 8,000 years BP, 2.0 m $100a^{-1}$ at 6,000 years BP and 0.9 m $100a^{-1}$ at present show different stages of postglacial recovery.

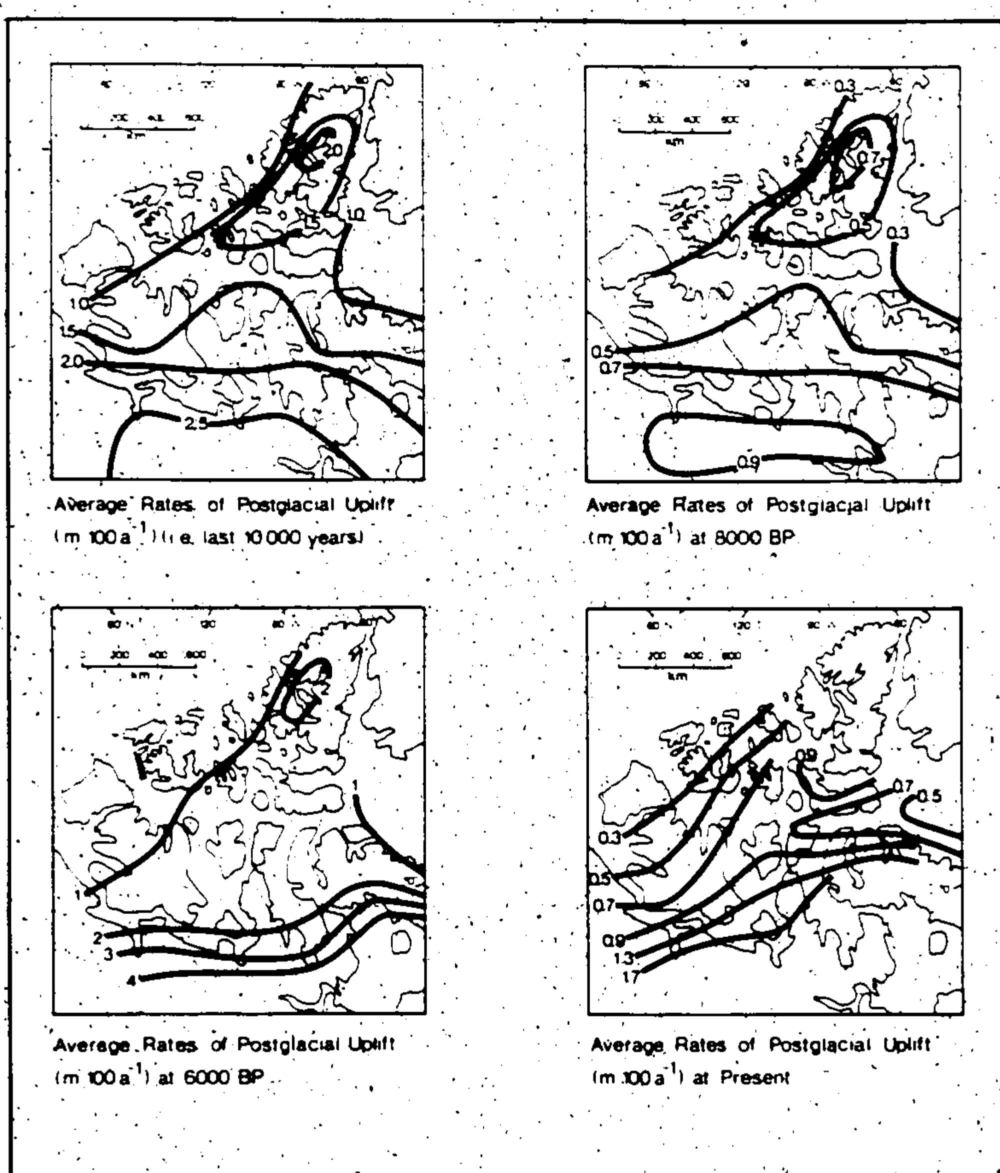


Figure 10 Diagrams illustrating stages of postglacial uplift in the Arctic Islands from 10,000 years ago to the present. (Source: modified from Andrews, 1970a; 1970b).

Most of the Queen Elizabeth Islands have geomorphological evidence of emergence (raised marine features, strandlines and erratics). A number of emergence curves have been constructed (Figure 11) based on radiocarbon-dated material from these marine features, such as peat, pumice, organic detritus and driftwood (Barnett, 1978; Blake, 1964; Dyke, 1979; Hattersley-Smith and Long, 1967; Henoch, 1964; McLaren and Barnett, 1978; Walcott, 1972a). Most curves show a rapid initial emergence followed by slower emergence. However, none of the curves were corrected for the global change in ocean volume during the Late Quaternary and Holocene times mainly because eustatic sea level response was assumed to be globally uniform (Clark et al., 1978; Walcott, 1972b). Clark (1976) proposed that the rapid emergence of an area probably comprises the gravitational and elastic crustal responses to rapid deglaciation. The rapid initial emergence of most sites located below marine limit may well have resulted from such responses.

The emergence curves (Figure 11) indicate a sharp decrease in the rate of land emergence at 8,000 years for the East and South Coast curves of Melville Island (Figure 11a) and Bathurst Island (Figure 11b), at 5,000 years to 6,000 years for Axel Heiberg and Ellesmere islands (Figure 11c and 11d), at 7,500 years for Cornwallis Island (Figure 11e) and at 6,000 years for Somerset Island (Figure 11f). This may suggest that the main deglaciation in the

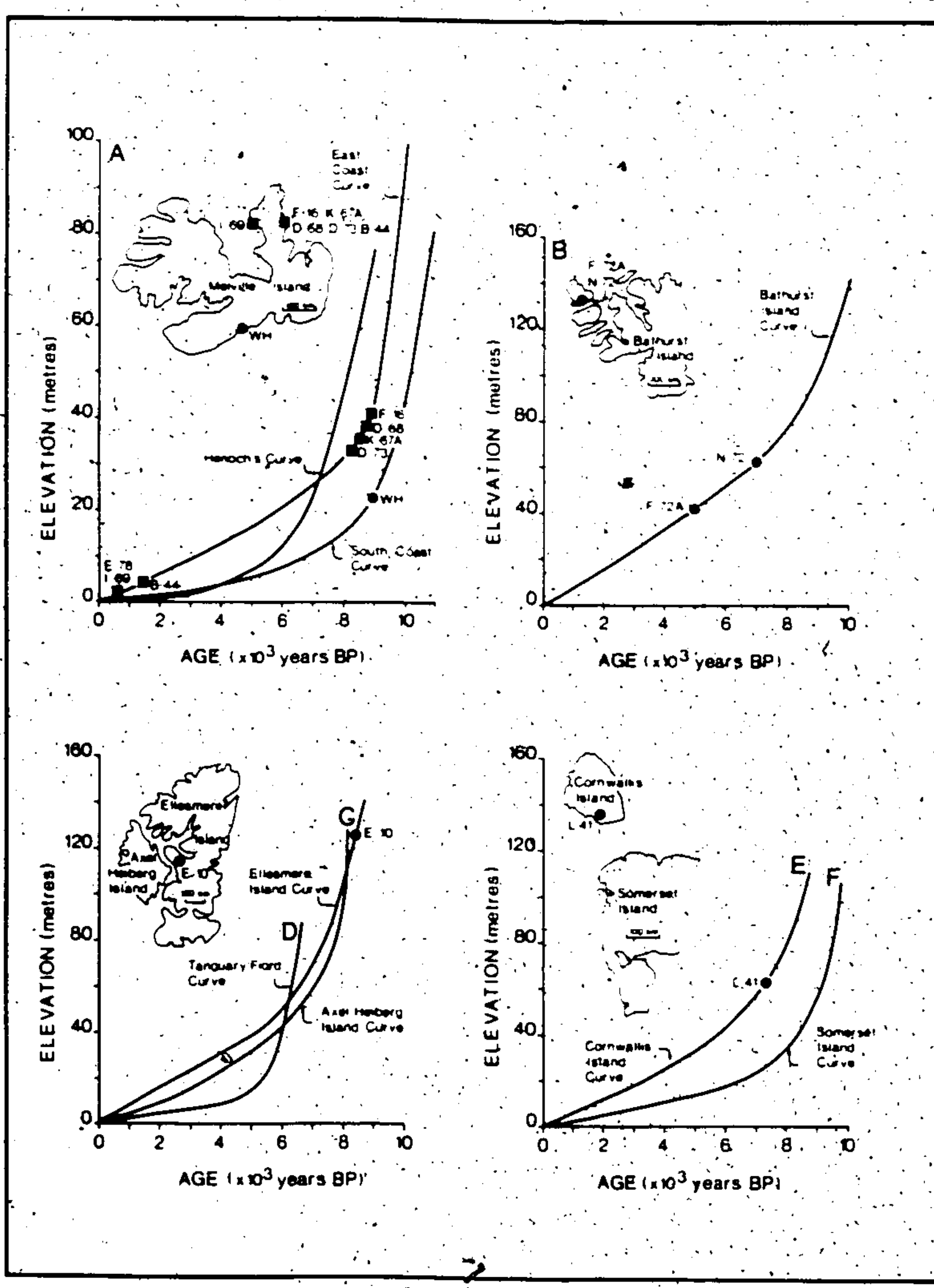


Figure 11 Diagrams illustrating emergence curves for Melville, Bathurst, Axel Heiberg, Ellesmere, Cornwallis and Somerset islands. Wellsites located below the inferred maximum marine limit are fitted on the curves. The inset maps indicate locations of the samples involved and the wellsites. (Source: A--McLaren and Barnett, 1978; B--Walcott, 1972a; C--Walcott, 1972a; D--Hattersley-Smith and Long, 1967; E--Walcott, 1972a; F--Dyke, 1979).

High Arctic Islands took place about 2,500 years to 3,000 years later on Ellesmere and Axel Heiberg islands than on Melville, Bathurst, Cornwallis and Somerset islands. Apart from latitude, these differences may be explained by: (a) deterioration in climate following the Climatic Optimum (6,000 to 4,000 years ago), (b) varying ice thicknesses and extent and (c) thinning and receding of the Franklin, Innuitian or Laurentide ice sheets.

Since several areas of the High Arctic Islands were depressed under the weight of an ice mass, inundated during the retreating phase and partially emerged during the isostatic recovery, the datable samples found along marine limits have provided the basis for the approximation of emergence rates. According to Blake (1976) the corridor extending from Bathurst Island to north-central Ellesmere Island reveals the greatest emergence in the Arctic Archipelago (150 m a.s.l. or more).

The spatial extent and thickness of the ice sheets are very much a point of controversy, and in dispute. Only the Laurentide Ice Sheet has clearly defined limits. Inferences as to the nature of ice thickness and extent of the last glaciation are therefore numerous. For instance, Sugden's (1977) and Paterson's (1977) assumption of a general ice thickness of 1,000 m to 2,500 m for the maximum Laurentide Ice Sheet over the Arctic Archipelago is in agreement with Denton and Hughes' (1981) range of 500 m to 1,500 m on westernmost Queen Elizabeth Islands and

Ellesmere Island and 2,000 m thickness on Amund Ringnes and Axel Heiberg islands during the maximum late Wisconsin ice sheet. Clark and Bloom (1979a; 1979b) predicted ice thicknesses of less than 1,000 m for the outer portions of the Laurentide Ice Sheet by using a steady-state ice-flow model.

Hattersley-Smith's (1969) estimate of a former maximum glacier thickness of 1,000 m in north-central Ellesmere Island contradicts Farrand's (1962) 3,000 m of ice covering northwestern Victoria Island and northern Ellesmere Island. In addition, England (1976a) inferred that the glaciers on Axel Heiberg Island during the Wisconsin glaciation were not more than 200 m thicker than those of today which range from 200 m to 660 m in thickness (Koerner, 1977). Predicted thicknesses in excess of 1,200 m for the probable coalescence of the Greenland and Innuitian ice sheets on the east-central coast of Ellesmere Island have also been reported (Blake, 1977).

The presence of widespread raised marine features of Late Quaternary and Holocene times, as well as the occurrence of marine shells above Late Quaternary and Holocene marine limits facilitate reconstruction. However, Blake (1976), Craig and Fyles (1960), Fyles (1965) Fyles and Blake (1965) report that parts of Prince Patrick, Brock, Borden and Ellef Ringnes islands have few raised marine features.

2.2 Evidence for cold nonglacial conditions

The presence of peat and organic deposits interbedded with tills of early Wisconsin age may indicate that conditions were warmer and wetter at that time. As such, there may have been no ice over the Queen Elizabeth Islands. Instead, radiocarbon age determinations indicate that interstadial and interglacial intervals occurred in the southern and eastern parts of the Arctic Archipelago. For example, peat deposits from Bathurst Island indicate an interglacial interval (Stuart River Interglacial) dated at more than 50,000 years BP (Blake, 1974). The absence of <u>coleoptera</u> (beetle) and <u>hymenoptera</u> (wasp) species has been interpreted as an indication of very cold climate (Danks, 1981; Matthews, 1979). The 50,000 years BP date does not correlate with the interstadials of southern Canada or the interglacials of British Columbia and Yukon Territory (Denton and Hughes, 1981).

Several age determinations in excess of 20,000 years BP have been obtained at various locations in the High Arctic. The presence of peat on Ellesmere Island (GSC-140, >36,400 years BP; GSC-268, >41,200 years BP), collected by Dyck and Fyles (1964) and Dyck et al. (1965) suggests that late Wisconsin ice was limited or nonexistent over southeastern and western Ellesmere Island at that time. Similarly, organic material (I-2322, 20,800±2,900 years BP; GSC-1656, 28,100±380 years BP) contained in till deposits in Inglefield Land, Greenland (Tedrow, 1970) and in northeastern Ellesmere Island (England, 1976a) suggest a period of ice-free conditions at these times, although the latter sample was found to be contaminated (Blake, 1974) and therefore ambiguous. Similarly, Barr (1971) mentions dates in excess of 30,000 years BP from a shell assemblage obtained from emerged beaches of northern Devon Island and interpreted this to be from an interglacial or interstadial. However, contamination by nearby coal, amber and old wood is suspected and this sample also is ambiguous.

According to Blake (1974), the general lack of organic deposits over the High Arctic Islands offer four explanations:

> 1-the area was covered by ice throughout Wisconsin time, hence no vegetation was present;
>
> 2-if there was a mid-Wisconsin nonglacial interval it was of such short duration and/or such severity in terms of climate that accumulations of terrestrial organic deposits could not develop;
>
> 3-if organic deposits of mid-Wisconsin age were present they have since been eroded by the action of glacier ice or some other agent; or
>
> 4-deposits in the 50,000 to 25,000 BP range do indeed exist, but have not been collected.
>
> (Blake, 1974, pp. 1038-1039)

2.3 Controls over permafrost temperature and thickness

In addition to Quaternary climatic fluctuations, it is also pertinent to the objectives of this thesis to outline some of the controls which influence ground temperatures in order to demonstrate whether or not the Quaternary history has affected current permafrost conditions.

2.3.1 Climate

Changes in climate (i.e., mean ground surface temperature) and geothermal gradient greatly affect the regional distribution and existence of permafrost. Lachenbruch (1957) suggests that the present temperature of permafrost is, in part, a response to past climatic changes since permafrost at depth compares to changes in ground surface temperature.

Lachenbruch (1968) postulated that the mean annual ground surface temperature and heat flow from the earth's interior act as important elements in the development of permafrost. Under equilibrium conditions the lower boundary of permafrost approaches a depth at which the temperature increase caused by heat flow offsets the amount by which the freezing point surpasses the mean ground surface temperature (Figure 12). Temperature changes at the surface propagate downwards with an amplitude that diminishes exponentially with depth and with a phase that lags the causative change at the surface. Seasonal

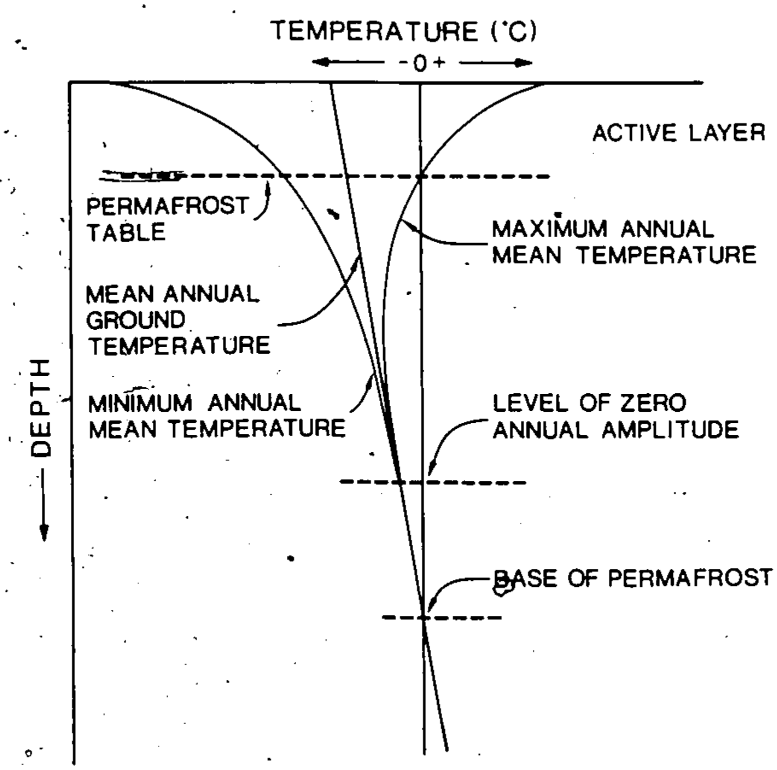


Figure 12 Ground temperature regime in permafrost. (Source: modified from Brown, 1970; Lachenbruch, 1968).

fluctuations of air temperature (i.e., energy and mass exchange at the ground surface) reflect similar results near the mean annual ground surface temperature, and as such, are responsible for the difference in mean annual temperature between ground and air.

Birch (1948), Gold and Lachenbruch (1973), Hotchkiss and Ingersoll (1934), Judge (1973c; 1973d; 1977), and Lachenbruch and Marshall (1969) infer evidence of past climatic conditions from ground temperature measurements. As illustrated by Lachenbruch and Marshall's (1969) profiles from Alaska, permafrost formed when surface temperatures were probably 2 to 4°C cooler than today for Cape Thompson and 4°C for Cape Simpson and Barrow. Lachenbruch and Brewer (1959) and Lachenbruch and Marshall (1969) further suggest that the ground surface temperature is experiencing a 1°C cooling per decade.

Warming trends similar to those in Alaska are reported from boreholes in northern Canada (Taylor et al., 1982), Spitsbergen and northern U.S.S.R. (Washburn, 1979; 1980). Most borehole measurements in northern Canada indicate recent changes in both surface temperatures and past climatic fluctuations. Paterson (1968) notes a curvature with a pronounced temperature gradient in a 121 metre temperature profile for a small ice cap on Meighen Island. The concavity in the temperature profile is thought to arise from increasing surface temperatures at the termination of the Little Ice Age. Past climatic changes in the

High Arctic have been deduced from ice cores from Camp Century, Greenland (Dansgaard et al., 1970; 1971) and the Devon Island ice cap (Fisher and Koerner, 1981; Fisher, 1982; Koerner, 1977; Paterson et al., 1977). Their analyses reveal both cold and warm temperature fluctuations during the Holocene. Such climatic fluctuations may have affected permafrost temperatures and thicknesses prior to postglacial emergence and may therefore explain temperature pertubations at depth.

Brown (1973; 1978b) states that a relationship exists between mean annual air temperature and permafrost temperature. Consequently, variations in air temperature from year to year result in corresponding fluctuations in ground surface temperature and thickness of the active layer. Goodrich (1978) reported that snowcover can raise the mean annual air temperature. Furthermore, vegetation cover variations can also initiate changes of mean surface temperature. Brown (1965; 1973) noted that denser vegetation decreases the energy transfer to the soil and results in a decrease in active layer thickness. For example, Brown (1973) measured depths of 2.2 m in rock (granite-gneiss) and only 0.3 m in peat mounds and upland plateaux on Devon Island. Similarly, Maxwell (1980) cites a depth of 0.9 m in dry gravel on north-eastern Ellesmere Island. In most cases, the removal of vegetation or a change in its composition modifies the mean ground surface temperature and thickness of the active layer. Ferrians and

Hobson (1973) reported variations in the active layer thickness in the range of 15 cm to 5 m in continuous, discontinuous and sporadic permafrost. In general, the variability of permafrost temperatures observed in shallow boreholes found in the High Arctic is mainly caused by seasonal thermal variations (Brown, 1977; Taylor et al., 1982).

2.3.2 Geology

Geology is also important in determining the temperature and thickness of permafrost, since it controls and affects thermal properties and terrestrial heat flow.

Gold and Lachenbruch (1973) define thermal conductivity as a measure of the rate at which heat is driven through a medium under a unit thermal gradient. For example, a high conductivity will result in a low gradient, and vice versa.

Variations of thermal conductivity in materials are dependent on the mineral composition, grain orientation and size, porosity, shape and orientation of voids and presence of any mineral infilling of pore space (Judge, 1973d). These variables may be affected by the conductivity of water, ice, air and other materials, as well as varying temperatures at depth. In the case of ice, frozen material will experience a higher conductivity than unfrozen material since the conductivity of ice is four times that of water. During the freezing phase, the movement of water through pores will release enough heat (latent heat) to raise the temperature of an equal volume of material by hundreds of degrees, and result in high specific heat values (Gold and Lachenbruch, 1973; Judge, 1973d). In addition, unfrozen material is subject to such processes as convection and water vapor migration through pores, and frozen material to heat conduction.

Martynov (1963) also illustrated that increasing moisture content leads to high thermal conductivity. This process occurs when the air contained in pores is replaced by water, thus resulting in better contact between particles. As previously mentioned, the effect of the moisture content is greater in frozen materials than in unfrozen (Gold and Lachenbruch, 1973; Martynov, 1963). The behaviour of moisture and water content in materials during the freezing phase are such that sands and coarse silts usually freeze at temperatures below -2°C, and clays at or below approximately -7°C (Gold et al., 1972).

Thermal diffusivity is related to thermal conductivity and is equal to the conductivity divided by the thermal capacity per unit volume (i.e., density and mass specific heat) (Carslaw and Jaeger, 1959; Ingersoll et al., 1948). Similar to thermal conductivity, the thermal diffusivity of materials greatly affects past changes in geothermal gradient. Judge (1973d) stated that frozen material is more prone to transient temperature disturbance than unfrozen material because the diffusivity of ice is eight times that of water. As a result, very low values exist during the freezing phase.

2.3.3 Thermal conductivity

The thermal properties of soil and rock materials (unfrozen and frozen) are relatively well known. Typical thermal conductivity values for some common materials are shown in Table 2. These may vary from a low of 0.8 $Wm^{-1}K^{-1}$ for shales to a high of 6.3 $Wm^{-1}K^{-1}$ for quartzites (Judge, 1973d). Entire geologic formations and/or lithologic units may be characterized by these measurements and applied to areas where thermal properties are unknown.

According to Jaeger (1965), thermal diffusivity values should range between $5.0 \times 10^{-7} m^2 s^{-1}$ and $25 \times 10^{-7} m^2 s^{-1}$, although as indicated in Table 2, quartzite has a value of $45.0 \times 10^{-7} m^2 s^{-1}$. Diffusivities of naturally-occurring soils are expected to range from $1.0 \times 10^{-7} m^2 s^{-1}$ to $15.0 \times 10^{-7} m^2 s^{-1}$ (Williams, 1982). In addition, specific heat of common rock materials lie between 0.75 kJ $kg^{-1}K^{-1}$ and 0.96 kJ $kg^{-1}K^{-1}$, vary with temperature, and are affected by density variations.

Thermal properties of soil and rock material also combine with geothermal gradients to accentuate the thermal regime of permafrost. Geothermal gradients typically range between 30 mKm^{-1} and 60 mKm^{-1} in permafrost regions. Materials with high thermal conductivities favour thicker permafrost than areas which have fluctuating climatic conditions and varying heat flows.

Table 2

Thermal Conductivities, Thermal Diffusivities and Specific Heat Values for Common Soil and Rock Materials.

Materials	Thermal Conductivity $Wm^{-1}K^{-1}$	Thermal Diffusivity $m^2s^{-1} \times 10^{-7}$	Specific Heat $kJ\ kg^{-1}K^{-1}$
sandy soil	-	9.0[a]	-
sandy clay	3.8[a]	3.8[a]	
shale	1.5[b]	8.0[b]	0.71[c]
limestone	2.9[b]	7.0[b]	0.91[c]
sandstone	4.2[b]	10.0[b]	0.92[c]
granite	2.9[b]	11.0[b]	-
quartzite	5.9[b]	45.0[d]	0.79[c]

Source: [a]Birch, 1961. [b]Judge, 1963d. [c]Williams, 1982. [d]Johnston, 1981.

2.3.4 Terrestrial heat flow

The variability of permafrost thickness may be explained, in part, by variations in terrestrial heat flow (Judge, 1973d; Taylor and Judge, 1981). The regional distribution of heat flow, combined with thermal conductivity of materials and ground surface temperatures are used to predict past and present permafrost thicknesses and temperatures (Judge, 1973b). The spatial variation of thermal properties of materials, together with temporal variation of ground surface temperature, and lateral variations of elevation or temperature cause disturbances which are noticeable in borehole temperature profiles.

Judge (1973b) reports that thicker permafrost will occur with a combination of low ground surface temperature, low to intermediate heat flow and high thermal conductivity. For example, heat flow values for northern Canada, indicate terrestrial heat flow values for wells in the Sverdrup Basin ranging from 62.8 mWm^{-2} to 83.7 mWm^{-2}. Elsewhere, values of 50.2 mWm^{-2} to 67.0 mWm^{-2} were calculated for the Parry Fold Belt (Central zone), and 33.5 mWm^{-2} to 54.4 mWm^{-2} on the Arctic Platform (Figure 13) (Judge, 1972; 1973b; 1974a). The highest heat flow was expected to occur in the Sverdrup Basin where there is evidence of igneous activity from Tertiary times, and lowest on the Arctic Platform where the basement has not been geologically active since the Precambrian (Judge, 1972). Recent geothermal investigations in the Arctic Islands (i.e., thermal

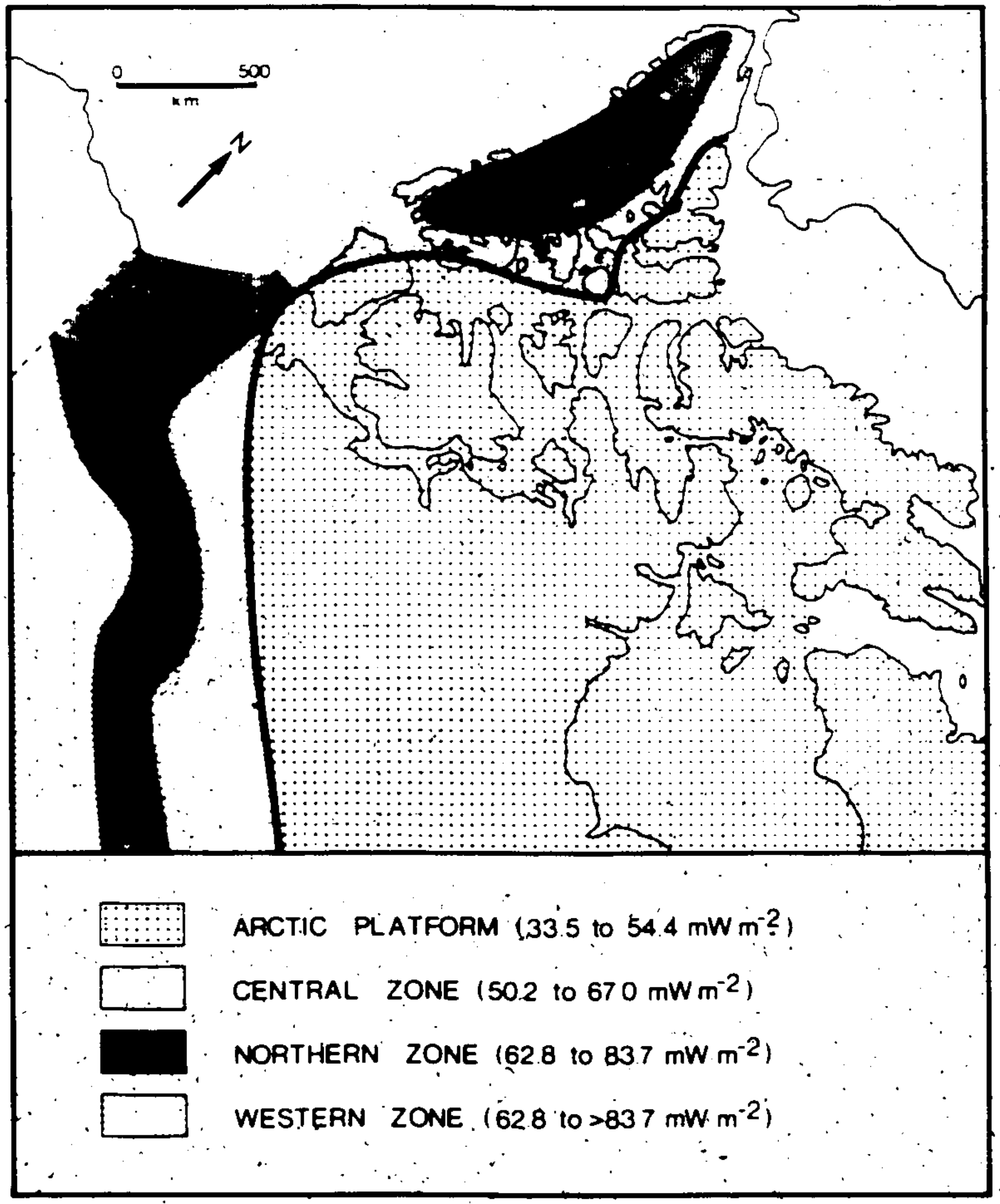


Figure 13 Postulated heat flow distribution in northern Canada. (Source: modified from Judge, 1972).

conductivity measurements, near ground surface temperatures, permafrost thicknesses and temperature gradients) have resulted in terrestrial heat flow values in the range of 60 mWm^{-2} to 120 mWm^{-2} (Judge and Taylor, 1979).

In comparison to these Canadian values, heat flow values from the U.S.S.R. are lower, and range from 20 mWm^{-2} to 41 mWm^{-2} on the central Siberian Plateau (Lubinova et al., 1972; Sharbatyan and Shumskiy, 1974), to 49 mWm^{-2} to 61 mWm^{-2} on the eastern Siberian Plain (Sergiyenko et al., 1972). In consequence, these permafrost depths are thicker in the U.S.S.R. than Canada.

2.3.5 Influence of water bodies

The thermal effect of water bodies has long been considered a modifier of permafrost (Lachenbruch, 1957). The influence of oceans, lakes, past sea level fluctuations and submergence have all contributed to the variability of permafrost thickness. Permafrost thicknesses are known to increase with distance from the shoreline.

Mean annual bottom temperature of northern oceans (e.g., Beaufort Sea) range from -1.5°C to -1.8°C in deep water (although sample temperatures as low as -2.2°C were recorded by Sellmann et al., 1979), to 0°C or above in water less than 20 m deep (Hunter et al., 1976). Analysis and estimates of thermal anomalies and disturbances in boreholes near water bodies may be calculated from equations derived by Lachenbruch (1957).

A temperature difference of -5.0°C to -15.0°C may exist between unfrozen bottom sediments and the emergent land surface. Gold and Lachenbruch (1973) and Lachenbruch and Marshall (1969) indicate that this heat originates beneath the water body. The heat transmitted to the nearby permafrost is often mistaken for heat flow from the earth's interior (e.g., Lachenbruch, 1957; Misener, 1955).

As in oceans, lakes are also associated with surface temperature anomalies. Their spatial dimension will determine whether they freeze to the bottom in winter or remain above 0°C. Lakes which do not freeze to the bottom promote the formation of taliks beneath them. For example, Johnston and Brown (1964), and Smith (1976) studied degradation, aggradation and equilibrium conditions and indicated no permafrost beneath several lakes in the Mackenzie Delta. Grigor'yev (1976) made similar observations along the coastal zone of Yakutia and reported "through" (open) and "non-through" (closed) taliks beneath lakes and rivers. According to these studies, the dimensions of taliks are a function of lake dimensions.

It follows therefore that thermal anomalies produced by past sea level fluctuations can influence permafrost thickness. Shallow permafrost may be explained by emergence of land from sea. In such instances, the permafrost above marine limit may be in equilibrium with present climate. However, below marine limit and at depth within the permafrost body, the permafrost may be either degrading, in equilibrium or aggrading, depending on past and present climate, geothermal heat flow, and nature of the water bodies.

Lachenbruch (1957), Lachenbruch and Marshall (1969) and Taylor and Judge (1981), all agree that a decrease of permafrost thickness near shorelines may reflect submergence of land by the sea prior to isostatic recovery following deglaciation. Areas which were once submerged most likely experienced seabottom temperatures of approximately -1.5°C prior to emergence. Therefore, periods of submergence by the sea and/or influence of an ice cover may have resulted in higher ground surface temperatures in postglacial times than today.

2.4 Discussion

The Quaternary history of the High Arctic Islands is controversial, given the absence of modern analogues for extensive ice sheets. Although numerous possibilities exist, the extent and origin of glaciation, as illustrated by the concepts introduced by Blake (1970) and England (1976a), remain poorly understood. Blake's (1970) model appears suitable for western and central regions of the High Arctic, while the eastern region of the High Arctic (i.e., Ellesmere Island) tends to relate more to England's (1976a) model.

According to Hodgson (personal communication, 1983), if the Queen Elizabeth Islands were glaciated, it is not known whether the ice was in a major ice sheet, experiencing "warm" basal temperatures, or in a separate island ice mass with "cold" basal temperatures. Likewise, if the Queen Elizabeth Islands were nonglaciated, the sea level either would have remained high throughout the Late Quaternary, or transgressed from lower levels to the marine limit and then regressed. Thus, it is not known whether glacio-isostasy is the actual mechanism dominating emergence in the High Arctic Islands (personal communication, Hodgson, 1983).

Areas influenced by Wisconsin glaciation and those unaffected by deglaciation during Late Quaternary times experienced quite different cold nonglacial climatic conditions. As a result, the thickness of permafrost which developed during Wisconsin and Late Quaternary times may vary considerably from place to place.

Since the climate was cooler during the Wisconsin glaciation than today, permafrost aggraded. However, degradation may also have occurred as temperatures beneath the ice approached the pressure-melting point. Büdel (1959) speculates that permafrost would have thawed beneath the thickest Pleistocene ice sheets and ground temperatures would have been modified for long periods of time. Similarly, Gerasimov and Markov (1968) reported that in Siberia the thickest permafrost lies in areas that remained unglaciated during the Pleistocene.

l'efficacité de l'administration des affaires de la société, et peu importe que ces motifs soient bien fondés.[110]

L'arrêt Re Jermyn Street Turkish Baths Ltd. fournit enfin un exemple éloquent qui illustre bien comment certains agissements, d'un caractère par ailleurs oppressif, peuvent en certaines circonstances ne pas constituer de l'oppression. Dans cet arrêt, la Cour d'appel estime en effet que l'émission d'actions, qui a pour effet de réduire la proportion des actions qui appartiennent aux actionnaires minoritaires, sans que ceux-ci n'aient l'occasion de s'en porter acquéreurs, la rémunération excessive des administrateurs et la tenue d'assemblées générales des actionnaires sans qu'avis en soit donné aux actionnaires minoritaires, ne peuvent justifier le recours de l'article 210 du Companies Act 1948.[111]

Paragraphe 2 - L'oppression justifiait la liquidation et la dissolution de la société pour des motifs de justice et d'équité

Les tribunaux britanniques jouissent du pouvoir général d'ordonner la liquidation et la dissolution d'une société, lorsqu'ils estiment que les règles de la justice

Permafrost thickness can be predicted if both the mean annual soil surface temperature (MASST) and geothermal gradient are known. Consider, for example, that today's MASST is -17°C and that the southern margin of the Wisconsin Ice Sheet (at its maximum) was 4°C to 6°C cooler than today (Sugden, 1977). Permafrost thicknesses can then be predicted using Terzaghi's (1952) equation:

$$H_p = -\frac{T}{i_g} \qquad [1]$$

where H_p = thickness of permafrost (m), T = MASST (°C) and i_g = geothermal gradient (mKm^{-1}). Corresponding geothermal gradients ranging from 22 mKm^{-1} to 60 mKm^{-1} (Stearns, 1966; Taylor et al., 1982) result in minimum and maximum permafrost thicknesses of approximately 350 m and 1,045 m. These values are considerably in excess of permafrost thicknesses in the Arctic Islands.

Permafrost thicknesses measured today reflect the ground surface temperature history of the past thousands to tens of thousands of years, integrating the successive effects of glaciation, deglaciation, marine submergence and emergence, and the recent climate. Submergence of an area results in a reduced amplitude of ground surface temperature and a change of MASST to a new equilibrium temperature. Assuming a MASST of -15°C with a geothermal gradient of 50 mKm^{-1} in postglacial times, and an assumed present MASST of -17°C with a geothermal gradient of 30 mKm^{-1}, permafrost depths of 300 m and 500 m, respectively, can be obtained. In addition, it can also be assumed that a mean seabottom temperature of -1.5°C has a permafrost depth of 30 m with a 50 mKm^{-1} geothermal gradient.

CHAPTER THREE

DATA SOURCES AND TECHNIQUES

Data used in this study consist of ground temperatures measured at abandoned wellsites by the Earth Physics Branch, Energy, Mines and Resources, Ottawa (Judge et al., 1979; 1981; Taylor and Judge, 1974; 1975; 1976; 1977; Taylor et al., 1982), together with thermal conductivity values derived from drill cuttings obtained from several wells on the Sabine Peninsula. The drill cuttings were supplied by the Institute of Sedimentology and Petroleum Geology (ISPG), Energy, Mines and Resources, Calgary.

3.1 Ground thermal data

The temperature data are for different lengths of record, ranging from periods of one year to eight years. Summary data are presented in Table 3. The location of the wellsites is illustrated in Figure 14. Depending mainly on the length of time required for drilling and the total depth of the well, the return to thermal equilibrium may take several years. Human and instrumental variations in measurement are thought to be negligible (Judge, 1973d, p. 24).

Temperature measurements are taken in the field (Figure 15a) using a lightweight portable cable system containing a single thermistor that is lowered in steps to obtain a series of temperature readings down a borehole

Table 3

Ground Temperature and Related Data for Wellsites Analyzed in the Study.

Wellsites	Geographical Co-ordinates	Thickness of Permafrost (m)	Geothermal Gradient (mKm^{-1})	Mean Surface Temperature (°C)	Elevation (m a.s.l.)	Distance from Sea (km)	Elevation of Inferred Marine Limit (m a.s.l.)
Drake B-44 (Melville Isl.)	76°23.1'N 108°16.1'W	188	48 (225-325 m)	-16.5	4	0.9	60
Drake F-78 (Melville Isl.)	76°27.3'N 108°29.4'W	171	51 (200-275 m)	-16.5	2	0.1	60
Drake D-73 (Melville Isl.)	76°22.1'N 108°29.5'W	288	52 (300-375 m)	-17.0	13	1.6	60
Drake D-68 (Melville Isl.)	76°27.1'N 108°55.1'W	264	42 (300-550 m)	-16.0	37	12.0	60
Drake F-67A (Melville Isl.)	76°26.4'N 108°55.1'W	P 275	A 48	A -17.0	35	8.7	60
Drake F-16 (Melville Isl.)	76°25.2'N 108°35.4'W	P 214	A 48	A -16.5	40	0.6	60
Hecla L-69 (Melville Isl.)	76°18.7'N 110°23.3'W	143	47 (200-350 m)	-16.5	2	0.02	60
Bent Horn N-72 (Cameron Isl.)	76°21.8'N 103°58.2'W	726	31 (125-325 m)	-16.5	63	2.0	
Bent Horn F-72A (Cameron Isl.)	76°21.5'N 103°58.2'W	660	31 (100-300 m)	-16.5	43	2.0	

Table 3 (Continued)

Wellsites	Geographical Co-ordinates	Thickness of Permafrost (m)	Geothermal Gradient (mKm^{-1})	Mean Surface Temperature (°C)	Elevation (m a.s.l.)	Distance from Sea (km)	Elevation of Inferred Marine Limit (m a.s.l.)
Pat Bay A-72 (Lougheed Isl.)	77°21.0'N 105°27.0'W	300	18 (25-150 m)	-16.5	17	2.0	90
Sutherland O-23 (King Christian Isl.)	77°42.9'N 102°08.5'W	316	53 (225-375 m)	-17.5	21	1.0	30-60
Thor P-38 (Thor Isl.)	78°07.8'N 103°15.2'W	336	65 (250-325 m)	-17.0	5	0.1	30-60
Hoodoo Dome H-37 (Ellef Ringnes Isl.)	78°06.5'N 99°45.6'W	306	58 (50-325 m)	-16.5	156	13.5	30-60
Dome Bay P-36 (Ellef Ringnes Isl.)	78°25.9'N 103°15.8'W	660	57 (390-570 m)	-16.0	154	7.0	30-60
Kristoffer Bay B-06 (Ellef Ringnes Isl.)	78°15.3'N 102°32.0'W	445	49 (400-825 m)	-17.5	15	0.3	30-60
Louise Bay O-25 (Ellef Ringnes Isl.)	78°44.9'N 102°42.0'W	256	62 (150-575 m)	-15.5	69	12.5	30-60
Cornwall O-30 (Cornwall Isl.)	77°29.8'N 94°39.0'W	325	35 (200-400 m)	-15.5	20	2.0	70-100
Jameson Bay C-31 (Prince Patrick Isl.)	76°40.2'N 116°43.7'W	487	20 (475-550 m)	-17.0	58	12.0	

Table 3 (Continued)

Wellsites	Geographical Co-ordinates	Thickness of Permafrost (m)	Geothermal Gradient (mKm^{-1})	Mean Surface Temperature (°C)	Elevation (m a.s.l.)	Distance from Sea (km)	Elevation of Inferred Marine Limit (m a.s.l.)
Walkins E-60 (Mackenzie King Isl.)	77°59.3'N 111°21.7'W	271	41 (336-427 m)	-15.0	64	9.0	
Brock I-20 (Brock Isl.)	77°59.7'N 114°33.9'W	429	26 (200-325 m)	-16.5	16	5.0	
Pedder Point ~~D-49~~ (Eglinton Isl.)	75°38.2'N 118°48.3'W	341	50 (25-325 m)	-16.0	101	7.0	
Storkerson A-15 (Banks Isl.)	72°54.0'N 124°33.5'W	500	26 (300-370 m)	-14.5	14	1.6	
Neil O-15 (Ellesmere Isl.)	80°44.6'N 83°04.8'W	549	24 (250-500 m)	-16.5	497	4.5	> 25
Gemini E-10 (Ellesmere Isl.)	79°59.4'N 84°04.2'W	501	30 (325-475 m)	-16.5	126	23.5	> 25
Mokka A-02 (Axel Heiberg Isl.)	79°31.2'N 87°01.2'W	500	31 (137-442 m)	-16.5	253	3.0	> 25
Devon E-49 (Devon Isl.)	75°04.3'N 91°48.3'W	600	14 (25-100 m)	-15.0	244	1.6	
Winter Harbour (Melville Isl.)	74°48.1'N 110°30.6'W	535	32 (39-534 m)	-16.0	~~22~~	1.0	60

Table 3 (Continued)

Wellsites	Geographical Co-ordinates	Thickness of Permafrost (m)	Geothermal Gradient (mKm^{-1})	Mean Surface Temperature (°C)	Elevation (m a.s.l.)	Distance from Sea (km)	Elevation of Inferred Marine Limit (m a.s.l.)
Dundas C-80 (Melville Isl.)	74°39.0'N 113°23.0'W	577	39 (500-650 m)	-16.0	240	20.5	60
Lobitos Resolute L-41 (Cornwallis Isl.)	74°40.7'N 94°44.6'W	600	17 (75-150 m)	-15.0	61	1.3	> 25
Garnier O-21 (Somerset Isl.)	73°40.9'N 90°36.8'W	500	D	-15.0	369	2.0	

Sources: Judge et al., 1979; 1981; Taylor and Judge, 1974; 1975; 1976; 1977; Taylor et al., 1982.

P--indicates predicted values.
A--indicates Assumed values.
D--indicates that the well was too disturbed to obtain results.

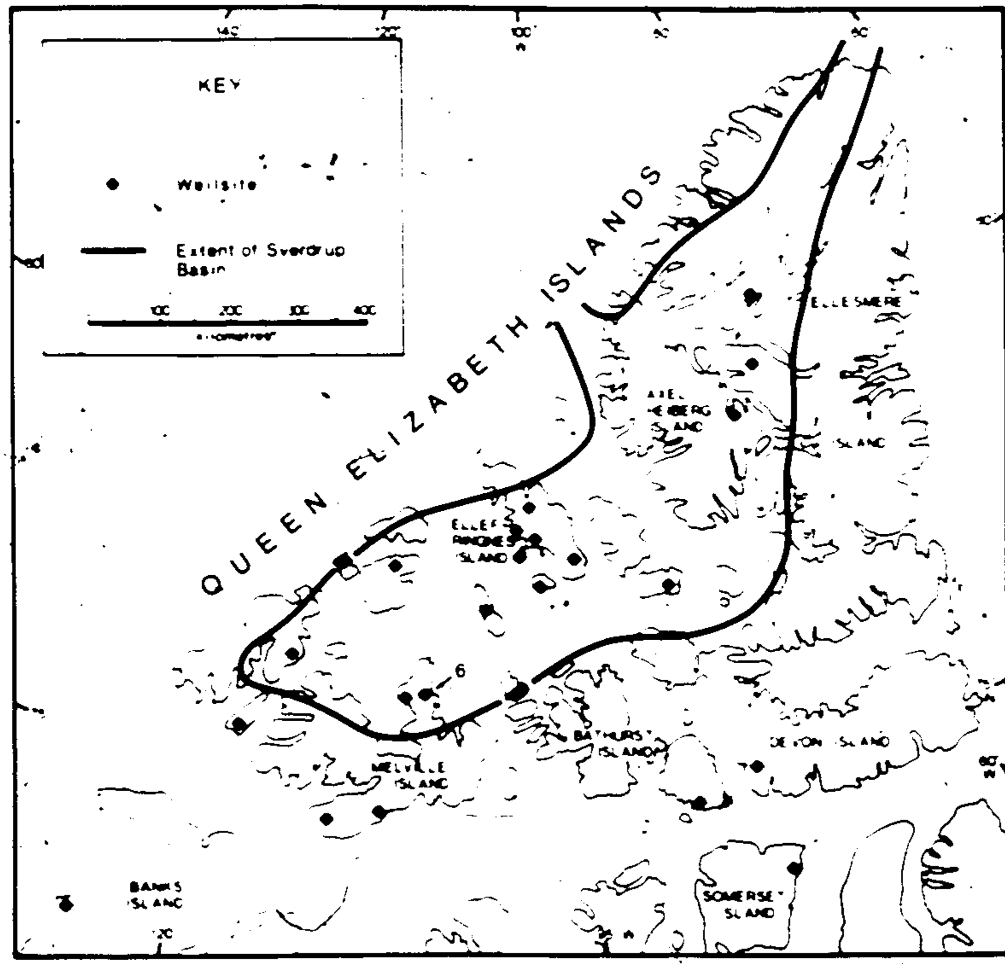
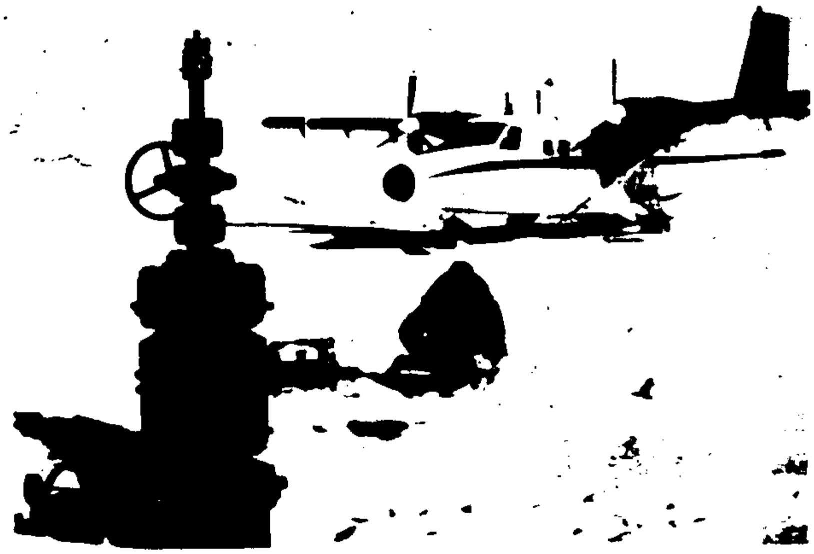


Figure 14 Location map of the Queen Elizabeth Islands showing the locations of wellsites analyzed in the study.

(a)



(b)

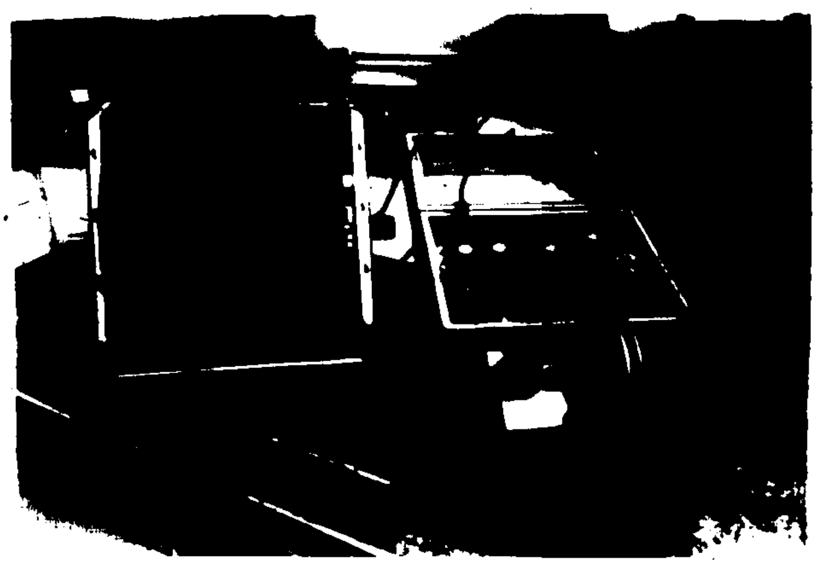


Figure 15 The measurement of ground thermal data. (a) Field measurement of well temperatures at Hecla I-69, Sabine Peninsula, eastern Melville Island, May 16, 1980. (b) Portable logging equipment for temperature measurement. As shown, the Brancker Bridge is connected to the cable wound on the lightweight winch.

(Judge 1973c; 1974a). All resistance measurements are made with a modified Wheatstone Bridge (Brancker Bridge Model GTB-1) (Figure 15b). The thermally insulated and strongly constructed bridge allows for the rugged handling and extremes of arctic temperature encountered during logging operations. A small external battery pack equipped with a cable and connector (kept inside the operator's clothing) is used to operate the bridge in very cold conditions.

3.2 Thermal conductivity measurements

Very few thermal conductivity measurements on rock materials from the High Arctic Islands have been reported in the literature. Only King (1977; 1979) has examined the physical properties of perennially frozen material from boreholes in the Arctic. Different methods for measuring the thermal conductivity of earth materials have been discussed by Judge (1973d). This section describes a simple divided-bar thermal conductivity apparatus for use with crushed samples from drill cuttings.

3.2.1 Divided-bar apparatus

The steady state divided-bar method (Figure 16) as described by Judge (1973a; 1973d), permits high accuracy measurements while using small temperature gradients across the sample. Accuracies of the method are approximately ±2% of the measured values.

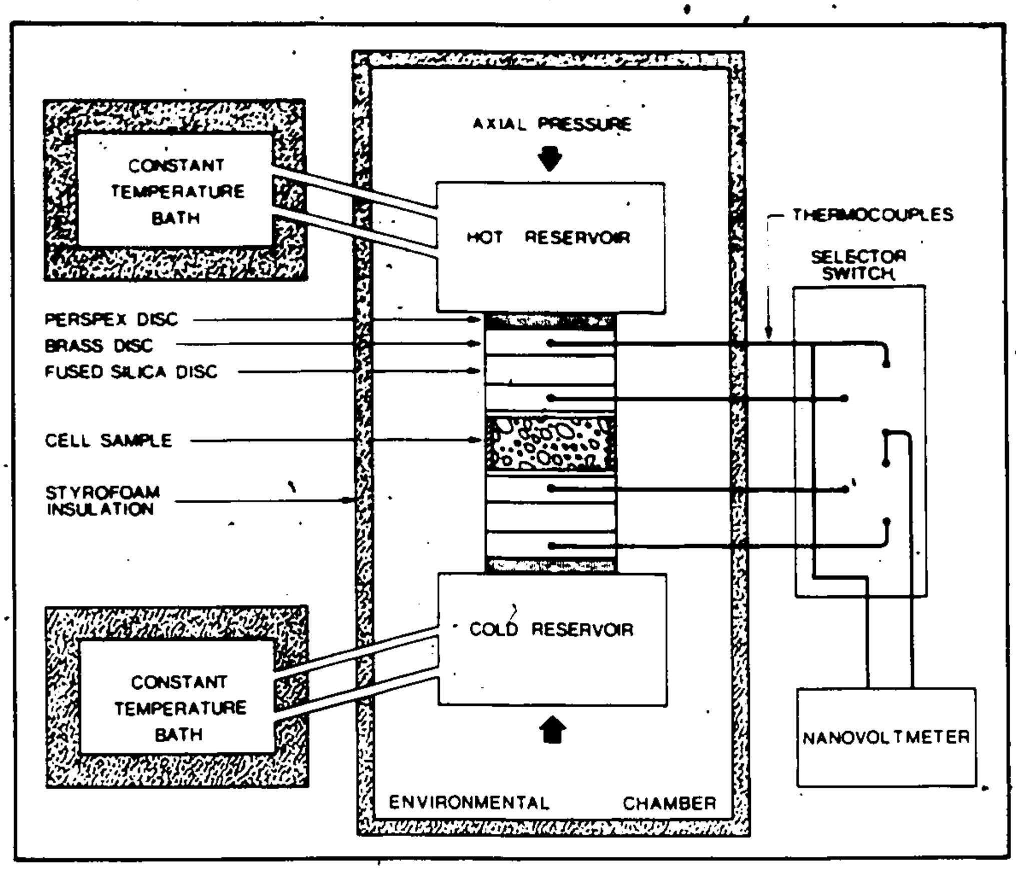


Figure 16 Diagrammatic illustration of divided-bar apparatus. (Source: Judge, 1973d).

Two cylindrical brass reservoirs (Figure 17) are kept at different but constant temperatures by two refrigerated baths circulating water to the reservoirs. The cold bath is maintained at a temperature 5°C cooler than room temperature and the warm bath at a temperature 5°C warmer than room temperature. The warmer reservoir is placed above the sample to reduce the possibility of convective fluid movement in the porous samples. Between the reservoirs three discs, consisting of perspex, brass and fused silica, are fastened together with a thin film of epoxy.

The perspex discs decrease the fluctuations of reservoir temperatures whereas the brass discs, having holes drilled radially in them, allow the insertion of thermocouple sensors. The fused silica discs act as material of known thermal conductivity value in the divided-bar. The temperature gradient across the discs of known value are compared to the temperature gradient across the sample. Four micro-miniature thermocouples are used to measure the difference in EMF between a common junction and the discs in the bar. The entire divided-bar assembly is mounted in a hydraulic jack (see Figure 17) to allow axial pressures to be maintained on the cell sample, and thus reduce the contact resistance between the stack of discs, and the cell sample. The temperature differences across the known conductivity of the fused silica discs and the unknown conductivity of the cell sample is measured using

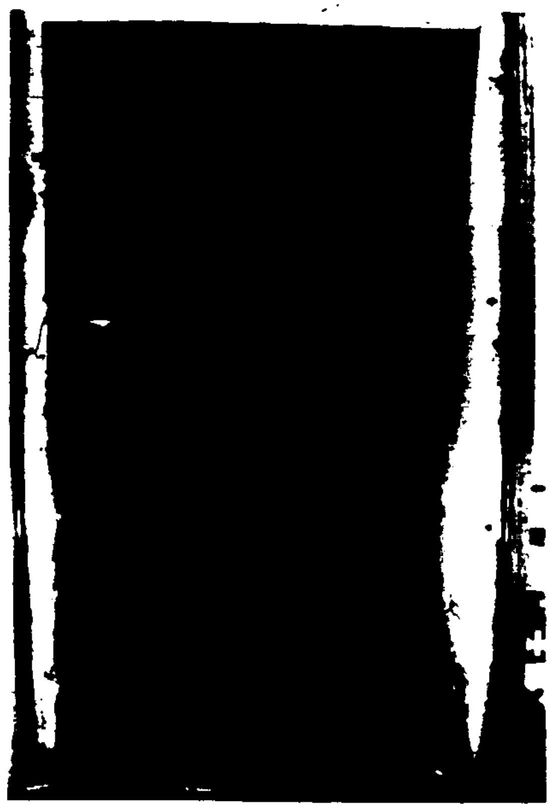


Figure 17 Divided-bar assembly with hydraulic jack inside insulated environment chamber. A plexiglass door is mounted in front of the chamber to allow monitoring of pressures and ambient temperatures. A cell sample is shown between the stack of discs.

a Keithley 180 Digital Nanovoltmeter.

The fused and crystalline quartz standards and thermal conductivity values established by Ratcliffe (1959) were used in the present study. Five standard fused silica (GE 101) discs of varying thicknesses are placed between the stacks in order to determine the temperature gradient across both the silica discs and the stack. After obtaining this gradient, the standard allows the thermal conductivity of the intermediate fused silica disc to be determined. Various problems and errors dealing with the design and use of the divided-bar apparatus are outlined by Jessop (1970).

Measurements were made for drill cuttings selected at approximately 30 m intervals from seven borehole logs which are in the repository at the Institute of Sedimentology and Petroleum Geology, Calgary. Lithologies ranged from shale to sandstone.

3.2.2 Preparation of samples

Sixty-eight samples from five boreholes (Drake E-78, Drake D-73, Drake D-68, Drake K-67A and Drake F-16) were pulverized into grain size material and packed uniformly into cells (Figure 18). These were then prepared by saturating crushed rock fragments with water containing a small amount of detergent. The latter prevents sample contamination. The packing procedure minimizes water content. Distorted values may also result from poorly packed cells containing air, since air has a very low thermal conductivity

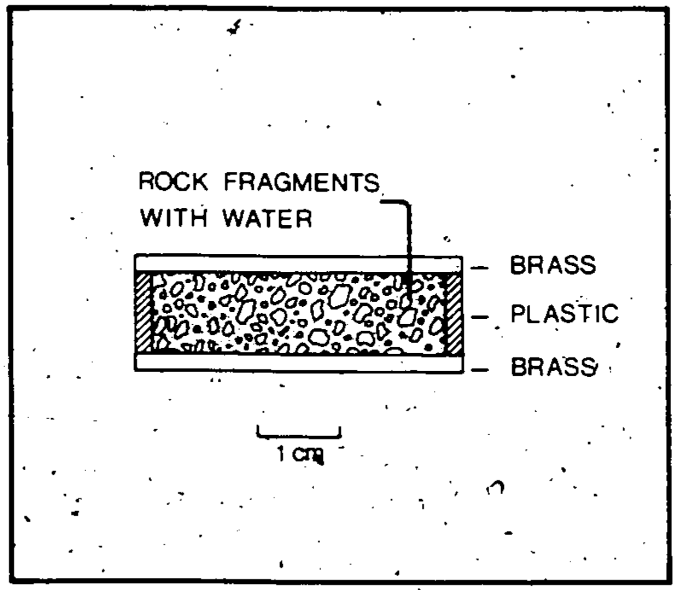


Figure 18 Scale diagram of the thermal conductivity cell (side view). The cell consists of two brass discs of equal outer (3.185 cm) and inner (2.855 cm) diameter and thickness (2.360 mm), and a plastic ring (1.000 cm long) glued with epoxy on the bottom brass ring.

(approximately 0.024 $Wm^{-1}K^{-1}$). The cells are therefore placed in a vacuum oven to extract any existing air pockets. Finally, a glycerol water solution is applied to the top and bottom of the cell to provide better contact with the discs on both the hot and cold reservoirs.

Conductivity is determined in the same manner as if the cell were a disc of solid rock (Sass et al., 1971). A strip of parafilm is stretched around the plastic rim overlapping the lid to prevent either evaporation or sublimation of moisture. Once the measurement is made, the top and bottom surfaces are wiped clean of the glycerol/water solution and the parafilm removed. Immediately following the thermal conductivity measurement, the wet sample weight is calculated by subtracting the cell weight from the wet weight and left to dry in order to determine the dry sample weight.

3.2.3 Analysis of thermal conductivities

The mean conductivity of the sample within the cell is inferred by the "Geometric" model mentioned in Judge (1973d) and Taylor (1978). This model was used to calculate in situ conductivities from measurements obtained from drill cuttings.

Since enclosing cell materials impose their own thermal conditions, problems in the calculation of the thermal conductivity values are encountered. These problems are eliminated by using the "Geometric" model to calculate the bulk conductivity of samples and as such, relate the individual conductivities of the matrix and of ice or water (Woodside et al., 1961). The bulk thermal conductivity of the cell mixture within a cell was estimated by:

$$k_B = k_w^{\theta} k_g^{(1-\theta)} \qquad [1]$$

where k_B is the bulk thermal conductivity of the cell mixture; k_w is the thermal conductivity of water (0.55 $Wm^{-1}K^{-1}$); k_g is the thermal conductivity of the grains in matrix; θ is the porosity, volume fraction.

A computer program was used to correct the measured values since the conductivity of the entire cell (i.e., the two brass discs, the plastic ring and the epoxy glue) is considered when the conductivity of the sample is determined. When this correction factor is considered, it is possible to obtain a thermal conductivity for the grains within the cell and then determine an estimated <u>in situ</u> thermal conductivity value with an assumed porosity from the following:

$$k_{is} = k_w^{\theta} k_g^{(1-\theta)} \qquad [2]$$

where k_{is} is the estimated <u>in situ</u> thermal conductivity; k_w is the thermal conductivity of water (0.55 $Wm^{-1}K^{-1}$); k_g is the thermal conductivity of the grains (obtained from equation (1) or φ is the assumed porosity of the formation (15% to 20%).

In situ thermal conductivities can be obtained for permafrost sections by substituting the thermal conductivity of water for the thermal conductivity of ice. Estimates of frozen and unfrozen *in situ* thermal conductivities were examined using equation (1). It was noticed that thermal conductivities from estimated frozen *in situ* were higher than those estimated from unfrozen *in situ*. This may be explained by the fact that the thermal conductivity of water and ice are approximately 0.55 $Wm^{-1}K^{-1}$ and 2.22 $Wm^{-1}K^{-1}$, respectively (Clark, 1966). The bulk conductivity is quite sensitive to whether water or ice fills the pore space because of the large contrast in conductivity of water and ice. Judge (1973b; 1973d) showed that a rock with 10% porosity will possess a 14% higher thermal conductivity when ice-filled (frozen) rather than water-filled (unfrozen). Such was the case when assuming porosities of 15% and 20% for frozen and unfrozen *in situ* conductivities. The determination of porosities for a number of samples of sandstones and shales from boreholes in the arctic by King (1977; 1979), led to the assumption of similar porosity values (15% to 20%) for each measured sample of the Sabine Peninsula. True porosities for the frozen and unfrozen sections of the wells can be determined from geophysical well logs, but an assumed porosity value was thought appropriate for the present work.

CHAPTER FOUR

PERMAFROST VARIABILITY AND QUATERNARY HISTORY

4.1 Introduction

This chapter assesses whether permafrost thicknesses below the inferred Late Quaternary marine limit are related to time since emergence. In addition, any relationship existing between permafrost thickness and distance from the present shoreline is also examined. Finally, the variability of permafrost thicknesses in the Sverdrup Basin region is briefly outlined. Emergence curves and site-specific factors (i.e., distance from the sea, elevation) were used to indicate the ages of sites since emergence.

The data analysed in this chapter were derived from a series of measurements on ground temperatures and permafrost depths for thirty abandoned wells. The data were grouped into five geographic "regions" or data sets (Figure 19). These are as follows:

(1) Region 1 corresponds to a glaciated area on the southern margin of the Sverdrup Basin. It consists of nine wells, two situated on Cameron Island and seven on the Sabine Peninsula of Melville Island.

(2) Region 2 is the glaciated area of the northern flank of the Sverdrup Basin.

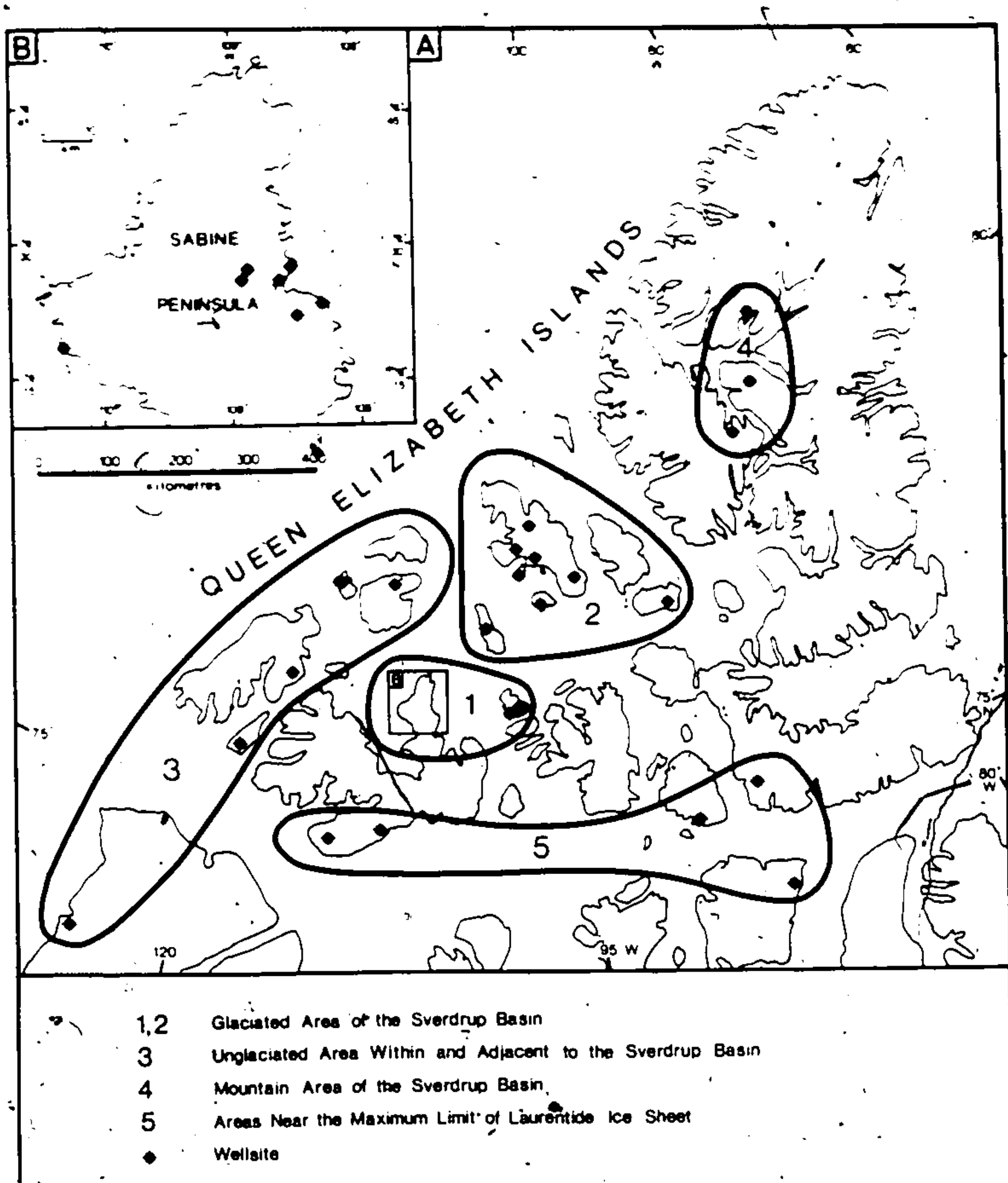


Figure 19 A: Map of wellsites divided into geographical regions in the Sverdrup Basin and adjacent areas of the High Arctic. B. Location of wellsites on the Sabine Peninsula.

It consists of eight wells, four on Ellef Ringnes Island, and one on each of the following islands: Thor, King Christian, Lougheed and Cornwall islands.

(3) Region 3 is an unglaciated area within and adjacent to the western margins of the Sverdrup Basin. It consists of five wells located on Mackenzie King, Brock, Prince Patrick, Eglinton and Banks islands.

(4) Region 4 is a mountain belt area of the Sverdrup Basin, and consists of two wells on Ellesmere Island and one on Axel Heiberg Island.

(5) Region 5 corresponds to an area near the margin of the Laurentide Ice Sheet. It consists of five wells located on Melville, Cornwallis, Devon and Somerset islands.

4.2 Permafrost distribution and thickness

Permafrost thickness measurements for sites located in the study area are shown in Table 4a. On the basis of predicted equilibrium temperatures, permafrost thicknesses were estimated from depths to the 0°C isotherm. Mean permafrost thicknesses for the five regions range from 322.5 m to 562.4 m.

Table 4a

Summary Data of Permafrost Thickness and Ground Temperature Parameters Used in the Study. Measures of Variability for Permafrost Thicknesses for Each Region and Combined Regions.

Regions	Mean Permafrost Thickness (m)	Number of Sites N	Standard Deviation (m)	Coefficient of Variation V (%)
1	325.4	9	214.6	65.9
2	368.0	8	129.7	35.3
3	405.2	5	96.8	23.9
4	517.0	3	27.7	5.4
5	562.4	5	43.8	7.8
1, 2 & 3	358.9	22	161.1	44.9
1 & 2	345.5	17	175.7	50.9
4 & 5	545.4	8	43.2	7.9
3, 4 & 5	491.5	13	96.2	19.6

et conformément à l'alinéa 222f) du Companies Act 1948, la liquidation et la dissolution de la société dont il était actionnaire.

Nous allons brièvement passer en revue les faits de quelques-unes de ces affaires; notre liste ne sera nullement exhaustive, mais plutôt l'illustration de certaines situations où les faits peuvent justifier, pour des motifs de justice et d'équité, la liquidation et la dissolution d'une société.

Dans Re S.A. Hawken Ltd., les demandeurs, qui étaient propriétaires de quarante-cinq pour cent des actions de la société, se sont vus refuser leurs conclusions axées sur l'article 210 du Companies Act 1948, mais accorder de consentement la liquidation et la dissolution de la société dont ils étaient actionnaires, parce qu'un profond désaccord séparait les parties et que la demande alléguait qu'une enquête était nécessaire pour faire la lumière sur l'administration des affaires de la société, sans toutefois incriminer spécifiquement aucun des dirigeants de la société.[155]

Pareillement, le demandeur de l'affaire Re Lundie Brothers Ltd., s'est vu accorder la liquidation et la

The variation of permafrost thickness may reflect present mean air temperatures which vary from -15.0°C on northern Banks Island to -19.0°C in the Sverdrup Basin. In addition, mean ground surface temperatures range from -15.5°C to -17.5°C, and are dependent on local air temperature and topography. Differences between mean air and mean ground surface temperatures vary from 0°C to 4.0°C (Table 4b). Therefore, mean ground surface temperatures are warmer than mean air temperatures. This difference may be due to the insulating effect of snow, its amount and distribution and the influence of vegetation and soils. Very low mean ground surface temperatures and high geothermal gradients (i.e., average of 36 mKm^{-1}) indicate that the Sverdrup Basin and adjacent islands experience relatively thick permafrost.

The frequency of occurrence of permafrost thicknesses in the boreholes is normally distributed (Figure 20). Most wellsites possess moderately deep (i.e., 100 m to 350 m) to very deep permafrost (i.e., 400 m to 750 m). Nevertheless, the distribution of permafrost varies from region to region and similar depths may be obtained in adjacent islands.

The variability of permafrost thicknesses is large. For example, the coefficient of variation (V) expresses the standard deviation as a percentage of its mean (see Table 4a) (region 1 deviates approximately 65.9% of its mean permafrost thickness of 325.4 m, while

Table 4b

Summary Data of Permafrost Thickness and Ground Temperature Parameters Used in the Study. Thermal Parameters for Wellsites Within the Five Regions.

Regions	Mean Air Temperatures[a] (°C)	Mean Ground Surface Temperatures[b] (°C)	Difference (°C)	Mean Permafrost Temperatures (°C)	Mean Temperature Gradients (mKm^{-1})
1	-18.0 Rea Pt.	-16.0 to -17.0	1.0 to 2.0	-7.5	43
2	-19.0 Isachsen	-15.5 to -17.5	1.5 to 3.5	-7.7	50
3	-15.0 to -19.0 Mould Bay	-15.0 to -17.0	0 to 4.0	-7.2	33
4	-17.5 to -18.0 Eureka	-16.5	1.0 to 1.5	-7.6	28
5	-15.5 to -16.0 Resolute Bay	-15.5 to -16.5	0 to 1.0	-7.8	26

[a]Values obtained from Figure 6.

[b]Values extrapolated from temperature profiles in Judge et al., 1979; 1981; Taylor and Judge 1974; 1975; 1976; 1977; Taylor et al., 1982.

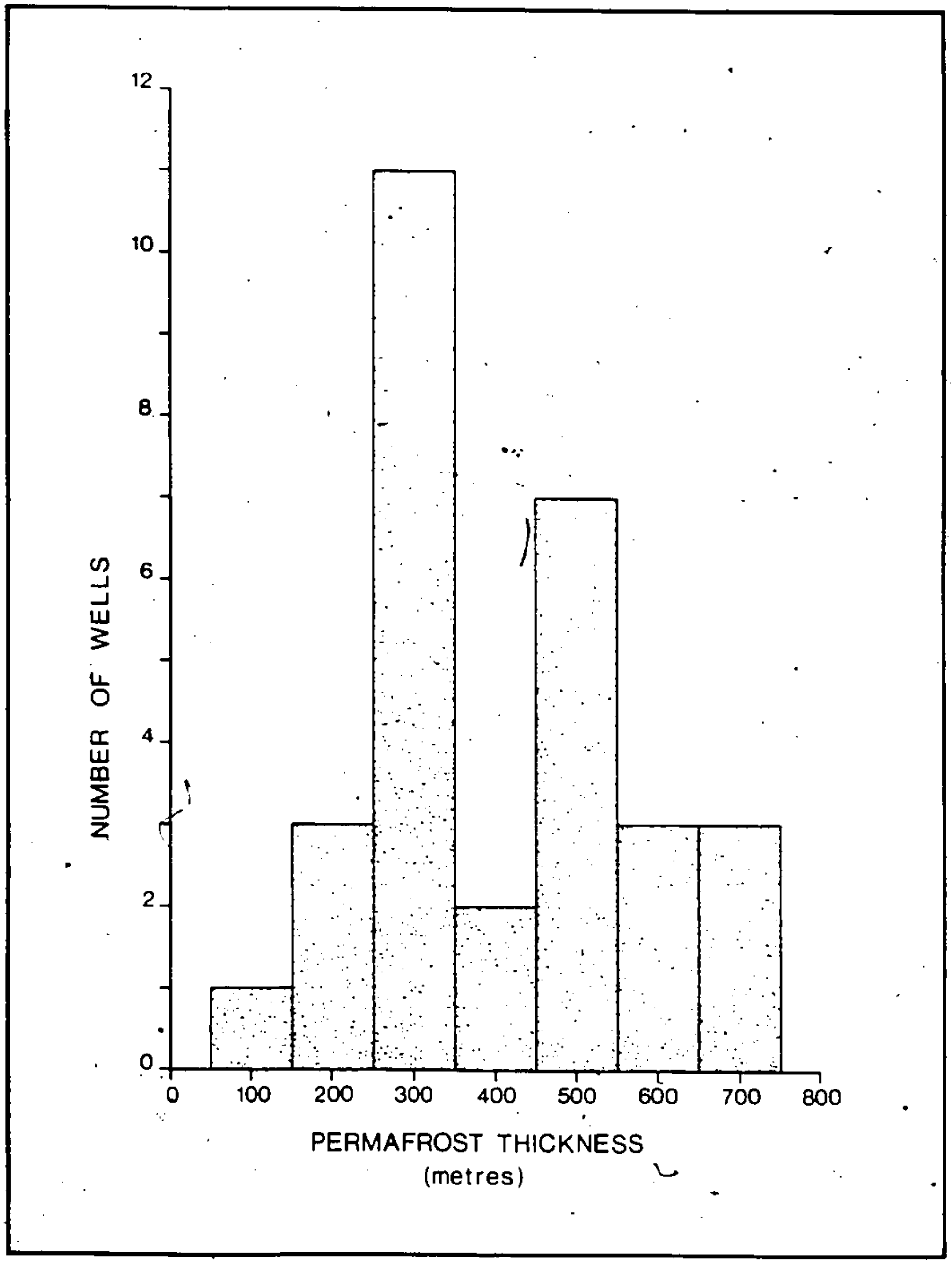


Figure 20 Frequency histogram of permafrost thickness measured in thirty wells of the High Arctic. (Source: as in Table 3).

region 5 deviates 7.8% from its mean of 562.4 m). Greater variability is noticed in the individual regions than in the combined regions.

Statistical tests (i.e., Student-t) were used to determine whether or not permafrost thicknesses differed significantly between regions. They suggest that, for the most part, permafrost thicknesses are not statistically different from one region to the next. However, a larger population is required in order to expand on the claim that permafrost thicknesses are approximately uniform throughout the regions.

The mean permafrost temperatures range from -7.2°C in region 3 to -7.8°C in region 5 (see Table 4b). Minimum and maximum permafrost temperatures are -9.5°C and -5.5°C. Individual ground temperature profiles are published regularly by the Earth Physics Branch. Most are characterized by a steady increase in temperature with depth, corresponding to heat flow and overlying effects of secular changes in mean annual ground surface temperature that are usually associated with climatic change (i.e., warmer ground surface temperatures in the last century). Most of the profiles show a marked curvature in the upper 50 m to 100 m, with near-surface temperatures being much warmer than those obtained by an upward extrapolation of the temperature gradient.

Mean geothermal gradients for the five regions vary from 26 mKm^{-1} in region 5 to 50 mKm^{-1} in region 2 (see Table 4b). Wells which experience low geothermal gradients combined with low ground surface temperatures (e.g., wells on Cameron and Ellesmere islands) also experience relatively thick permafrost. The intervals of lower and higher temperature gradients in the profiles correlate with similar intervals of lower or higher thermal conductivities (Taylor and Judge, personal communication, 1983). It appears that the variation of temperature gradient is due mainly to the thermal conductivity of materials and heat flow from the earth's interior.

The variability in permafrost thickness throughout the study area is also partly attributed to lithological differences (Figure 21). This may, in part, be the result of in situ porosities in frozen and unfrozen materials. Taylor and Judge (1981) indicate that permafrost thicknesses in the Arctic Islands tend to be thinner in shale formations than in sandstone formations because of the higher thermal conductivity of sandstone. It should also be noted that thickness may be influenced by past and present climate and sea level fluctuations. Permafrost thickness tends to be thicker with higher elevations although present ground surface temperatures are not primarily dependent on elevation. However, elevation may enhance the depth of permafrost at sites which lie above inferred marine limits.

Le demandeur a néanmoins l'obligation d'alléguer le préjudice injuste que lui causeraient la liquidation et la dissolution de la société dont il est actionnaire, et, à défaut de consentement de la partie adverse, il doit également en faire la preuve.[165]

Section II - La condition d'ouverture du recours de l'article 75 du <u>Companies Act 1980</u>

La date du 22 décembre 1980 correspond à l'entrée en vigueur de l'article 75 du <u>Companies Act 1980</u> et, par le biais du paragraphe 75(11) de ladite loi, à l'abrogation de l'article 210 du <u>Companies Act 1948</u>.

Malgré une certaine controverse chez les auteurs britanniques, créée par William Goodhart[166] et entretenue par John Birds,[167] nous estimons, avec D.J. Bakibinga[168] ainsi que Victor Joffe et Andrew Hochhauser,[169] que l'article 75 du <u>Companies Act 1980</u> régit le recours au cas de préjudice injuste institué le 22 décembre 1980, ou en tout temps depuis cette date, alors que l'article 210 du <u>Companies Act 1948</u> continue de s'appliquer aux procédures d'un recours au cas d'oppression institué avant le 22 décembre 1980.

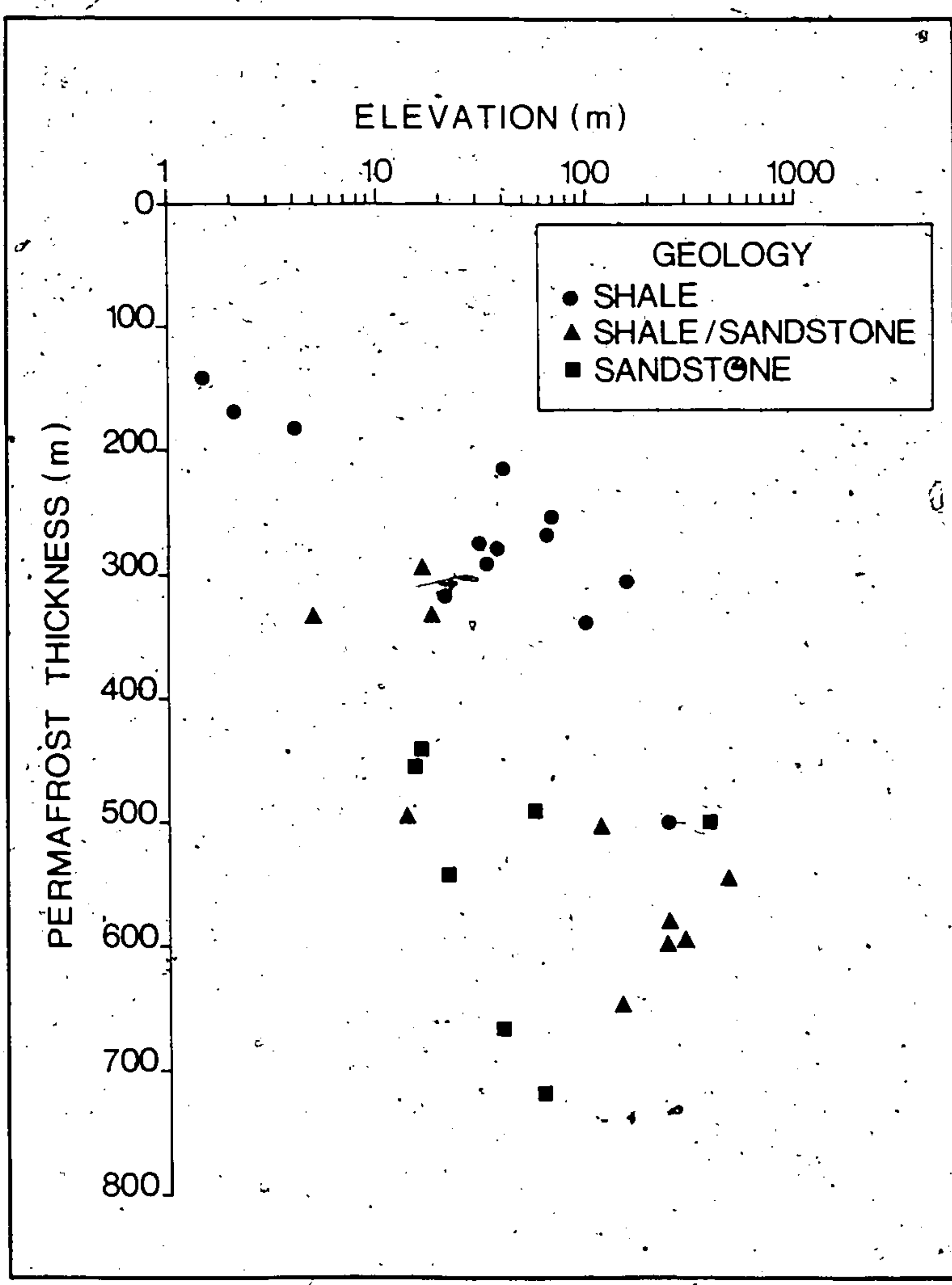


Figure 21 Diagram showing the influence of elevation and geology on permafrost thicknesses for thirty wells, Arctic Canada. Lithology is generalized for intervals within the permafrost (i.e., shale, sandstone and a combination of the two).

4.3 Late Quaternary shoreline fluctuations

Location of wells with respect to inferred maximum marine limits indicate that twenty wells out of thirty are located below marine limit. In addition, most wells below marine limit experience thinner permafrost than wells above marine limit. This demonstrates that submergence and emergence, along with previously mentioned factors, are a partial cause in the distribution (i.e., temperature, thickness and extent) of permafrost below marine limit.

There is a clear correlation between permafrost thickness and wellsite distance from the sea (Figure 22). However, varying trends are observed in different regions (Figure 23). Regression analysis indicates a positive correlation for region 1 (i.e., permafrost thickness increases with increasing distance); and negative correlations for all other regions. The coefficients of determination (r^2) indicate that variations in wellsite elevation are associated with the variations in permafrost thickness. This implies that wellsite elevation acts as a modifier of permafrost thickness.

Student-t testing ($\alpha = 0.005$) was undertaken to determine whether or not mean wellsite distances from the sea and wellsite elevations differed significantly with mean permafrost thicknesses from each region. It was concluded that permafrost thickness increases linearly with wellsite distance from the sea in regions 1, 4 and, 5. In theory, permafrost thickness increases with increasing

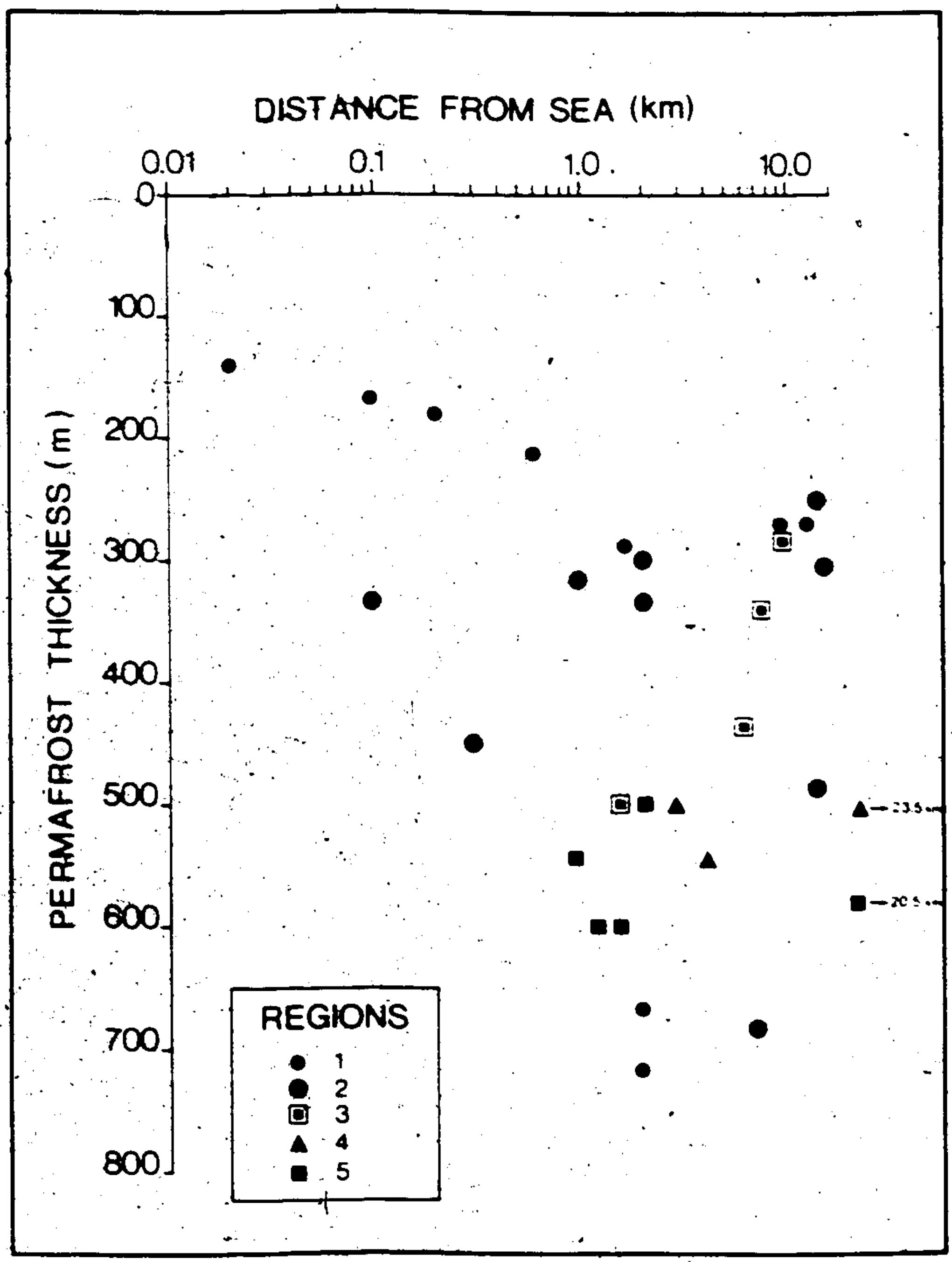


Figure 22 Diagram showing permafrost thickness versus wellsite distance from the sea, Arctic Islands. (Source: as in Table 3).

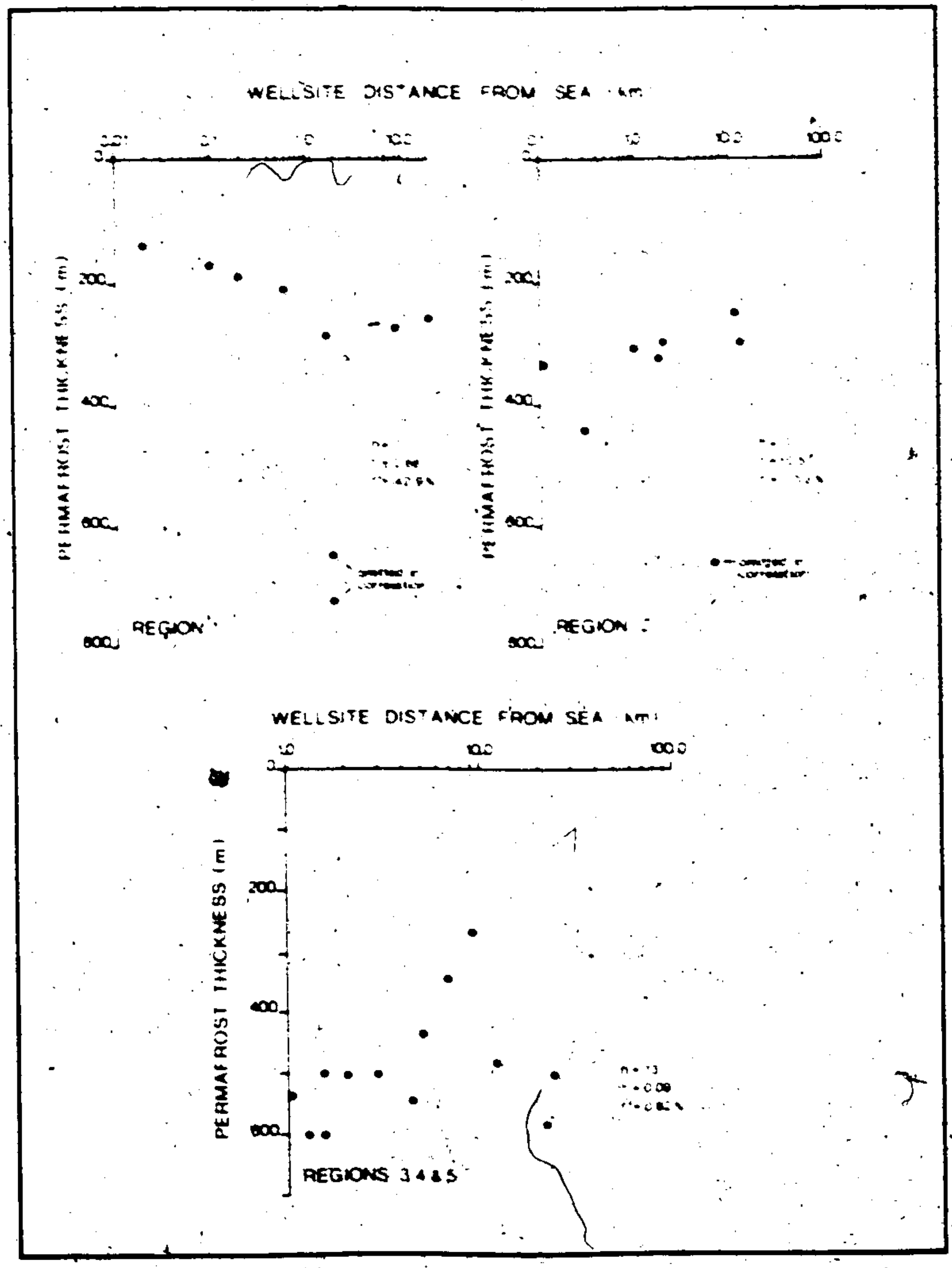


Figure 23 Relationship between permafrost thickness and wellsite distance from the sea according to geographic regions, Arctic Islands. See Figure 19 for identification of geographic regions.
(Source: as in Table 3).

distance from the shoreline because of: (a) a shoreline effect (i.e., the warming influence of water bodies), (b) the influence of emergence and/or submergence during Late Quaternary times, (c) geothermal heat flow and (d) higher moisture contents and porosities below marine limit than above marine limit, thus affecting thermal properties of materials and permafrost depths.

Since submergence and emergence during Late Quaternary times can influence permafrost thickness and distribution it was assumed that permafrost became thinner (i.e., degraded) as the sea encroached and aggraded as the land emerged.

The inferred Late Quaternary marine limit divides those sites that experienced submergence from those that did not, on the basis of elevations (Table 5). The approximate age of a site is taken from the elevation of the site on the approximate emergence curves. In the case of some sites, ages were interpolated from dated marine limits.

Many sites experienced no submergence following the most recent deglaciation. However, sites with elevations below the inferred marine limit show rapid initial emergence on the emergence curves, thus suggesting that they experienced submergence for a relatively short period of time. By contrast, other sites have emerged only in the last few thousand years (e.g., Sabine Peninsula of Melville Island).

Table 5

Approximate Age of Emergence and Permafrost Thickness of Wellsites in the High Arctic Islands.

Regions	Wellsites	Permafrost Thickness (m)	Time Since Emergence (years BP)
	Drake E-78	171	700 [c]
	Drake D-73	288	8,325 [c]
	Drake B-44	188	7,350 [c]
	Drake D-68	264	8,650 [c]
1	Drake K-67A	275	8,500 [c]
	Drake F-16	214	8,850 [c]
	Hecla I-69	143	700 [e]
	Bent Horn N-72	726	7,000 [e]
	Bent Horn F-72A	660	5,000
	Hoodoo Dome H-37	306	9,700*[a,d]
	Dome Bay P-36	660	9,700*[a,d]
	Kristoffer Bay B-06	445	6,350 [a,d]
	Louise Bay O-25	256	9,500 [a,d]
2	Thor P-38	336	3,300 [a,d]
	Sutherland O-23	316	7,250 [a,d]
	Cornwall O-30	325	7,100 [a,d]
	Pat Bay A-72	300	8,000 [b,d]
	Jameson Bay C-31	483	
	Brock I-20	429	
3	Wilkins E-60	271	
	Pedder Point D-49	343	
	Storkerson A-15	500	
	Neil O-15	549	4,495*[e]
4	Gemini E-10	502	8,250-8,500*[e]
	Mokka A-01	500	3,275*[e]
	Devon E-43	600	7,800*[e]
	Lobitos Resolute L-41	600	7,250 [e]
5	Garnier O-21	500	9,200*[f]
	Dundas C-80	577	10,250*[c]
	Winter Harbour	535	8,850 [c]

*Wellsites above inferred marine limit, therefore only age of marine limit.

[a]Blake, 1970 [b]Hodgson, 1981. [c]McLaren and Barnett, 1978

[d]St-Onge, 1965. [e]Walcott, 1972a. [f]Dyke, 1979.

A good example to demonstrate the thermal influence of Late Quaternary shoreline fluctuations arises at the two Bent Horn wellsites (N-72 and F-72A) on Cameron Island. The approximate ages of these sites were obtained from the emergence curve of Bathurst Island. Both sites are situated approximately 2 km from an emerging shoreline and their elevations suggest that the higher site (Bent Horn N-72) emerged about 7,000 years ago, and the lower site (Bent Horn F-72A) at about 5,000 years ago. A difference of 66 m in permafrost thickness for the two sites also indicates that N-72 (726 m) emerged prior to F-72A (660 m).

It should be emphasized that much of the land that is presently submerged was, a few thousand years ago, part of the land and therefore exposed to the same rigorous climate that resulted in the present deep permafrost. Since these two sites, as well as others located below marine limits, once experienced seabottom temperatures of approximately -1.5°C prior to emergence, and that seabottom temperatures are much warmer than the land surface, it follows, that the permafrost that formed prior to submergence may have persisted at great depths beneath the sea for many thousands of years. This may very well be the case for other sites in the Arctic Islands.

A number of permafrost thicknesses have been obtained for the Ellef Ringnes region (region 2) but no emergence curves are available for this area. Two curves

(Figure 24) were constructed from radiocarbon dates on marine shells and organic material (N.B. locations of the collection sites are indicated in the inset map). It is assumed that the approximate age of 9,500 years BP for Louise Bay 0-25 corresponds to its emergence and possibly to a minimum date of deglaciation for northern Ellef Ringnes Island. The emergence curve also indicates an approximate age of 9,700 years BP for the marine limit, and this is assumed to be synchronous with deglaciation (i.e., 11,000 to 9,000 years BP).

Unlike the permafrost thickness of the Bent Horn sites, most sites in region 2 experience relatively deep permafrost. Sites above the inferred marine limit possess considerably thicker permafrost than sites below marine limit, and permafrost thicknesses were highly variable as sites emerged from the sea.

In the case of the Sabine Peninsula sites (region 1), the most inland site (Drake D-68) emerged approximately 8,650 years ago, about 7,950 years before two lower sites (Hecla I-69 and Drake E-78), and about 200 years after the Winter Harbour wellsite located on southern Melville Island (see Figure 11a). The emergence curves offer two possibilities: (a) deglaciation of southern Melville Island occurred prior to northeastern Melville Island, (b) the increasing thickness of ice in the northeast provided greater glacio-isostatic loading in northeastern Melville Island than southern Melville Island.

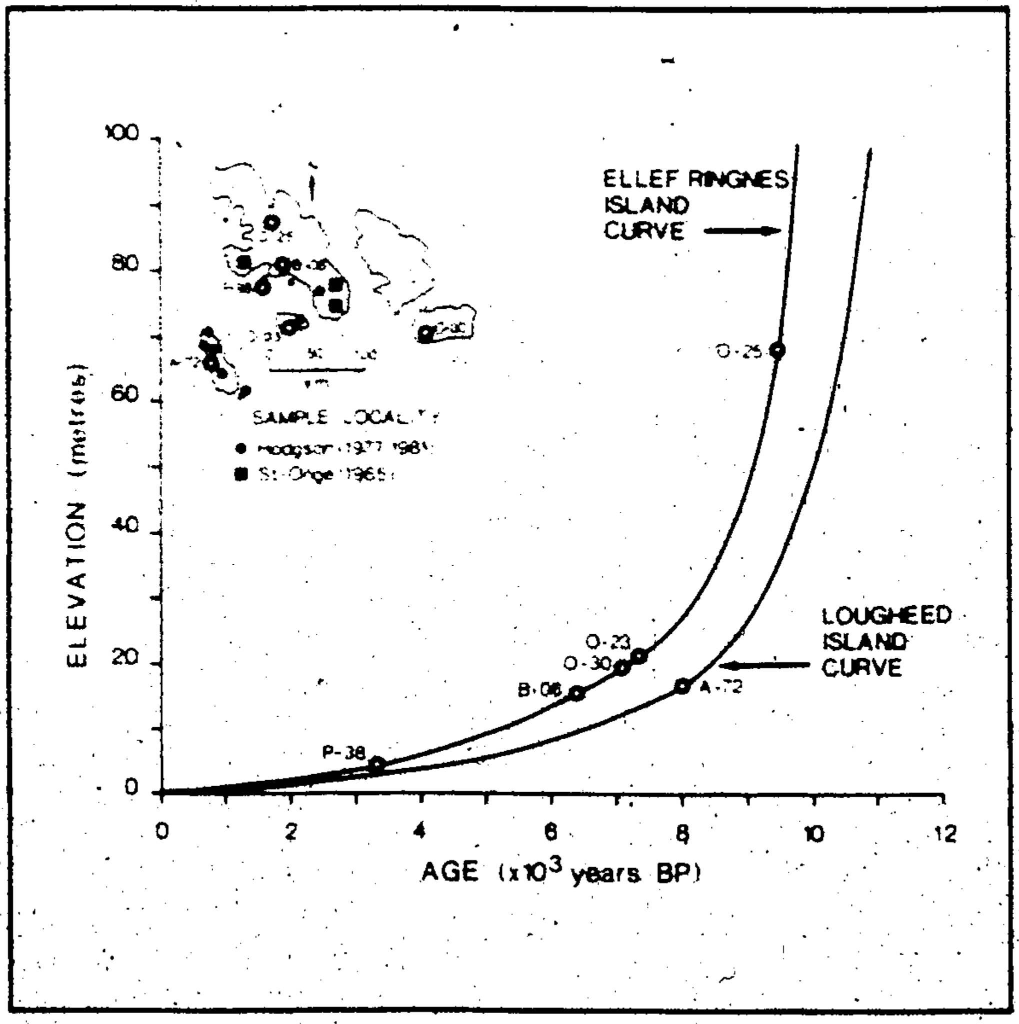


Figure 24 Emergence curves compiled for Ellef Ringnes and Lougheed islands. Wellsites located below the inferred maximum marine limit are fitted on the curves. The inset map indicates the location of the ^{14}C samples and the wellsites.

4.4 Summary

The nature and distribution of permafrost in the High Arctic suggests that its variability is the combined result of the mean annual ground surface temperature, the geothermal heat flow, the thermal properties of the subsurface material and the Quaternary history. Permafrost thicknesses which occur below the inferred Late Quaternary maximum marine limit in some areas (i.e., region 1: Sabine Peninsula of Melville Island and Cameron Island) primarily relate to time since emergence, whereas in other areas (i.e., regions 2, 4 and 5) thicknesses have not been affected by glacio-isostatic responses. It is also recognized that a relationship exists between permafrost thickness, distance from the sea and elevation. Finally, geology and thermal properties of materials appear to play a major role in the modification of permafrost temperature and thickness.

CHAPTER FIVE

GEOTHERMAL REGIMES OF THE SABINE PENINSULA, MELVILLE ISLAND

5.1 Introduction

The prediction of permafrost thickness requires knowledge of ground temperature gradients, thermal conductivity of materials and regional distribution of geothermal heat flow (Judge, 1973b). This chapter describes measurements obtained from the divided-bar thermal conductivity apparatus for seven wells on the Sabine Peninsula of Melville Island.

This chapter is included in this thesis as an example of a different approach to the understanding of permafrost variability in the High Arctic Islands. The main objectives of this chapter are threefold: (a) to investigate whether permafrost thickness on the Sabine Peninsula is controlled by geomorphic histories and/or thermal properties of rock material, (b) to determine the geothermal regime of the Sabine Peninsula and (c) to predict permafrost depths on the peninsula.

5.2 Regional setting

The seven wells studied on the Sabine Peninsula are underlain by the soft ice-rich and highly sensitive shale of the Christopher Formation. Six are in the Drake Point gas field (Drake E-78, Drake B-44, Drake D-73, Drake D-68, Drake F-16, Drake K-67A) and one in the Hecla gas field (Hecla I-69) (Figure 25). The surficial deposits, vegetation cover and geomorphic processes in the vicinity of these wells are indicated in Table 6. The Sabine Peninsula is an area of low relief, averaging less than 75 m a.s.l. in the north to 150 m a.s.l. in the interior, with the exception of two circular piercement domes which represent the greatest relief at approximately 215 m a.s.l. Sites located in the interior of the peninsula have permafrost thicknesses that vary by a factor of 2 in comparison to coastal sites. It is generally assumed that the peninsula was covered by an ice sheet until approximately 10,000 years ago and that it is still recovering from postglacial rebound at a rate of approximately 0.35 cm year^{-1} (McLaren and Barnett, 1978). Periods of submergence and emergence during Late Quaternary and Holocene times resulted in a maximum marine limit of approximately 60 m a.s.l. (Henoch, 1964; McLaren and Barnett, 1978).

5.3 Results

5.3.1 Interpretation of thermal conductivities

Table 7 lists the estimated in situ thermal conductivities for each geological formation. The average conductivities for the formations were similar and consistent from one borehole to another, with an overall variation of less than 20%. For example, the estimated thermal

Figure 25 Oblique air view of northern Sabine Peninsula, eastern Melville Island. Wellsite locations and local geological formations are indicated. (Source: National Air Photo Library T417L-55).

Table 6

Surficial Characteristics of Each Wellsite.

Wellsites	Surficial Deposits	Vegetation Cover	Locality with Respect to Marine Limit	Periglacial Processes
Drake B-44	Undifferentiated beach deposits underlain by Christopher shales and silts	>60% wet tundra meadows	b.m.l.	slumping and gullying along minor streams; tundra ponds
Drake E-78	Veneer of undifferentiated colluvial deposits underlain by Christopher shales and silts	>60% saxifrage barrens	b.m.l.	slight gullying along streams
Drake D-73	Undifferentiated alluvial deposits with some colluvial deposits underlain by Christopher shales and silts	>60% saxifrage barrens	b.m.l.	major slumping near sumps
Drake D-68	Undifferentiated glaciofluvial deposits underlain by Christopher shales and silts	60% saxifrage barrens	b.m.l.	terrain disturbance; slumping of the sump; erosion and gullying along terrace and streams, ice wedges
Drake K-67A	Undifferentiated glaciofluvial deposits underlain by Christopher shales and silts	60% saxifrage barrens	b.m.l.	terrain disturbance; modified by erosion and gullying
Drake F-16	Undifferentiated shale deposits underlain by Christopher shales and silts	60%	b.m.l.	modified by erosion and gullying
Hecla I-69	Undifferentiated beach deposits underlain by Christopher shales and silts	60-75% moss & grass meadows	b.m.l.	terrain disturbance; coastal erosion; tundra ponds

Sources: Barnett et al., 1975; National Air Photo Library, A24719 nos. 45-50, 114-126, 183-211, 253-256 and A23088 nos. 241-244.

Table 7

Estimated in situ Thermal Conductivity Values from Assumed Porosities of Water and Ice for Varying Geological Formations

Wellsites	Estimated Thermal Conductivities ($Wm^{-1}K^{-1}$) from Assumed Porosities (%) Water 15	Water 20	Ice 15	Ice 20	Depth (m)	Formation	Lithology
Drake B-44	2.9	2.6	3.6	3.5	30.0-140.0	Christopher	claystone
	2.8	2.5	3.4	3.3	140.0-390.0		shale
Drake E-78	2.1	1.9	2.5	2.5	30.5-121.9	Christopher	shale
	2.2	2.1	2.7	2.7	121.9-300.2		claystone
Drake D-73	2.3	2.1	2.1	2.8	30.5-396.0	Christopher	shale
Drake D-68	2.0	1.9	2.5	2.5	30.5-381.0	Christopher	shale
	2.3	2.2	2.9	2.9	381.0-518.2		sandstone
	2.5	2.3	3.1	3.0	518.2-701.0	Isachsen?	claystone
	3.1	2.8	3.8	3.7	701.0-795.5	Mould Bay?	sandstone
Drake K-67A	2.4	2.2	3.0	3.0	42.7-195.1	Christopher	claystone
	2.7	2.5	3.4	3.3	195.1-451.1		sandstone
Drake F-16	2.0	1.9	2.5	2.4	33.5-217.9	Christopher	shale
	2.2	2.0	2.7	2.7	217.9-274.3		claystone
	2.6	2.4	3.2	3.0	274.3-397.8		sandstone
Hecla I-69	2.0	1.8	2.4	2.4	30.0-350.0	Christopher	shale
	2.2*	2.0*	2.7*	2.7*	350.0-465.0	Isachsen	shale, siltstone
	2.3	2.2	2.9	2.9	465.0-610.0	Mould Bay	shale, sandstone

* Assumed values.

conductivity of Christopher shale, with an assumed porosity of 15%, was 2.3 $Wm^{-1}K^{-1}$ at Drake D-73, 2.1 $Wm^{-1}K^{-1}$ at Drake E-78 and 2.0 $Wm^{-1}K^{-1}$ at Drake F-16, Hecla I-69 and Drake D-68.

The bulk thermal conductivity values, as well as the estimate in situ thermal conductivity values for each sample from the seven wells are listed in Appendix A. The grain densities and water contents within the cell samples, along with assumed porosity values are also included with the conductivities (mean grain density of 2.63 Mgm^{-3} and a mean moisture content of 51%). Mean thermal conductivity values obtained from the "Geometric" model range from 2.7±0.2 $Wm^{-1}K^{-1}$ to 3.8±0.5 $Wm^{-1}K^{-1}$ for the seven wellsites. Moderately high values may be the result of high porosities ranging from 55% to 65% for shales, 35% to 60% for claystones and 20% to 50% for sandstones. In addition, poor packing of cells caused by swelling of clay particles in shale and claystone, and variations in lithology within the cells (i.e., interbedding of shales of low thermal conductivity with sandstone of high thermal conductivity) must be considered. The estimated in situ thermal conductivity values with porosities of 15% to 20% (for water and ice) are lower than those previously derived from the "Geometric" model. Thus, high porosities tend to increase conductivities above the measured values from the model. Such porosities are in reasonable agreement with those obtained by King (1977) (e.g., 13% for shale; 17% for sandstones) and reflect differences in shale content and porosity.

Thermal conductivity values shown in Appendix B represent plotted thermal conductivities with assumed porosities of 15% for ice above the permafrost base, and 15% for water below the permafrost base. A lack of drill cuttings for Hecla I-69 led to the insertion of assumed thermal conductivity values in the bottom section of the Christopher Formation and the entire Isachsen Formation. Assumed thermal conductivity values were also used for Drake D-73 to reduce high heat flow at a specific depth. These values were representative of thermal conductivity values found in nearby wells.

Lithological differences at depth account for the varying thermal conductivity values obtained from the seven wellsites. The thermal conductivity measurements cover a range of 1.8 $Wm^{-1}K^{-1}$ to 3.8 $Wm^{-1}K^{-1}$. The values in Table 7 and Appendix A indicate similar agreement with other measured conductivities. For example, Judge (1973b) interpolates a thermal conductivity of approximately 2.8 $Wm^{-1}K^{-1}$ for shaley sandstone while Judge and Beck (1973) report values ranging between 2.9 $Wm^{-1}K^{-1}$ and 4.2 $Wm^{-1}K^{-1}$ for similar materials in different localities.

5.3.2 Interpretation of heat flow.

Heat flow values were calculated by a computer program modified by Dr. A. M. Jessop of the Earth Physics Branch. The program incorporates topographic, moving shoreline (age of postglacial emergence) and climatic corrections. It also converts measured borehole temperatures into corrected values for the required climatic history.

Heat flows from the five wellsites were calculated by the interval method and the thermal depth method (i.e., the "Bullard" heat flow). The interval method computes the heat flow in sections where temperature measurements are available. The computer program combined the produce of the least squares gradient of required temperature data in the section with the mean of the thermal conductivities from the same section to obtain a heat flow per section. The thermal depth method explained by Cermak and Jessop (1971) was also used for heat flow calculations. This method combines temperature at depth corrected for past climates, thermal conductivity and mean surface temperature. Heat flows were calculated for every 30 m and 190 m at the four Drake Point sites, and for every 30 m and 250 m at Hecla I-69. These depths were arbitrarily chosen in response to any possible underground temperatures reflecting recent climatic changes, as well as irregularities or anomalies within borehole measurements.

Several corrections to the temperature and heat flow were necessary to change the vertical curvatures in the various heat flow profiles of Appendix B. First, a topographic correction takes into consideration large water bodies and undulating relief in the vicinity of the wellsite, mean surface temperature, mean seawater temperature (approximately -1.5°C) and geothermal gradient. Second, a moving shoreline correction was considered. This is of particular importance since all wellsites are located approximately between 0.02 km and 12.0 km from the shore. It is assumed that the mean ground surface and seawater temperatures are different. Third, a climatic correction was considered by using both an assumed climatic history of the area and an ice-base temperature during glaciation. The theory and method of calculating climatic corrections to heat flow measurements are described by Birch (1948) and Crain (1969).

By introducing a correction for the effect of the last glaciation (Wisconsin) under the assumption that it terminated approximately 11,900 years ago (Denton and Hughes, 1981), one assumes surface temperatures relative to the present day (which acts as the reference temperature). Climatic corrections are based on the difference between the assumed temperatures in the past and extrapolated surface temperature from present observations.

Palaeoclimatic trends in the Arctic are depicted diagrammatically in Figure 26a - d. A range of temperatures was then considered for each time interval and heat flows were subsequently obtained (Table 8).

It is assumed that the prevailing temperature on the ice-ground boundary was close to pressure melting point during most of glacial times. A glacial ice-base temperature of between -3.8°C to -6.9°C was assumed. By

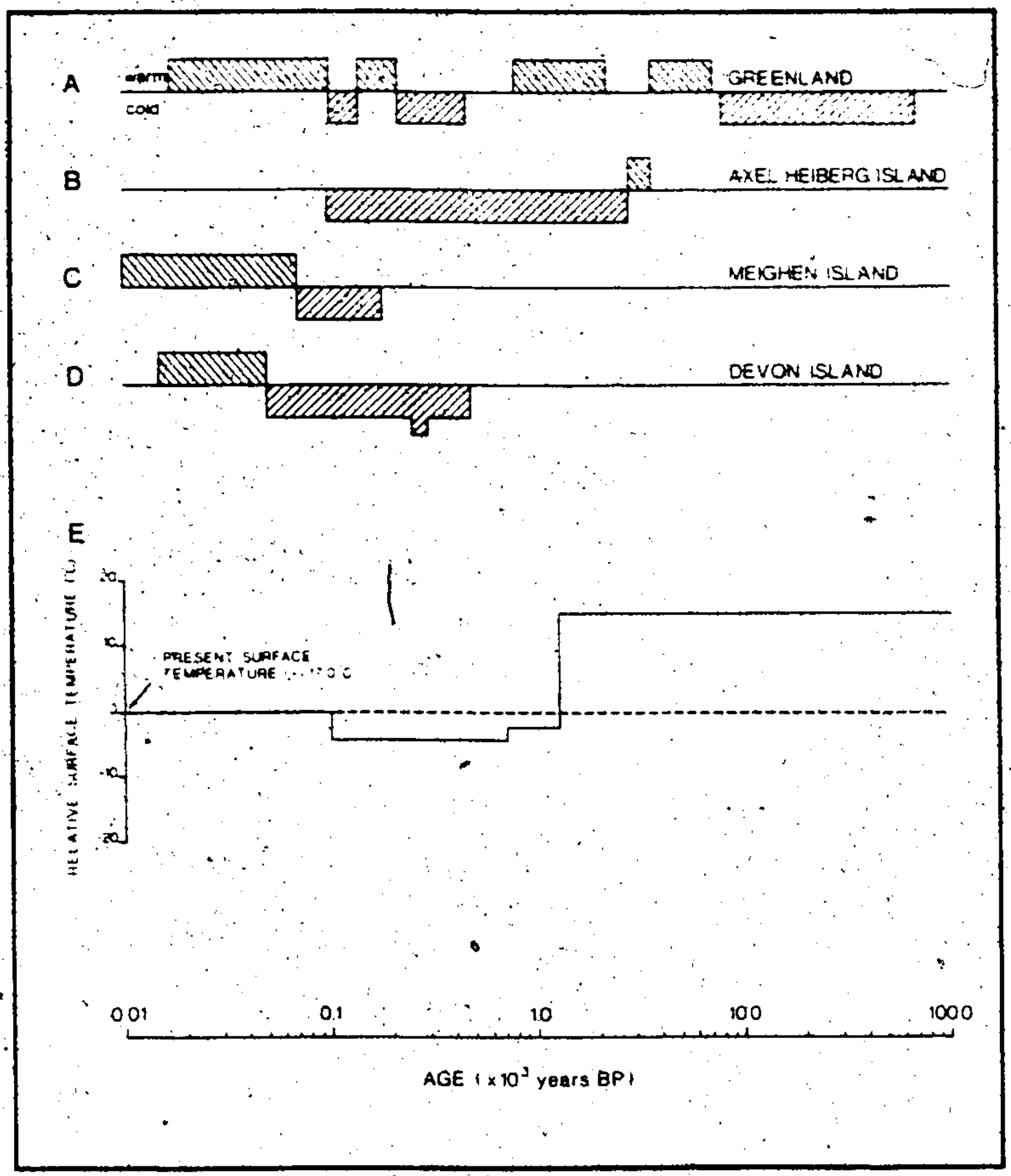


Figure 26 Palaeoclimatic trends (A-D) from the Arctic indicating previously cooler and/or warmer ground surface temperatures (A—Dansgaard et al., 1970; 1971; B--Nichols, 1972; C--Paterson, 1968; D--Fisher and Koerner, 1981). The main trends are used to assume past ground surface temperatures for the Sabine Peninsula consistent with the geothermal regime (i.e., prior to 10,000 years ago one assumes temperatures 10°C warmer than present ground surface temperatures). E--Sample of climatic model used to generate heat flow values listed in Table 8.

Table 8

Values of Heat Flow from the Sabine Peninsula, Eastern Melville Island.

Wellsites	Heat Flow (mWm^{-2})			
	Uncorrected (measured)	Corrected for Topography	Corrected for Moving Shorelines	Corrected for Climatic History
Drake B-44	108.0±3.7	94.8±2.3	118.8±3.9	78.1±1.9
Drake E-78	119.8±3.2	103.5±2.0	73.2±3.2	64.8±2.0
Drake D-73	163.9±9.1	159.6±8.9	148.1±7.7	139.9±7.4
Drake D-68	99.6±2.7	99.0±2.7	99.6±2.7	91.8±2.1
Hecla I-69	77.3±2.9	80.3±2.6	81.0±3.4	87.8±1.4

using these values along with mean surface temperatures, a difference of 15°C was obtained. The climatic model shown in Figure 26e assumes ice-base temperatures and average surface temperatures of 1°C cooler than present for each wellsite.

A probable error of 15% to 20% results from the climatic correction. Jessop (1968; 1983) and Cermak and Jessop (1971) report errors of 10% to 30% for similar corrections. Problems likely to be encountered in determining reliable temperature gradients, thermal conductivities and heat flows have been described in many places in the literature (Beck, 1965; Judge, 1973d).

Calculated equilibrium temperature profiles for the Sabine Peninsula (Figure 27) provide mean ground surface temperatures, permafrost thicknesses and temperature gradients at depth. Table 8 lists the different heat flow values obtained by continuing temperature gradients and thermal conductivities and applying various corrections. The heat flow over the peninsula is relatively uniform and ranges from 64.8 mWm^{-2} to 119.8 mWm^{-2}, with the exception of 163.9 mWm^{-2} for Drake D-73. Values for the Sabine Peninsula correspond to projected heat flows previously revealed by Judge (1972; 1973b; 1974b) and Judge and Jessop (1978) who expected the terrestrial heat flow to be high (50 mWm^{-2} to 84 mWm^{-2} or more) in the Sverdrup Basin because of evidence of igneous intrusions in Tertiary times.

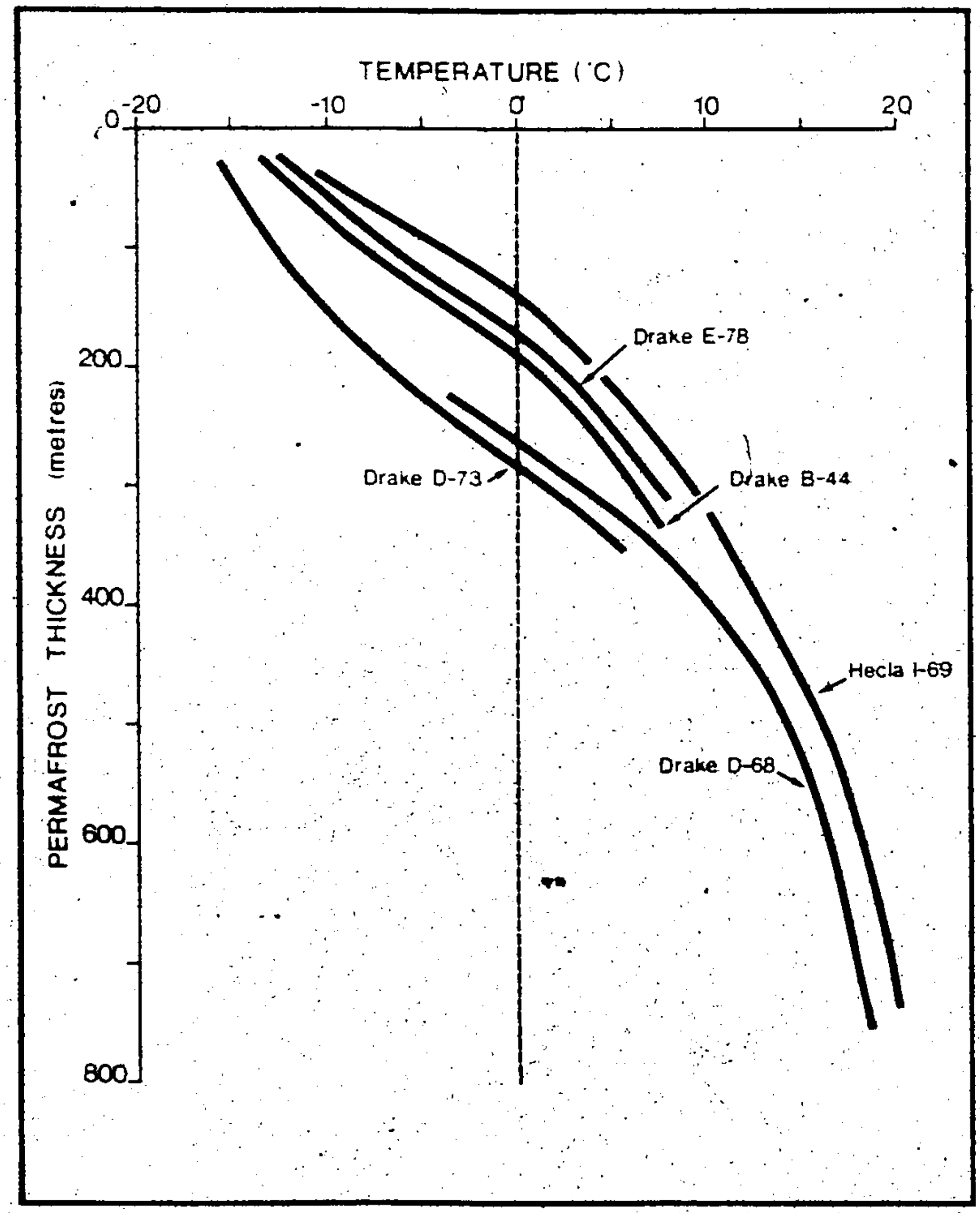


Figure 27 Calculated equilibrium temperature profiles for five wells on the Sabine Peninsula, eastern Melville Island.

The variations of heat flow are the result of different thermal conductivities in addition to thermal effects from the last glaciation. As mentioned by Judge and Beck (1973), geologic formations having higher heat flow values also tend to have higher proportions of low conductivity shales. Such was the case for Drake D-73, Drake D-68, Drake E-78 and Hecla I-69. The mean of all climatically corrected heat flow values shown in Table 8 is 90.4 ± 3.3 mWm^{-2} (i.e., regional heat flow). The gradient, thermal conductivity and heat flow profiles in Appendix B all indicate a decrease from the upper lithology to the lower lithology (e.g., Drake E-78, shale to claystone), and emphasize the importance of the underlying geology and its thermal properties.

Figure 28 suggests that heat flow is lower at sites nearest to the shoreline. This is the result not only of different temperature gradients and thermal conductivities for each formation, but also of present surface temperatures and the influence of the sea.

The main assumption in heat flow determinations is the stability of equilibrium heat with depth whereby changes in temperature gradients are usually accompanied by similar changes in thermal conductivities. Large changes in temperature, gradient and heat flow are shown sequentially in each of the profiles in Appendix B. The pronounced curvatures in gradient and heat flow are common to all wells on the Sabine Peninsula. This type of effect

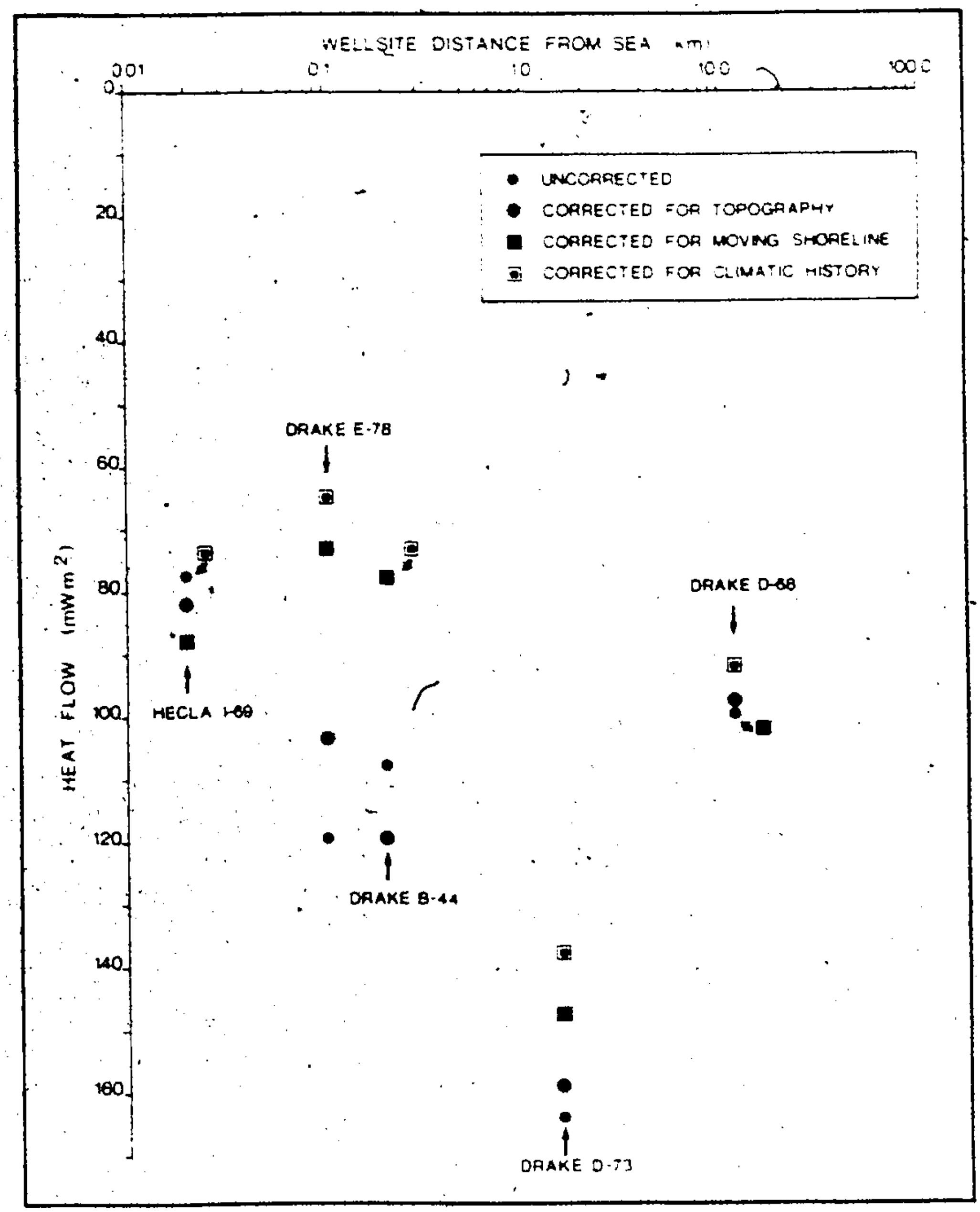


Figure 28 Diagram illustrating relationship between heat flow and distance from the sea for five wells on the Sabine Peninsula. Heat flow appears to be generally higher with distance from the sea.

was also noticed by Misener (1955) in a deep well near Resolute Bay. However, the curvatures on the peninsula seem to occur at similar depth intervals and may arise from the climatic influence of the Little Ice Age (approximately 100 to 500 years BP) and/or from the effect of Late Quaternary submergence and emergence.

Minor sequential changes occurred in the top sections of the temperature, temperature gradient and heat flow profiles as the years of submergence of the sites were changed, especially for Drake B-44, Drake E-78 and Hecla I-69. These sites have emerged only in the last 700 to 1,400 years, thus suggesting that their thermal regimes, in comparison to inland sites, have not yet attained their quasi-equilibrium state with the present ground surface temperature.

The effect of ground surface temperatures prior to submergence, seabottom temperatures upon submergence and ground surface temperatures upon submergence are apparent in the upper few hundred metres of the composite temperature profiles of the Sabine Peninsula (see Figure 27). As in the case of most wells in the Arctic, the temperature profiles parallel each other and their gradients change abruptly as they cross the 0°C isotherm. This change from low gradient in permafrost to high gradient beneath, is caused by a change from high conductivity in permafrost to low conductivity beneath. This change in gradients below the permafrost base also suggests a thermal equilibrium state with the surface temperature of several thousand years ago.

5.3.3 Prediction of permafrost thicknesses

The application of various corrections to the heat flow values are useful in determining permafrost thickness. Climatic corrections suggest Pleistocene ice-base temperatures and average surface temperatures 1°C cooler than present. This type of correction extrapolates former permafrost depths in excess of present depths (Table 9). Heat flows obtained from the corrected model predict equilibrium permafrost thicknesses which could have existed in areas free of ice during Late Quaternary times. Permafrost would be considerably thicker if conditions were in equilibrium with today's present MASST (approximately -17.0°C). Permafrost thicknesses vary from 143 m to 188 m at coastal wells (Drake B-44, Drake E-78 and Hecla I-69) while inland wells which experienced short marine inundation (Drake D-68 and Drake D-73) are more uniform in thickness, varying between 264 m and 288 m. Table 9 shows the variability of permafrost thicknesses when corrections are taken into account.

The permafrost thicknesses for Drake F-16 and Drake K-67A were calculated from Terzaghi's (1952) equation and from the following generalized heat flow equation:

$$Q = -k \nabla T \qquad [1]$$

Table 9

Probable Permafrost Depths which may have Existed in Five Wells on the Sabine Peninsula during the Late Quaternary. Depths were Obtained Using Heat Flow Corrections.*

Wellsites	Permafrost Depth (m)				Time Since Emergence
	Measured	Corrected for Topography	Corrected for Moving Shoreline	Corrected for Climatic History	$\times 10^3$ years BP
Drake B-44	188	365	205	277	1.15
Drake E-78	171	190	191	307	0.70
Drake D-73	288	294	289	306	8.33
Drake D-68	264	267	264	270	8.65
Hecla I-69	143	366	153	240	0.70

* See text.

where Q is the heat flow (mWm^{-2}); k is the thermal conductivity ($Wm^{-1}K^{-1}$); and ∇T is the temperature gradient (mKm^{-1}).

A permafrost thickness of 654 m was predicted for Drake F-16 by using the mean thermal conductivity value of 2.5 $Wm^{-1}K^{-1}$ (with an assumed porosity of 15% for ice above 200 m and 15% for water below 200 m), along with an appropriate regional heat flow and ground surface temperature. A thickness of 618 m was predicted for Drake K-67A with a mean conductivity of 2.8 $Wm^{-1}K^{-1}$ (with an assumed porosity of 15% for ice above 250 m and 15% for water below 250 m). These predicted values are not of the same order of magnitude as those of nearby wells. This may be due, in part, to low temperature gradients at depth, since nearby wells experience gradients in the range of 42 mKm^{-1} to 52 mKm^{-1}. Temperature gradients of 83 mKm^{-1} for Drake F-16 and 64 mKm^{-1} for Drake K-67A would be required in order to obtain permafrost thicknesses in the range of 200 m to 250 m, but gradients of this magnitude are too high for the Sabine Peninsula and the Sverdrup Basin.

Permafrost thicknesses for Drake F-16 and Drake K-67A were also predicted by using the same computer program which produced corrected heat flow values. Main heat flows and temperature gradients for varying depth intervals combined with the thermal conductivity values and ground surface temperatures for Drake F-16 and K-67A enable the calculation of permafrost thickness. For example, permafrost thicknesses of 214 m and 275 m were predicted for Drake F-16 and Drake K-67A, respectively.

The difference in the predicted permafrost thickness is problematic. The first prediction considers neither the effect of a large water body, nor topographic, climatic and glacial influences. By contrast, the second prediction regards these as important factors. Permafrost thicknesses obtained by the latter prediction are of the same order of magnitude as the other wells on the peninsula (i.e., within the range of 143 m to 288 m). This may be due to low ground surface temperatures, the high geothermal heat flow of the Sverdrup Basin and the low thermal conductivity of the Christopher Formation (i.e., shale, sandstone and claystone).

5.4 Summary

Ground temperature measurements and the analysis of the thermal conductivity of rock material recovered from seven wells indicate the geothermal regime of the Sabine Peninsula.

Thermal profiles (e.g., temperature, gradient and heat flow) reveal a pronounced curvature at the Drake Point wells. This suggests that the thermal properties of the lithology are susceptible to slight changes in gradients around the 0°C isotherm. In all probability, they were climatically and/or glacially influenced prior to submergence. The estimated *in situ* thermal conductivity values for the seven wells ranged from 2.0 $Wm^{-1}K^{-1}$ to 4.8 $Wm^{-1}K^{-1}$. They were derived assuming porosities of 15% and 20%. From a combination of known thermal conductivity values and temperature gradients, the regional heat flow from the earth's interior was calculated to be 90.4±3.3 mWm^{-2}, a value typical for the Sverdrup Basin (Judge, 1973; 1974b).

With a general knowledge of the thermal properties and heat flow in the Sabine Peninsula, it is possible to infer the nature of some of the physical factors controlling the thermal regime. For instance, permafrost thickness does reflect lithology (i.e., ice-rich sediments of the Christopher Formation), the generally high heat flow (suggestive of a geologically young basin and/or long-lived heat source) and the recent emergence from the sea. It would appear therefore, that permafrost thicknesses on the peninsula are also controlled by both Late Quaternary geomorphic history and the thermal properties of rock material.

CHAPTER SIX

CONCLUSIONS

6.1 General

The purpose of this thesis was to relate differences in permafrost temperature and thickness to variations in distance from sea, time since emergence and thermal conductivity. The temporal dimension demanded knowledge of the Late Quaternary history of the Queen Elizabeth Islands whereas the spatial dimension demanded an analysis of the dynamic behaviour of permafrost at a regional level.

During Late Quaternary times, permafrost thickness was not due solely to climatic conditions but also to geomorphic history and the thermal properties of rock materials.

Several correlations are apparent between permafrost thicknesses and site-specific factors. The first is that permafrost thickness increases with distance from the sea. This is mainly because of the warming effect of the sea and the influence of submergence in the Late Quaternary. Since the presence of permafrost depends on historical factors as well as on present conditions, it is assumed that permafrost degraded during submergence and aggraded following emergence. Furthermore, the isostatic responses of the earth's crust gave rise to non-equilibrium thermal conditions.

The second correlation relates permafrost thickness to elevation. Most sites located at an elevation below the inferred maximum marine limit experienced submergence for a relatively short period of time (700 to 9,500 years BP). The fact that submergence affected the thermal regime of permafrost is in itself an important consideration when assessing permafrost variability. For sites located at greater elevations (i.e., above the inferred maximum marine limit), permafrost varied according to local climatic conditions (past and present), geology and thermal properties. Sites located below marine limit experience thinner permafrost than those above marine limit.

Deeper permafrost may have existed at sites below the inferred maximum marine limit if little or no submergence had occurred. Thus, permafrost thicknesses in previously inundated areas are related to time since emergence. This conclusion is supported by the deep permafrost values predicted for the Sabine Peninsula of Melville Island. Nevertheless, the low conductivities and high temperature gradients observed on the peninsula have contributed to thicker permafrost in sites near the marine limit than coastal sites.

Thermal conductivity, temperature gradient and heat flow are important thermal parameters in the prediction of permafrost thickness. The regional terrestrial heat flow of the Sabine Peninsula was obtained using a one-dimensional model based on the heat conduction theory.

As a result, the low thermal conductivity and high temperature gradient of the subsurface material yielded a high heat flow in the Sabine Peninsula, typical of the High Arctic Islands. These parameters have led to relatively shallow permafrost in comparison to other sites elsewhere in the Sverdrup Basin, and have facilitated the prediction of permafrost thickness in two wells where the geology is known but no deep temperature data exists.

The geothermal regime of the Sabine Peninsula is influenced by thermal properties of rock material, Late Quaternary history (e.g., submergence and emergence) and present day climatic conditions. The data show that permafrost thicknesses on the Sabine Peninsula range from 143 m in coastal wells to 288 m in inland wells, with a mean thermal conductivity of 3.1 ± 0.3 $Wm^{-1}K^{-1}$, a mean geothermal gradient of 48 mKm^{-1} and a mean heat flow of 90.4 ± 3.3 mWm^{-2}. Thermal conductivity values are of the same order of magnitude as those reported by Judge (1973b) and Judge and Beck (1973). In addition, the high temperature gradients, as in the case of heat flow, are typical of the Sverdrup Basin.

Since the geothermal data and geomorphic history of each site are difficult to relate, it is suggested that thermal parameters are more important than Late Quaternary conditions in influencing permafrost. However, the thermal effect of a large water body appears to significantly modify permafrost. Such an effect most likely occurs throughout all the Arctic Islands.

6.2 Limitations and future research

Limitations of the study relate to (a) the restricted quantity of data used, and (b) the subsequent analysis of the data. Each well experiences lateral and temporal variations of ground surface temperature, and spatial variations of thermal properties of materials.

The main source of error in assigning a thermal conductivity value to a particular formation is the sampling technique. Greater accuracy during the sampling procedures of material would permit a more accurate estimation of thermal conductivities at depth. The technique used on drilling platforms to recover samples is variable. Rock chips of different materials are brought to the surface and assigned an approximate depth. Nevertheless, thermal conductivity values would be more precise if more careful monitoring of sample depth is undertaken.

The few thermal parameters mentioned in the study are by no means the only factors influencing permafrost. Such parameters as thermal diffusivity, specific heat and near-surface thermal studies would allow a complete investigation of thermal regimes at each site. The causes of spatial (e.g., climatic effects) and temporal (e.g., physical effects) variations of ground surface temperatures should also be investigated. Further studies related to disturbances of the surface heat balance caused by either climatic, geomorphic, vegetative or anthropogenic changes are also required to assess the aggradation and degradation of permafrost at sites located below marine limit.

A better knowledge of porosities and conductivities at depth would reveal the actual sensitivity of measured values and involve more precise assumptions when applying corrections to heat flow values. On the other hand, the selection of palaeoclimatic trends and assumed ice-base temperatures used to generate heat flow values are subject to minor inaccuracies since abrupt changes are made on assumed past ground surface temperatures. A more precise method to avoid such anomalies is needed.

The geothermal data of seven wells has been used to develop a simple model of surface temperature history for the Late Quaternary history of the Sabine Peninsula of Melville Island. Present investigations indicate the need for further field and laboratory studies directed toward thermal properties of materials, and subsurface thermal regimes. In addition, further studies related to the effect of Late Quaternary submergence and emergence, as well as ice-sheet boundaries are of utmost importance in the complete understanding of the arctic environment.

APPENDIX A

THERMAL CONDUCTIVITY MEASUREMENTS FOR SEVEN WELLSITES, SABINE PENINSULA

Table A-1

Thermal Conductivity Measurements Derived from the Geometric Model and Estimated *in situ* Thermal Conductivity Values for Drake B-44, Sabine Peninsula.

Depth (m)	Mean Grain Density Mgm^{-3}	Mean Thermal Conductivity from Geometric Model $Wm^{-1}K^{-1}$	Estimated Mean *in situ* Thermal Conductivity ($Wm^{-1}K^{-1}$) from Assumed Porosities (%)				Lithology
			Water .15	Water .20	Ice .15	Ice .20	
							Christopher Formation
30.5	2.64	3.9±0.5	2.9	2.7	3.6	3.5	claystone
64.0	2.63	4.1±0.5	3.1	2.8	3.8	3.6	claystone
88.4	2.65	5.4±0.7	3.9	3.4	4.8	4.5	claystone
112.8	2.66	2.9±0.4	2.3	2.1	2.8	2.8	claystone
134.1	2.63	3.3±0.5	2.5	2.3	3.1	3.0	claystone
152.4	2.74	4.8±0.6	3.5	3.1	4.3	4.1	shale
182.9	2.66	3.6±0.1	2.7	2.5	3.3	3.2	shale
204.2	2.58	3.7±0.8	2.8	2.5	3.4	3.3	shale
234.7	2.66	3.9±0.3	2.9	2.6	3.5	3.5	shale
271.3	2.73	3.5±0.2	2.7	2.4	3.3	3.2	shale
289.6	2.69	2.7±0.1	2.1	2.0	2.6	2.6	shale
301.7	2.59	3.4±0.6	2.6	2.4	3.2	3.1	shale
320.0	2.68	4.4±0.9	3.2	2.9	3.9	3.8	shale
335.3	2.71	3.6±0.3	2.7	2.5	3.4	3.3	shale
371.8	2.65	3.3±0.5	2.5	2.3	3.1	3.0	shale
Mean Values	2.66	3.8±0.5	2.8	2.6	3.5	3.4	

Table A-2

Thermal Conductivity Measurements Derived from the Geometric Model and Estimated *in situ* Thermal Conductivity Values for Drake E-78, Sabine Peninsula.

Depth (m)	Mean Grain Density Mgm^{-3}	Mean Water Content %	Mean Thermal Conductivity from Geometric Model $Wm^{-1}K^{-1}$	Estimated Mean *in situ* Thermal Conductivity ($Wm^{-1}K^{-1}$) from Assumed Porosities (%) Water .15	Water .20	Ice .15	Ice .20	Lithology
								Christopher Formation
30.5	2.50	59	2.7±0.5	2.1	2.0	2.6	2.6	shale
60.9	2.53	60	2.8±0.3	2.2	2.0	2.7	2.6	shale
89.9	2.47	58	2.4±0.1	1.9	1.8	2.3	2.3	shale
121.9	2.51	58	2.8±0.3	2.2	2.0	2.7	2.7	claystone
155.4	2.52	62	2.9±0.7	2.2	2.0	2.7	2.7	claystone
182.9	2.52	56	2.8±0.4	2.2	2.0	2.7	2.7	claystone
213.4	2.51	58	2.8±0.5	2.2	2.0	2.7	2.6	claystone
245.4	2.50	54	2.8±0.2	2.3	2.0	2.7	2.7	claystone
281.9	2.50	55	3.0±0.3	2.3	2.1	2.9	2.8	claystone
300.2	2.58	59	2.8±0.1	2.2	2.0	2.7	2.7	claystone
Mean Values	2.51	58	2.8±0.3	2.2	2.0	2.7	2.6	

Table A-3

Thermal Conductivity Measurements Derived from the Geometric Model and Estimated *in situ* Thermal Conductivity Values for Drake D-73, Sabine Peninsula

Depth (m)	Mean Grain Density Mgm^{-3}	Mean Water Content %	Mean Thermal Conductivity from Geometric Model $Wm^{-1}K^{-1}$	Estimated Mean *in situ* Thermal Conductivity ($Wm^{-1}K^{-1}$) from Assumed Porosities (%) Water .15	Water .20	Ice .15	Ice .20	Lithology
								Christopher Formation
30.5	2.61	60	2.6±0.4	2.1	1.9	2.6	2.5	shale
60.9	2.60	61	2.9±0.4	2.3	2.1	2.8	2.8	shale
91.4	2.58	58	2.9±0.3	2.3	2.1	2.8	2.8	shale
121.9	2.59	58	3.2±0.5	2.5	2.3	3.0	2.9	shale
152.4	2.56	56	3.3±0.4	2.5	2.3	3.1	3.0	shale
182.9	2.58	60	3.1±0.4	2.5	2.2	2.9	2.8	shale
213.4	2.64	60	3.1±0.4	2.4	2.2	2.9	2.9	shale
243.8	2.44	60	2.8±0.4	2.2	2.0	2.7	2.6	shale
274.3	2.51	62	3.0±0.5	2.3	2.1	2.9	2.8	shale
304.8	2.57	57	3.2±0.3	2.5	2.3	3.0	3.0	shale
335.3	2.51	57	2.9±0.2	2.3	2.1	2.8	2.8	shale
365.8	2.52	58	2.7±0.3	2.1	1.9	2.6	2.6	shale
396.2	2.55	58	2.4±0.1	1.9	1.8	2.4	2.4	shale
Mean Values	2.56	59	2.9±0.3	2.3	2.1	2.8	2.8	

Table A-4

Thermal Conductivity Measurements Derived from the Geometric Model and Estimated *In situ* Thermal Conductivity Values for Drake D-68, Sabine Peninsula.

Depth (m)	Mean Grain Density Mgm^{-3}	Mean Water Content %	Mean Thermal Conductivity from Geometric Model $Wm^{-1}K^{-1}$	Estimated Mean *in situ* Thermal Conductivity ($Wm^{-1}K^{-1}$) from Assumed Porosities (%): Water .15	Water .20	Ice .15	Ice .20	Lithology
								Christopher Formation
30.5	2.75	59	2.3±0.1	1.8	1.7	2.3	2.2	shale
60.9	2.70	57	2.3±0.1	1.9	1.8	2.3	2.3	shale
106.7	2.68	54	2.4±0.1	1.9	1.8	2.4	2.4	shale
152.4	2.71	58	2.4±0.2	1.9	1.8	2.4	2.4	shale
182.9	2.66	56	2.3±0.1	1.9	1.8	2.3	2.3	shale
228.6	2.67	50	2.8±0.1	2.2	2.0	2.7	2.6	shale
274.3	2.64	48	2.5±0.1	2.0	1.8	2.4	2.4	shale
304.8	2.67	47	2.7±0.1	2.2	2.0	2.6	2.6	shale
335.3	2.73	44	3.0±0.1	2.3	2.1	2.8	2.8	shale
381.0	2.72	50	2.8±0.1	2.2	2.0	2.7	2.7	shale
426.7	2.59	37	2.3±0.1	1.8	1.7	2.2	2.3	sandstone
457.2	2.69	33	3.1±0.2	2.4	2.2	2.9	2.9	claystone
484.6	2.67	32	4.1±0.3	3.0	2.7	3.7	3.6	sandstone
518.2	2.72	42	2.7±0.2	2.1	2.0	2.6	2.6	claystone
548.6	2.71	42	2.7±0.2	2.2	2.0	2.7	2.6	claystone
579.1	2.68	43	2.7±0.1	2.1	2.0	2.6	2.6	claystone
606.6	2.86	38	3.6±0.1	2.7	2.5	3.3	3.2	claystone
640.1	2.72	37	3.4±0.1	2.6	2.4	3.2	3.1	claystone
670.6	2.82	28	4.6±0.4	3.4	3.0	4.1	4.0	claystone
701.0	2.81	[illegible]	3.7±0.1	2.8	2.5	3.4	3.4	sandstone
731.5	2.67	23	4.3±0.4	3.2	2.9	3.9	3.8	sandstone
762.0	2.57	28	4.3±0.5	3.1	2.8	3.8	3.7	sandstone
795.5	2.66	29	4.4±0.7	3.2	2.9	4.0	3.9	sandstone
Mean Values	2.70	42	3.1±0.2	2.4	2.3	2.9	2.8	

Table A-5

Thermal Conductivity Measurements Derived from the Geometric Model and Estimated in situ Thermal Conductivity Values for Drake K-67A, Sabine Peninsula.

Depth (m)	Mean Grain Density Mgm^{-3}	Mean Water Content %	Mean Thermal Conductivity from Geometric Model $Wm^{-1}K^{-1}$	Estimated Mean in situ Thermal Conductivity ($Wm^{-1}K^{-1}$) from Assumed Porosities (%) Water .15	Water .20	Ice .15	Ice .20	Lithology
								Christopher Formation
42.7	2.46	45	3.5±0.8	2.3	2.1	2.8	2.7	claystone
88.4	2.74	49	3.9±0.2	2.9	2.7	3.6	3.5	claystone
140.2	2.75	54	3.1±0.3	2.4	2.2	3.0	2.9	claystone
195.1	2.80	52	2.5±0.4	1.8	1.7	2.5	2.4	sandstone
246.9	2.85	40	3.3±0.1	2.6	2.3	3.1	3.1	sandstone
280.4	3.01	43	3.7±0.5	3.0	2.7	3.4	3.5	sandstone
301.8	2.81	51	3.3±0.5	2.5	2.3	3.1	3.0	claystone
329.2	2.82	37	4.3±0.4	3.2	2.9	3.9	3.8	sandstone
356.6	2.81	41	3.5±0.4	2.6	2.4	3.2	3.2	sandstone
393.2	2.84	39	3.4±0.1	2.6	2.4	3.2	3.1	sandstone
451.1	2.95	38	4.1±0.3	3.0	2.7	3.7	3.6	sandstone
Mean Values	2.80	44	3.5±0.4	2.6	2.4	3.2	3.2	

Table A-6

Thermal Conductivity Measurements Derived from the Geometric Model and Estimated *in situ* Thermal Conductivity Values for Drake F-16, Sabine Peninsula.

Depth (m)	Mean Grain Density Mgm^{-3}	Mean Water Content %	Mean Thermal Conductivity from Geometric Model $Wm^{-1}K^{-1}$	Estimated Mean *in situ* Thermal Conductivity ($Wm^{-1}K^{-1}$) from Assumed Porosities (%)				Lithology
				Water		Ice		
				.15	.20	.15	.20	
								Christopher Formation
33.5	2.68	62	2.6±0.2	2.1	1.9	2.6	2.5	shale
67.1	2.59	63	2.4±0.2	1.9	1.8	2.3	2.3	shale
102.1	2.41	59	2.4±0.7	1.9	1.8	2.3	2.3	shale
118.9	2.61	65	2.6±0.5	2.0	1.9	2.5	2.5	shale
169.2	2.63	59	2.6±0.2	2.1	1.9	2.5	2.5	shale
217.9	2.67	57	2.6±0.1	2.1	1.9	2.6	2.5	claystone
251.5	2.71	48	2.6±0.5	2.3	2.1	2.9	2.8	claystone
274.3	2.82	41	3.2±0.2	2.5	2.3	3.0	3.0	sandstone
307.8	2.85	37	3.7±0.4	2.9	2.7	3.6	3.3	sandstone
397.8	2.67	47	3.0±0.3	2.3	2.1	2.8	2.8	sandstone
Mean Values	2.66	54	2.8±0.3	2.2	2.0	2.7	2.6	

Table A-7

Thermal Conductivity Measurements Derived from the Geometric Model and Estimated *in situ* Thermal Conductivity Values for Hecla I-69, Sabine Peninsula.

Depth (m)	Mean Grain Density Mgm^{-3}	Mean Thermal Conductivity from Geometric Model $Wm^{-1}K^{-1}$	Estimated Mean *in situ* Thermal Conductivity ($Wm^{-1}K^{-1}$) from Assumed Porosities (%) Water .15	Water .20	Ice .15	Ice .20	Lithology
							Christopher Formation
30.5	2.49	2.0±0.2	1.7	1.6	2.1	2.1	shale
64.0	2.37	2.4±0.1	1.9	1.8	2.4	2.3	shale
88.4	2.53	2.9±0.1	2.3	2.1	2.8	2.8	shale
121.9	2.46	2.5±0.1	2.0	1.8	2.4	2.4	shale
213.4	2.53	2.5±0.2	2.0	1.8	2.4	2.4	shale
457.2	2.60	3.4±0.3	2.6	2.3	3.2	3.1	Isachsen Formation shale, siltstone
							Mould Bay Formation
472.4	2.64	2.5±0.2	2.0	1.9	2.5	2.5	shale
487.7	2.63	2.5±0.1	2.0	1.9	2.5	2.5	shale
499.8	2.49	2.6±0.2	2.0	1.9	2.5	2.5	shale
521.2	2.54*	2.9±0.2	2.2	2.1	2.8	2.7	shale
551.7	2.49	3.3±0.5	2.5	2.3	3.1	3.0	shale
560.8	2.50	2.9±0.5	2.3	2.1	2.9	2.8	shale
579.1	2.46	2.4±0.4	1.9	1.8	2.4	2.4	shale
594.4	2.53	2.7±0.2	2.2	2.0	2.7	2.6	shale
609.6	2.50	2.5±0.2	2.0	1.9	2.5	2.5	claystone
Mean Values	2.52	2.7±0.2	2.1	1.9	2.6	2.6	

APPENDIX B

PERMAFROST TEMPERATURES, TEMPERATURE GRADIENTS, THERMAL CONDUCTIVITIES AND HEAT FLOW PROFILES FOR FIVE WELLSITES, SABINE PENINSULA

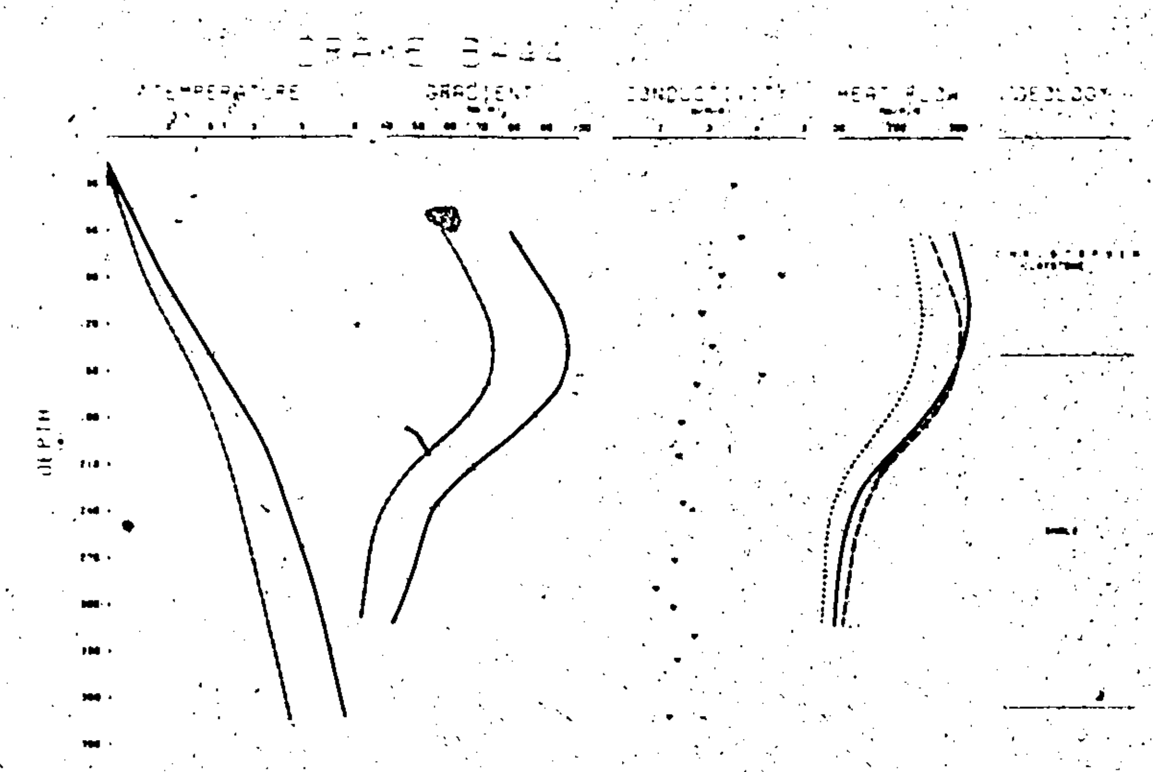


Figure B-1 Temperature, temperature gradient, thermal conductivity and heat flow for Drake B-44. Solid curves show measured values; short dashed curves show values corrected for submergence; long dashed curve shows values corrected for climatic history.

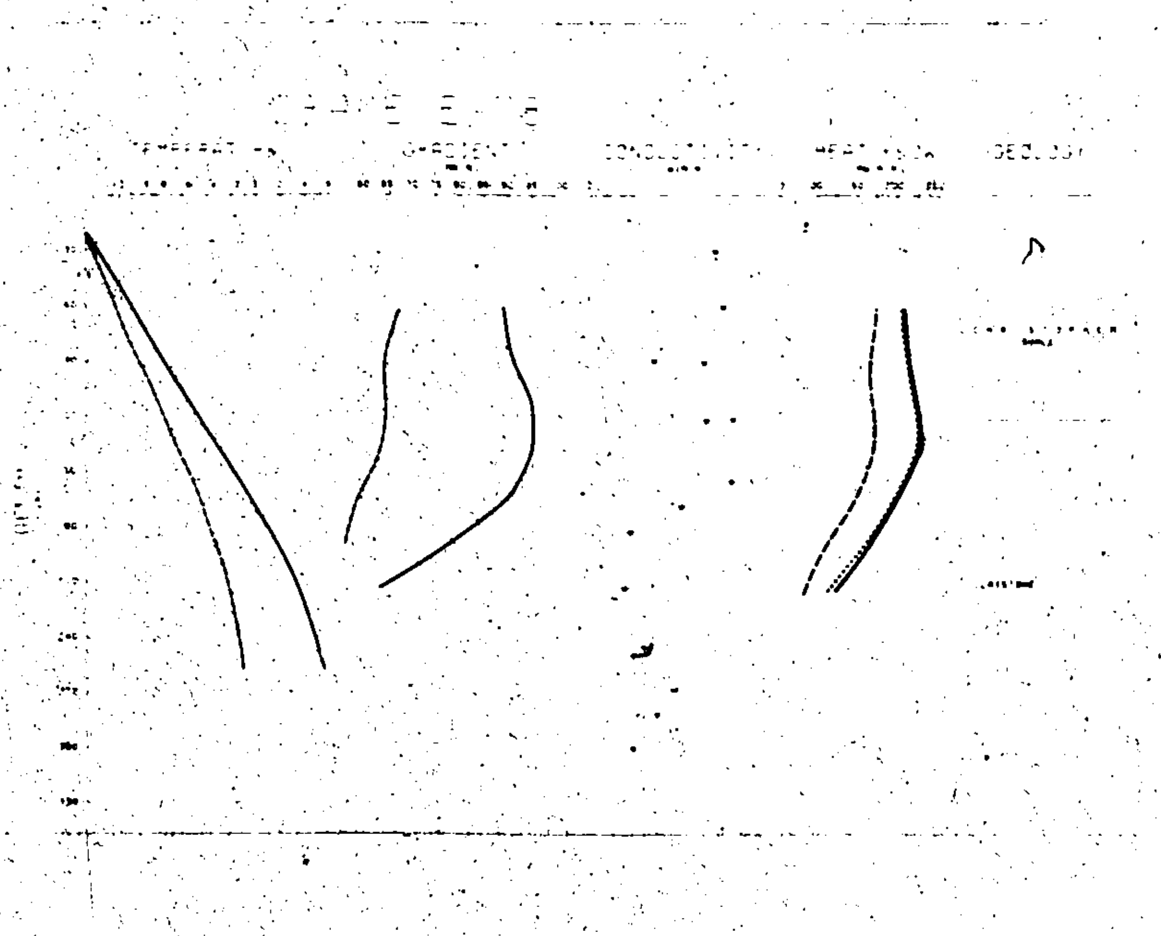


Figure B-2 Temperature, temperature gradient, thermal conductivity and heat flow for Drake E-78. Solid curves show measured values; short dashed curves show values corrected for submergence; long dashed curve shows values corrected for climatic history.

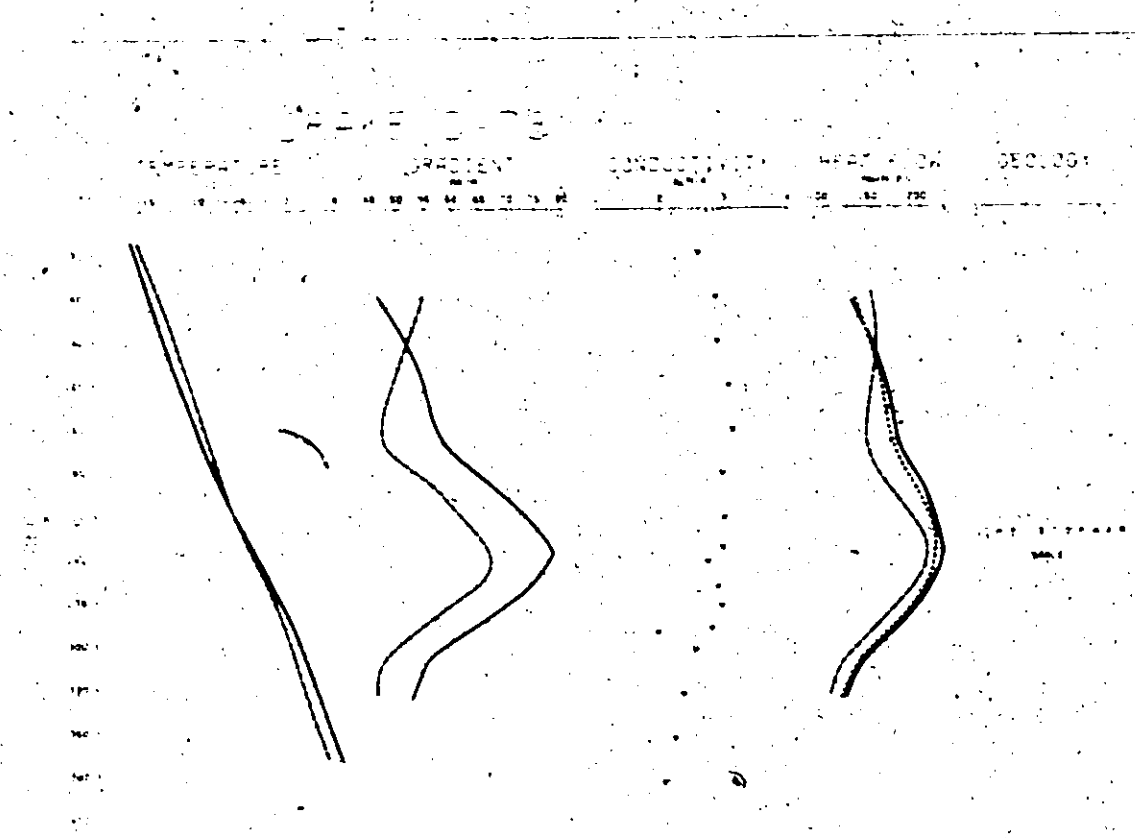


Figure B-3 Temperature, temperature gradient, thermal conductivity and heat flow for Drake D-73. Solid curves show measured values; short dashed curves show values corrected for submergence; long dashed curve shows values corrected for climatic history.

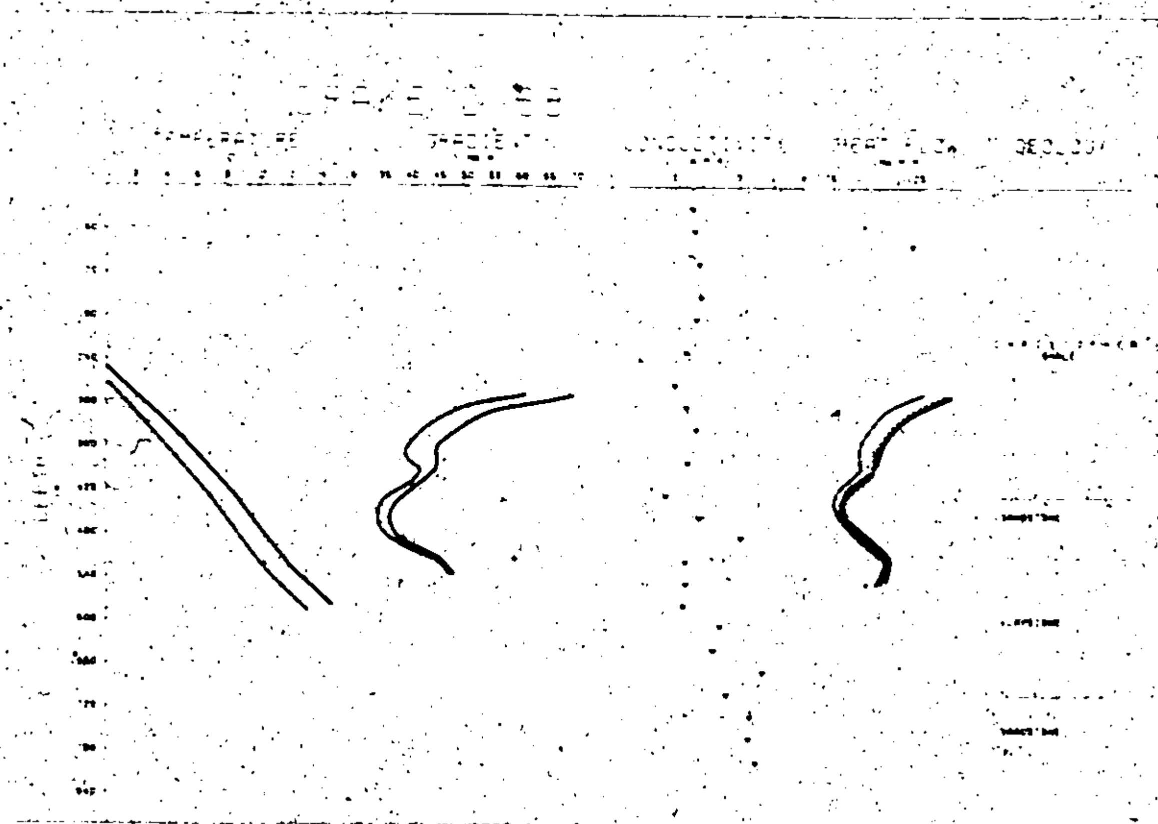


Figure B-4 Temperature, temperature gradient, thermal conductivity and heat flow for Drake D-68. Solid curves show measured values; short dashed curves show valdes corrected for submergence; long dashed curve shows values corrected for climatic history.

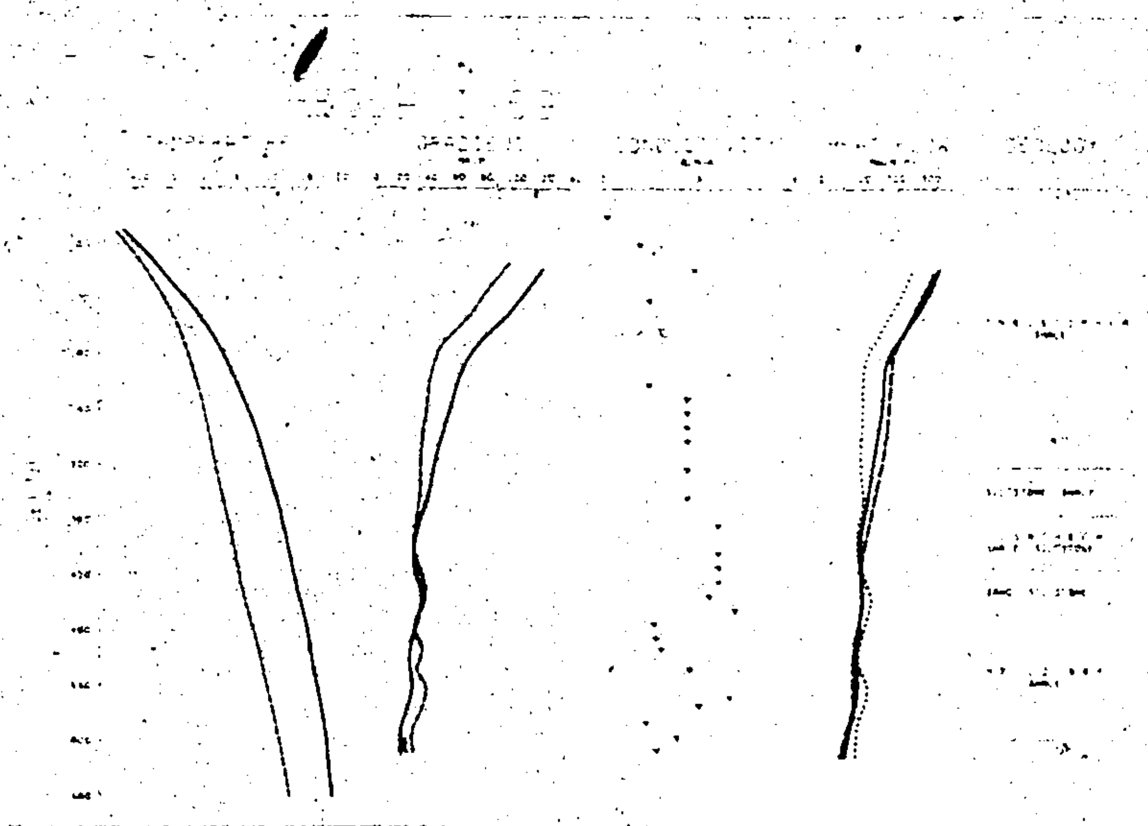


Figure B-5 Temperature, temperature gradient, thermal conductivity and heat flow for Hecla I-69. Solid curves show measured values; short dashed curves show values corrected for submergence; long dashed curve shows values corrected for climatic history.

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Dans Re Lundie Brothers Ltd., le demandeur a, entre autres conclusions, cherché à obtenir l'annulation d'une résolution du conseil d'administration qui l'a destitué de son poste d'administrateur et de dirigeant, de même qu'une modification de l'entente régissant la signature des chèques au nom de la société.[287]

Ce ne sont là que deux décisions judiciaires où le demandeur a cherché à obtenir une ordonnance qui réglemente la manière dont la société dirigera ses affaires. Les possibilités sont infinies et ne relèvent que de l'imagination des plaideurs et de la diversité des faits dont le tribunal est saisi.

Rappelons toutefois la mise en garde du tribunal dans Re Antigen Laboratories Ltd., en vertu de laquelle le demandeur ne peut se contenter de réclamer une vague ordonnance qui vise à réglementer pour l'avenir la direction des affaires de la société, mais doit plutôt suggérer au tribunal la manière précise dont il exercera son pouvoir.[288]

Paragraphe 3 - Le tribunal peut ordonner le rachat d'actions

Le premier aspect qu'il faut souligner au sujet de ce pouvoir particulier du tribunal, c'est qu'il permet au demandeur de solliciter une ordonnance, soit en vue de se porter acquéreur des actions qui appartiennent aux défendeurs,[289] soit en vue d'obtenir le rachat de ses actions par les défendeurs[290] ou par la société elle-même.[291]

Cet achat ou ce rachat d'actions permettent de mettre fin à l'oppression[292] ou au préjudice injuste subi par le demandeur, puisqu'il a l'effet d'exclure de la société le demandeur ou les défendeurs. A l'occasion de la fixation du prix d'achat ou de rachat des actions, le tribunal détermine un prix qui permet d'accorder une compensation au demandeur pour le préjudice qu'il a subi.

Si le cours des actions du demandeur a été dévalué par suite de la conduite oppressive des défendeurs et que le tribunal ordonne le rachat des actions du demandeur par les défendeurs, ceux-ci paieront un prix équivalent à ce qu'aurait été le cours des actions à la date de l'institution du recours, s'il n'y avait pas eu de conduite oppressive.[293]

Lorsque le tribunal ordonne le rachat des actions du demandeur par la société, il s'agit là d'une exception au principe qui interdit à la société de procéder au rachat de ses actions[294] afin notamment de protéger ses créanciers. En pareil cas, l'article 210 du Companies Act 1948 et l'article 75 du Companies Act 1980 prévoient que le tribunal ordonnera également la réduction proportionnelle du capital-actions émis de la société.

Comme en fait état lord Denning dans Scottish Co-operative Wholesale Society Ltd. v. Meyer, l'achat ou le rachat d'actions s'avère une des ordonnances les plus utiles que prévoit spécifiquement la loi, parce que cette ordonnance permet au tribunal de rendre justice aux actionnaires qui ont subi un préjudice. Il n'y a en effet rien qui s'oppose à ce que le tribunal, dans l'exercice de sa discrétion et lors de la fixation du prix d'achat ou de rachat des actions, contraigne les défendeurs à compenser le demandeur pour le préjudice que ceux-ci lui ont causé.[295]

L'achat ou le rachat d'actions constituent l'alternative valable à l'ordonnance de liquidation et de dissolution d'une société, en ce qu'elle préserve l'existence de la société en cause, mais assure le retrait de l'une des parties au litige en lui garantissant un juste prix pour ses actions. La société peut alors poursuivre son existence, cette fois libérée de toute querelle interne.

Ce type de redressement judiciaire obtient la faveur des plaideurs,[296] de même que l'encouragement du tribunal qui n'hésite parfois pas à conseiller aux parties d'en venir à une transaction sur le litige au moyen de l'achat ou du rachat des actions de l'une des parties,[297] le meilleur règlement d'un litige étant toujours celui convenu par les parties d'un commun accord.

Paragraphe 4 - Le tribunal peut ordonner une modification aux statuts de la société

Les paragraphes 210(3) et (4) du <u>Companies Act 1948</u>, de même que les paragraphes 75(5), (6) et (7) du <u>Companies Act 1980</u>, prévoient un régime détaillé de dispositions applicables lorsque le tribunal ordonne une modification aux statuts d'une société.

La modification ordonnée par le tribunal produit les mêmes effets que si elle avait été dûment adoptée par une résolution de l'assemblée générale des actionnaires, et les dispositions de la législation applicable aux sociétés régissent les statuts ainsi modifiés.

Nonobstant toute autre disposition de la législation applicable aux sociétés, la société ne peut toutefois, sans l'autorisation du tribunal, modifier ensuite ses statuts de manière à contrevenir à l'ordonnance du tribunal.

Lorsque le tribunal ordonne une modification aux statuts de la société, celle-ci doit déposer une copie de cette modification auprès du registraire des sociétés. Si la société ne s'exécute pas dans les quatorze jours qui suivent la date de l'ordonnance, la société et chacun de ses administrateurs s'exposent à payer une amende pour avoir contrevenu aux dispositions de la loi.

Sollicitée à titre accessoire dans Re H.R. Harmer Ltd.[298] et dans Re Lundie Brothers Ltd.,[299] cette ordonnance n'a été accordée qu'une seule fois dans l'arrêt Re H.R. Harmer Ltd. Elle peut toutefois se révéler fort utile à titre de complément aux autres mesures ordonnées par le tribunal.

Dans Re H.R. Harmer Ltd., le tribunal a ordonné la modification des statuts de la société en cause afin de destituer le principal défendeur de son poste de président-directeur général de la société, parce que les statuts de la société lui garantissaient un droit viager au poste de président-directeur général.[300]

Dans Re Lundie Brothers Ltd., le demandeur a sollicité une ordonnance pour modifier les statuts de la société afin d'enlever au président-directeur général de la société son droit de vote prépondérant en cas d'égalité des voix.[301]

Paragraphe 5 - Le tribunal peut condamner la société ou tout actionnaire de celle-ci au paiement des frais

Les recueils judiciaires ne contiennent qu'une seule décision où le tribunal discute de la condamnation à payer les frais judiciaires subis dans le cadre du recours de l'article 210 du Companies Act 1948, et il s'agit de la décision Re S.A. Hawken Ltd.[302]

Avec le consentement des parties, le tribunal ordonne la liquidation et la dissolution de la société en cause et décide que les frais subis par les demandeurs et la société seront payables à même le produit de la liquidation de la société. Le litige de la décision Re S. A. Hawken Ltd. porte toutefois sur les frais judiciaires recouvrables par les demandeurs et l'inclusion des frais afférents à une preuve supplémentaire qui n'est pas requise par les règles de pratique du tribunal en matière de liquidation et de dissolution d'une société.

Le juge Wynn-Parry décide que l'affidavit prescrit par les règles de pratique est toujours nécessaire, mais quelquefois insuffisant, et doit alors être complété par une preuve additionnelle. En pareil cas, le tribunal fera droit aux frais relatifs à cette preuve additionnelle, surtout si les défendeurs contestent initialement la demande présentée dans le cadre de l'article 210 du Companies Act 1948.[303]

Même si la décision Re S.A. Hawken Ltd. constitue le seul exemple de contestation au niveau des frais du recours de l'article 210 du Companies Act 1948 ou de l'article 75 du Companies Act 1980, il est bon de rappeler que ces deux articles confèrent au tribunal la plus entière discrétion de prononcer toute ordonnance qu'il juge appropriée, y compris évidemment une ordonnance relative aux frais du recours.

En cette matière, le tribunal suivra habituellement la pratique de condamner la partie perdante aux frais, mais pourra aussi ordonner, s'il y a lieu, leur paiement à même le produit de la liquidation de la société en cause.

Dans le cadre du recours de l'article 75 du Companies Act 1980, le tribunal peut autoriser, aux conditions qu'il détermine, l'institution d'un recours dérivé. Le cas échéant, à la requête du demandeur, la permission du tribunal pourra être liée à une ordonnance qui accorde au demandeur les frais provisoires du recours. Le recours dérivé est alors intenté au nom et donc aux frais de la société.[304]

Même avant l'adoption du recours de l'article 75 du Companies Act 1980, l'arrêt Wallersteiner v. Moir (No 2) a prévu la possibilité pour l'actionnaire de s'adresser au tribunal en cours d'instance pour obtenir une ordonnance provisoire quant aux frais du recours dérivé.[305]

A la lumière de la discrétion illimitée dont jouit le tribunal dans le cadre du recours de l'article 75 du Companies Act 1980, il est permis de croire que les pouvoirs du tribunal ne se limitent pas au jugement final, mais lui permettent d'ordonner la condamnation au paiement des frais judiciaires du recours, même à titre provisoire, afin de permettre au demandeur de poursuivre son recours. Rien n'empêche également le tribunal d'ordonner, outre les frais judiciaires, le paiement de frais extra-judiciaires là où les circonstances le justifient.

Les recueils judiciaires ne font toutefois pas encore état de telles décisions, et il faut donc laisser aux plaideurs le soin de faire valoir le mérite de l'argumentation qui précède.

Section II - Les pouvoirs particuliers conférés par l'article 75 du Companies Act 1980

Loin de limiter la discrétion du tribunal, l'énumération de conclusions particulières dans le texte de l'article 75 du Companies Act 1980 permet au demandeur de concevoir plus facilement les conclusions de son recours.

La liste des ordonnances spécifiquement décrites par l'article 75 du Companies Act 1980 est plus importante que celle de l'article 210 du Companies Act 1948, mais ne sera peut-être jamais complètement employée parce que la seule menace d'un recours fondé sur l'article 75 du Companies Act 1980 peut suffire à éviter certains excès dans la direction des affaires d'une société.[306]

Paragraphe 1 - Le tribunal peut prononcer une ordonnance prohibitive

Par ce pouvoir spécifique qu'il ne faut pas confondre avec le pouvoir du tribunal de réglementer la manière dont la société dirigera ses affaires, le législateur a créé une ordonnance qui est semblable à l'injonction négatoire[307] et permet au tribunal d'ordonner à la société de ne pas faire ou de cesser de faire toute action que le demandeur lui reproche.

Cette ordonnance peut s'avérer très utile pour restreindre la commission d'une seule action qui porterait injustement préjudice aux droits du demandeur, comme, par exemple, la modification des statuts d'une société.[308]

Paragraphe 2 - Le tribunal peut prononcer une ordonnance mandatoire

Semblable à l'injonction mandatoire,[309] ce pouvoir permet au tribunal d'enjoindre à la société de faire toute action déterminée lorsque le demandeur établit que l'omission de faire cette action lui cause injustement préjudice.

Paragraphe 3 - Le tribunal peut autoriser un recours dérivé

Dernier pouvoir particulier que prévoit spécifiquement l'article 75 du Companies Act 1980, ce point ne fera l'objet d'aucun commentaire puisqu'à l'exception de ce que nous en avons déjà dit de manière accessoire, le recours dérivé ne fait pas partie de notre étude.

Conclusion

L'étude successive du recours au cas d'oppression de l'article 210 du Companies Act 1948 et du recours au cas de préjudice injuste de l'article 75 du Companies Act 1980, permet de tirer certaines conclusions.

En premier lieu, il faut constater que le recours de l'article 75 du Companies Act 1980 protège mieux les droits de l'actionnaire minoritaire en lui permettant de s'adresser plus souvent aux tribunaux pour obtenir un redressement judiciaire à l'égard d'un plus grand nombre d'actes répréhensibles dont la responsabilité incombe non seulement à la société, mais en dernière analyse à ses actionnaires majoritaires et à ses administrateurs.

A cet égard, il faut rappeler que le recours de l'article 75 du Companies Act 1980 ne permet pas de s'attaquer aux résolutions de l'assemblée générale des actionnaires si elles ne sont pas suivies d'une action ou d'une omission de la société ni d'entreprendre en justice les actions individuelles posées par certains actionnaires.

Dans le but de mieux protéger les actionnaires minoritaires en pareille situation, certains législateurs américains ont imposé aux actionnaires majoritaires et aux administrateurs d'une société, l'obligation d'agir avec intégrité, loyauté, bonne foi et justice envers la société et ses actionnaires minoritaires.[310]

L'adoption d'une telle solution en droit britannique irait à l'encontre de la décision Percival v. Wright,[311] mais force nous est de conclure à la nécessité de ce renversement jurisprudentiel qui seul peut contribuer à mieux protéger les droits des actionnaires minoritaires d'une société.

Nous avons également vu que l'article 75 du Companies Act 1980 couvre l'action ou l'omission commise au nom de la société par un de ses administrateurs, dirigeants ou mandataires. Il y aurait sans doute lieu de modifier le texte de l'article 75 du Companies Act 1980 pour bien mettre en évidence qu'il vise non seulement l'action ou l'omission de la société elle-même, mais aussi cette action ou omission lorsqu'elle est commise au nom de la société par un administrateur, dirigeant, employé ou mandataire de la société.

A l'occasion de cette modification, la portée de l'article 75 du Companies Act 1980 pourrait être étendue de manière à couvrir l'action ou l'omission de l'assemblée générale des actionnaires, de même que l'action ou l'omission d'un ou de plusieurs actionnaires qui, ensemble, détiennent la majorité du droit de vote qui peut être exprimé lors d'une assemblée générale des actionnaires.

En second lieu, il convient de noter le développement prometteur d'une nouvelle norme de justice dans la direction des affaires d'une société, laquelle norme permettra aux tribunaux de trancher tout litige fondé sur l'article 75 du Companies Act 1980. A cette occasion, les tribunaux devront veiller à établir un juste équilibre entre les droits d'un actionnaire minoritaire et ceux qui appartiennent aux actionnaires majoritaires.

En dernier lieu, il incombe aux tribunaux de définir les sources du préjudice injuste causé aux droits de l'actionnaire-demandeur dans le cadre d'un recours intenté en vertu de l'article 75 du <u>Companies Act 1980</u>. A cet égard, il faut souhaiter que le critère de l'absence d'intérêt de la société joue un rôle prédominant dans l'examen de la validité d'une action ou d'une omission imputable à la société, ses administrateurs, dirigeants, mandataires ou actionnaires majoritaires.

De même, souhaitons que soit levée dans les plus brefs délais toute ambiguïté au sujet du préjudice injuste causé aux droits de l'actionnaire-demandeur lorsque les faits imputables à la société lui permettent de demander, pour des motifs de justice et d'équité, la liquidation et la dissolution de la société dont il est actionnaire.

Les prochaines années verront donc surgir un nouveau droit des actionnaires minoritaires axé sur le recours de l'article 75 du Companies Act 1980. L'auteur espère que cette thèse a mis en lumière certaines des voies qu'empruntera la jurisprudence pour reconnaître à l'actionnaire minoritaire de nouveaux droits et lui accorder un accès plus facile et plus fréquent auprès des tribunaux.

NOTES

1. Cette estimation du nombre des démocraties est tirée d'une conférence prononcée le 3 mars 1983 à l'Université d'Ottawa par Madame Simone VEIL, dans le cadre des Conférences Yvon Beaulne sur la protection internationale des droits de la personne. Intitulé Les droits fondamentaux et le Parlement européen, le texte de cette conférence est partiellement reproduit dans Simone VEIL, La communauté et les droits de la personne, (1983) 1 Annuaire canadien des droits de la personne 1-16.

2. La "société par actions", décrite aux articles 1863, 1864, 1889, 1890 et 1891 du Code civil du Bas Canada, correspond, comme l'indique la version anglaise de son nom, au joint-stock company du droit britannique, l'ancêtre de la company et du business corporation, soit la "compagnie" et la "société commerciale". L'auteur entend donc employer tout au long de cette thèse, à moins que le contexte ne s'y oppose, les mots "société" et "société par actions" au sens de "company", "business corporation", "compagnie" et "société commerciale".

3. L'auteur partage ici l'opinion émise par G.R. BRETTEN dans Protection of minorities, (1972) 116 Sol J 345.

4. Companies Act 1948, (U.K.) 11 & 12 Geo VI, c.38, ci-après cité seulement sous son titre "Companies Act 1948", entré en vigueur le 1er juillet 1948 (voir à cet effet le paragraphe 462(2) du Companies Act 1948).

5. Companies Act 1980, 1980 U.K., c.22, ci-après cité seulement sous son titre "Companies Act 1980", entré en vigueur le 22 décembre 1980 (voir à cet effet le Companies Act 1980 (Commencement No.2) Order 1980, Statutory Instruments 1980 No.1785, adopté conformément au paragraphe 90(3) du Companies Act 1980).

6. Voir la définition des mots "oppression", "opprimer", "préjudice" et "injuste" dans Paul ROBERT, Dictionnaire alphabétique & analogique de la langue française; Le petit Robert, Paris, Société du nouveau Littré, 1976.
Quant à eux, les tribunaux britanniques semblent avoir adopté une définition de l'oppression qui se rapproche de la suivante, tirée du dictionnaire Oxford (The Oxford English dictionary, Oxford, The Clarendon Press, 1961, 12 volumes et un supplément) au mot "oppressive": "1. Of the nature of oppression or tyrannous treatment of subjects, inferiors, etc.; unjustly burdensome, harsh or merciless; tyrannical." Comparer avec la définition donnée par le vicomte Simonds dans Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 ALL ER 66, 71 (HL): "burdensome, harsh and wrongful".

7. Committee on company law amendment, GREAT BRITAIN BOARD OF TRADE, Report; Chairman: Mr. Justice Cohen, London, HMSO, 1945, pages 30, 94 et 95.

8. Elder v. Elder & Watson Limited, I1952I SC 49, 58 (Court of Session), par lord Keith.

9. Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492, 505; I1973I AC 360, 385 (HL), par lord Cross of Chelsea.

10. Company law committee, GREAT BRITAIN BOARD OF TRADE, Report of the Company law committee; Chairman: Lord Jenkins, London, HMSO, 1962, aux pages 74 à 78.

11. L'article 210 du Companies Act 1948 permet au tribunal d'intervenir lorsque "the affairs of the company are being conducted in a manner oppressive to some part of the members", alors que l'article 75 du Companies Act 1980 permet à l'actionnaire de s'adresser au tribunal lorsque "the affairs of the company are being or have been conducted in a manner which is unfairly prejudicial to the interests of some part of the members" ou lorsque "any actual or proposed act or omission of the company I...I is or would be so prejudicial".

12. Loi sur les sociétés commerciales canadiennes, 1974-75-76 S.C., c. 33, telle que modifiée par 1978-79 S.C., c. 9, art. 234; Loi sur les sociétés canadiennes sans but lucratif, 1980 P.L.C. C-10 (adopté en 1ere lecture le 16 avril 1980 par la Chambre des communes

et adopté en 3e lecture le 12 décembre 1979 par le Sénat sous le no S-7), art. 214; Companies Act, 1967 R.S.N.S., c. 42, art. 5 du Third Schedule, tel qu'ajouté par l'art. 2 de la loi intitulée An Act to amend Chapter 42 of the Revised Statutes, 1967, the Companies Act, 1980 S.N.S., c. 26; Loi sur les corporations commerciales, 1981 L.N.B., c. B-9.1, art. 166; Business Corporations Act, 1982, 1982 S.O., c. 4, art. 247; The Corporations Act, 1976 S.M., c. 40, art. 234; The Business Corporations Act, 1978 R.S.S., c. B-10, art. 234; Business Corporations Act, 1981 S.A., c. B-15, art. 234; Company Act, 1979 R.S.B.C., c. 59, art. 224.

13. Loi sur les sociétés commerciales canadiennes, sous-alinéa 207(1)b)(ii); Loi sur les sociétés canadiennes sans but lucratif, 1980 P.L.C. C-10 (adopté en 1ere lecture le 16 avril 1980 par la Chambre des communes et adopté en 3e lecture le 12 décembre 1979 par le Sénat sous le no S-7), sous-alinéas 187(1)b)(ii) et 187(2)b)(ii); The Companies Act, 1970 R.S.N., c. 54, alinéa 138e); Winding Up Act, 1974 R.S.P.E.I., c. W-7, alinéa 22c); Companies Winding Up Act, 1967 R.S.N.S., c. 47, art. 4; Loi sur la liquidation des compagnies, 1973 L.R.N.B., c. W-10, alinéa 3f) et Loi sur les corporations commerciales, 1981 L.N.B., c. B-9.1, sous-alinéa 141(2)b)(ii); Loi sur la liquidation des compagnies, 1977 L.R.Q., c. L-4, art. 24; Business Corporations Act, 1982, 1982 S.O., c. 4.

sous-alinéa 206(1)b)(iv); The Corporations Act, 1976 S.M., c. 40, sous-alinéa 207(1)b)(ii); The Business Corporations Act, 1978 R.S.S., c. B-10, sous-alinéa 207(1)b)(ii); Business Corporations Act, 1981 S.A., c. B-15, sous-alinéa 207(1)b)(ii); Company Act, 1979 R.S.B.C., c. 59, alinéa 295(3)a).

14. Loi sur les sociétés commerciales canadiennes, alinéas 207(1)a) et 234(3)l); Loi sur les sociétés canadiennes sans but lucratif, 1980 P.L.C. C-10 (adopté en 1ère lecture le 16 avril 1980 par la Chambre des communes et adopté en 3e lecture le 12 décembre 1979 par le Sénat sous le nº S-7), alinéas 187(1)a), 187(2)a) et 214(3)l); Companies Act, 1967 R.S.N.S., c. 42, alinéa 5(3)l) du Third Schedule, tel qu'ajouté par l'art. 2 de la loi intitulée An Act to amend Chapter 42 of the Revised Statutes, 1967, the Companies Act, 1980 S.N.S., c. 26; Loi sur les corporations commerciales, 1981 L.N.B., c. B-9.1, alinéas 141(1)a) et 166(3)l); Business Corporations Act, 1982, 1982 S.O., c. 4, alinéas 206(1)a) et 247(3)l); The Corporations Act, 1976 S.M., c. 40, alinéas 207(1)a) et 234(3)l); The Business Corporations Act, 1978 R.S.S., c. B-10, alinéas 207(1)a) et 234(3)l); Business Corporations Act, 1981 S.A., c. B-15, alinéas 207(1)a) et 234(3)n); Company Act, 1979 R.S.B.C., c. 59, alinéas 224(2)f) et 295(3)a), ainsi que l'article 296.

15. Voir _supra_, note 7, 2e recommandation, p. 95.

16. _Idem_, n° 58, p. 30.

17. _Idem_, n° 59, p. 30.

18. Voici, pour plus de commodité, le texte de l'article 210 du _Companies Act 1948_, tel que modifié par le paragraphe 35(2) du _Companies Act 1967_, 1967 U.K., c.81 (ci-après cité seulement sous son titre "_Companies Act 1967_"):

> 210. (1) Any member of a company who complains that the affairs of the company are being conducted in a manner oppressive to some part of the members (including himself) or, in a case falling within subsection (2) of section thirty-five of the 1967 Act, the Board of Trade, may make an application to the court by petition for an order under this section.
>
> (2) If on any such petition the court is of opinion
>
> (a) that the company's affairs are being conducted as aforesaid; and
>
> (b) that to wind up the company would unfairly prejudice that part of the members, but otherwise the facts would justify the making of a winding-up order on the ground that it was just and equitable that the company should be wound up;

the court may, with a view to bringing to an end the matters complained of, make such order as it thinks fit, whether for regulating the conduct of the company's affairs in future, or for the purchase of the shares of any members of the company by other members of the company or by the company and, in the case of a purchase by the company, for the reduction accordingly of the company's capital, or otherwise.

(3) Where an order under this section makes any alteration in or addition to any company's memorandum or articles, then, notwithstanding anything in any other provision of this Act but subject to the provisions of the order, the company concerned shall not have power without the leave of the court to make any further alteration in or addition to the memorandum or articles inconsistent with the provisions of the order; but, subject to the foregoing provisions of this subsection, the alterations or additions made by the order shall be of the same effect as if duly made by resolution of the company and the provisions of this Act shall apply to the memorandum or articles as so altered or added to accordingly.

(4) An office copy of any order under this section altering or adding to, or giving leave to alter or add to, a company's memorandum or articles shall, within fourteen days after the making thereof, be delivered by the company to the registrar of companies for registration; and if a company makes default in complying with this subsection, the company and every officer of the company who is in default shall be liable to a default fine.

(5) In relation to a petition under this section, section three hundred and sixty-five of this Act shall apply as it applies in relation to a winding-up petition, and proceedings under this section shall, for the purposes of Part V of the Economy (Miscellaneous Provisions) Act, 1926, be deemed to be proceedings under this Act in relation to the winding up of companies.

19. Voici, pour plus de commodité, le texte de l'alinéa 222f) du Companies Act 1948:

222. A company may be wound up by the court if

(f) the court is of opinion that it is just and equitable that the company should be wound up.

20. Voir *supra*, note 10, n° 199 à 212, pages 73 à 78.

21. *Idem*, n° 201, page 75, et n° 212a), page 78.

22. *Idem*, n° 202, 203 et 204, page 75.

23. *Idem*, n° 203 et 204, page 75, ainsi que n° 212b) et 212c), page 78.

24. *Idem*, n° 206, 207 et 208, pages 76 et 77, ainsi que n° 212d) et 212e), page 78;

- *Foss* v. *Harbottle*, (1843) 2 Hare 461; 67 ER 189;

- Voir, pour un exposé du principe de l'arrêt *Foss* v. *Harbottle*, l'article suivant, rédigé en deux parties: K.W. WEDDERBURN, *Shareholders' rights and the rule in Foss v. Harbottle*, (1957) 15 Camb LJ

194-215 et (1958) 16 Camb LJ 93-106;

- Voir, pour des commentaires additionnels sur le principe de l'arrêt Foss v. Harbottle, et une perspective canadienne des réformes législatives entreprises pour remédier à divers problèmes engendrés par l'application de ce principe: Patrick PHELAN, Minority shareholder's actions: English common law and Canadian statutory reform, (1981) 194 U W Ont L Rev 153-159.

25. Voir *supra*, note 10, n° 209, page 77, et n° 212f), page 78.

26. Voici, pour plus de commodité, le texte de l'article 75 du <u>Companies Act 1980</u>:

> 75. (1) Any member of a company may apply to the court by petition for an order under this section on the ground that the affairs of the company are being or have been conducted in a manner which is unfairly prejudicial to the interests of some part of the members (including at least himself) or that any actual or proposed act or omission of the company (including an act or omission on its behalf) is or would be so prejudicial.
>
> (2) If in the case of any company
>
> (a) the Secretary of State has received a report under section 168 of the 1948 Act (inspectors' reports) or exercised his powers under Part III of the 1967 Act or section 36(2) to (6) of the Insurance Companies Act 1974 (inspection of company's books and papers); and
>
> (b) it appears to him that the affairs of the company are being or have been conducted in a manner which is unfairly prejudicial to the interests of some part of the members or that any actual or proposed act or omission of the company (including an act or omission on its behalf) is or would be so prejudicial,
>
> he may himself (in addition to or instead of presenting a petition for the winding-up of the company under section 35(1) of the 1967 Act) apply to the court by petition for an order under this section.
>
> (3) If the court is satisfied that a petition under this section is well founded it may make such order as it thinks fit for giving relief in respect of the matters complained of.
>
> (4) Without prejudice to the generality of subsection (3) above, an order under this section may
>
> (a) regulate the conduct of the company's affairs in the future;

(b) require the company to refrain from doing or continuing an act complained of by the petitioner or to do an act which the petitioner has complained it has omitted to do;

(c) authorise civil proceedings to be brought in the name and on behalf of the company by such person or persons and on such terms as the court may direct;

(d) provide for the purchase of the shares of any members of the company by other members or by the company itself and, in the case of a purchase by the company itself, the reduction of the company's capital accordingly.

(5) Where an order under this section requires the company not to make any, or any specified, alteration in the memorandum or articles then, notwhithstanding anything in the Companies Acts, the company shall not have power without the leave of the court to make any such alteration in breach of that requirement.

(6) Any alteration in the memorandum or articles of the company made by virtue of an order under this section shall be of the same effect as if duly made by resolution of the company and the provisions of the Companies Acts shall apply to the memorandum or articles as so altered accordingly.

(7) An office copy of any order under this section altering, or giving leave to alter, a company's memorandum or articles shall, within 14 days from the making of the order or such longer period as the court may allow, be delivered by the company to the registrar of companies for registration; and if a company makes default in complying with this subsection, the company and every officer of the company who is in default shall be liable on summary conviction to a fine not exceeding one-fifth of the statutory maximum or, on conviction after continued contravention, a default fine not exceeding one fiftieth of the statutory maximum for every day until that copy is delivered.

(8) In relation to a petition under this section, section 365 of the 1948 Act (general rules for winding up) shall apply as it applies in relation to a winding-up petition.

(9) This section shall apply to a person who is not a member of a company but to whom shares in the company have been transferred or transmitted by operation of law as it applies to a member of the company, and references to a member or members shall be construed accordingly.

(10) In subsections (2) to (9) above "company" means any body corporate which is liable to be wound up under the 1948 Act.

(11) Section 210 of the 1948 Act and section 35(2) of the 1967 Act (which are superseded by this section) shall cease to have effect except in relation to proceedings on a petition presented before the appointed day.

27. Voir le paragraphe 75(11) du Companies Act 1980.

28. Il s'agit ici du "Secretary of State for Trade, one of her Majesty's Principal Secretaries of State". Voir à cet effet la note qui apparaît dans Halsbury's Statutes of England; Continuation volume 1980, 3e éd., v. 50(1), London, Butterworths, 1981, page 130 dans les notes;

Voir également Re St Piran Ltd., [1981] 3 All ER 270, 273 (Ch D), par le juge Dillon.

29. <u>Re H.R. Harmer Ltd.</u>, décision non rapportée de la <u>Chancery Division</u>, rendue par le juge Roxburgh, dont un extrait est cité sur ce point à [1958] 3 All ER 689, 704 et 705 (CA).

30. <u>Ibid.</u> Dans cette affaire, les demandeurs possédaient les neuf dixièmes des actions ordinaires qui ne comportaient pas de droit de vote, mais seulement quatre dixièmes d'un pour cent des actions ordinaires qui comportaient un droit de vote;

Comparer avec ce que dit lord Jenkins, siégeant en appel dans la même affaire, <u>Re H.R. Harmer Ltd.</u>, [1958] 3 All ER 689, 698 (CA): " <u>the affairs of the company are being conducted</u>" [...] <u>is wide enough to cover oppression by anyone who is taking part in the conduct of the affairs of the company, whether de facto or de jure</u>.

31. <u>In re Stewarts (Brixton) Ltd.</u>, décision non rapportée de la <u>Chancery Division</u>, rendue le 27 novembre 1981 par le juge Vinelott, et résumée à la page 11 de l'édition du 11 décembre 1981 du <u>Financial Times</u> de Londres. Cette décision est également résumée et commentée par John BIRDS, dans <u>Section 210 is not dead and buried</u>, (1982) 3 Co Law 77.

32. <u>Elder</u> v. <u>Elder & Watson Limited</u>, [1952] SC 49, 58 (<u>Court of Session</u>), par lord Keith. L'actionnaire qui se porte demandeur dans le cadre de l'article 210 du <u>Companies Act 1948</u>, doit donc

se restreindre à la preuve de l'oppression dont il est victime à l'égard de ses droits d'actionnaire, ce qui exclut, par exemple, l'oppression à l'égard de ses droits d'administrateur, de dirigeant, d'employé ou de créancier, s'il cumule également ces qualités en plus d'être l'un des actionnaires de la société. L'auteur examine en détail cette question au chapitre II.

33. Dans la plupart des sociétés à caractère public, la cession des actions qui appartiennent à un actionnaire, s'effectue selon les règles prévues aux articles 22 à 28 de la première partie de la table A de la première annexe au Companies Act 1948, et la reconnaissance par la société du nouvel actionnaire ne pose généralement aucun problème, surtout s'il s'agit d'actions qui sont entièrement payées.

Le cas échéant, l'article 26 de la première partie de la table A de la première annexe au Companies Act 1948, précise que les administrateurs qui refusent d'inscrire la cession des actions, doivent expédier dans les deux mois un avis de leur refus au cessionnaire des actions. Celui-ci peut alors se prévaloir de la procédure de l'article 116 du Companies Act 1948 pour obtenir la rectification du registre des actionnaires, si le refus des administrateurs revêt un caractère arbitraire;

Le professeur Lawrence Cecil B. GOWER, dans Gower's principles of modern company law, 4e édition, London, Stevens, 1979, page 445, note 4, signale qu'à l'exception des actions qui ne sont pas entièrement payées, une société à caractère public n'impose que rarement des restrictions à la libre cession de ses actions; d'autre part, nous fait-il remarquer, une société ne pourra faire coter ses actions à la Bourse s'il existe de telles restrictions à la libre cession de ses actions;

. Lorsqu'il s'agit d'une société à caractère fermé, l'article 3 de la deuxième partie de la table A de la première annexe au Companies Act 1948, reconnaît aux administrateurs la plus entière discrétion de refuser l'inscription de la cession des actions de leur société. Le rapport Jenkins (voir supra, note 10, n° 211, pages 77 et 78) recommande de n'apporter aucune limite à cette discrétion.

34. Re JN2 Ltd., [1977] 3 All ER 1104, 1107 et 1108 (Ch D), par le juge Brightman.

35. Idem, pages 1108 et 1109.

36. [1963] 2 All ER 940; [1964] Ch 240 (CA).

37. Charles Forte Investments Ltd. v. Amanda, [1963] 2 All ER 940, 947-948; [1964] Ch 240, 255, 257 et 258 (CA), par lord Willmer; à la page 950; 261, par lord Danckwerts; et à la page 951; 262, par le juge Cross.

38. L'auteur emploie, tout au long de cette thèse, l'expression "statuts de la société" pour englober le "memorandum of association" et les "articles of association" du droit britannique des sociétés par actions.

39. Charles Forte Investments Ltd. v. Amanda, [1963] 2 All ER 940, 947; [1964] Ch 240, 254 et 255 (CA), par lord Willmer.

40. Lawrence Cecil B. GOWER, op. cit., n. 33, page 658, note 22.

41. Il s'agit ici de l'ancienne règle de droit dont la formulation latine est bien connue des juristes: "De minimis non curat lex", ou de sa variante: "De minimis non curat praetor";

. Voir en ce sens les propos de lord Danckwerths dans Charles Forte Investments Ltd. v. Amanda, [1963] 2 All ER 940, 950; [1964] Ch 240, 260 (CA), lequel estime que le tribunal ne peut reconnaître au demandeur, à cause du peu d'actions dont il est propriétaire, le même droit qu'à l'associé de demander la liquidation et la dissolution de la société. Voir aussi les propos du juge Cross à [1963] 2 All ER 940, 951; [1964] Ch 240, 263 (CA), lequel signale qu'il peut survenir des affaires où il conviendrait de présenter une demande de liquidation et de dissolution en alléguant le refus d'inscrire la cession des actions.

42. Charles Forte Investments Ltd. v. Amanda, [1963] 2 All ER 940, 949; [1964] Ch 240, 259 (CA), par lord Willmer; et à la page 951; 262, par le juge Cross.

43. Re JN2 Ltd., [1977] 3 All ER 1104, 1106 (Ch D), par le juge Brightman.

44. Ebrahimi v. Westbourne Galleries Ltd., [1972] 2 All ER 492, 495 (HL), par lord Wilberforce.

45. Charles Forte Investments Ltd. v. Amanda, [1963] 2 All ER 940, 948; [1964] Ch 240, 247 et 248 (CA), par lord Willmer; aux pages 951; 262 et 263, par le juge Cross;

Voir également les propos du lord-président Clyde dans Baird v. Lees, [1924] SC 83, 92 (Court of Session), lequel estime que le tribunal peut refuser d'ordonner, pour des motifs de justice et d'équité, la liquidation et la dissolution d'une société, s'il existe des actionnaires qui ne sont pas partie au litige et auxquels l'ordonnance du tribunal causerait un préjudice.

46. Letitia CRABB, Minority protection and section 75, (1982) 3 Co Law 3, 2e note, émet l'hypothèse que les dispositions du paragraphe 75(9) du Companies Act 1980 pourraient couvrir la situation du cessionnaire d'actions dont le nom n'est pas inscrit au registre des actionnaires,

et lui permettre d'intenter, directement et sans autre procédure, le recours de l'article 75 du Companies Act 1980. L'auteur partage cette opinion et estime que les hésitations du professeur Crabb proviennent de ce que le contenu du paragraphe 75(9) du Companies Act 1980 va au-delà des recommandations du rapport Jenkins (voir supra, n. 10, n° 209, page 77 et n° 212f), page 78), en ce qu'il traite non seulement de la transmission des actions conformément aux dispositions de la loi, mais aussi de la cession d'actions.

47. Voir supra, note 34.

48. Voir supra, notes 15 et 16.

49. Re Chesterfield Catering Co. Ltd., [1977] Ch 373, 375, 376, 380 et 381 (Ch D), par le juge Oliver.

50. D. Bronwyn BROADHURST, Who is a "member"?, (1976) 126 New LJ 806-807.

51. Lawrence Cecil B. GOWER, op. cit., n. 33, aux pages 667 et 668, de même qu'à la page 466.

52. Voir supra, note 10, paragraphes n° 209 et 212f), aux pages 77 et 78;

On peut toutefois noter que la publication du rapport Jenkins est antérieure à la décision rendue par le juge Pennycuick dans l'affaire Re Jermyn

Street Turkish Baths Ltd., [1970] 3 All ER 57, 64 et 65; [1970] 1 WLR 1194, 1205 (Ch D).

53. Re Jermyn Street Turkish Baths Ltd., [1970] 3 All ER 57, 64 et 65; [1970] 1 WLR 1194, 1205 (CH D), par le juge Pennycuick.

54. Re Jermyn Street Turkish Baths Ltd., [1971] 3 All ER 184, aux pages 193, 194 et 201 (CA), par lord Buckley.

55. Voir supra, note 53.

56. Letitia CRABB, loc.cit., n. 46, page 3.

57. [1977] 1 All ER 417, 420; [1977] 1 WLR 153, 156 et 157 (Ch D), par le juge Slade;

. Voir, au même effet, l'arrêt In re Cape Breton Company, (1881) 19 Ch D 77, 79 et 80 (CA), par le maître des rôles Jessel, lord Brett et lord Lindley; ainsi que la décision Morgan v. Gray, [1953] 1 All ER 213, 217; [1953] Ch 83, 87 et 88 (Ch D), par le juge Danckwerts; que le juge Slade cite à l'appui de sa décision dans Re Wolverhampton Steel & Iron Co. ~~Ltd~~

58. Re Wolverhampton Steel & Iron Co. Ltd., [1977] 3 All ER 467, 468 et 469; [1977] 1 WLR 860, 861 et 862 (CA), par Lord Ormrod; à la page 470; 863, par lord Goff;

. La décision de la Cour d'appel dans Re Wolverhampton Steel & Iron Co. Ltd. se trouve à répudier implicitement la décision Re H. L. Bolton Engineering Co. Ltd. I1956I Ch 577, 583 et 584 (Ch D), où le juge Wynn-Parry avait estimé qu'à défaut d'être inscrit au registre des actionnaires, le syndic à la faillite d'un actionnaire n'avait pas la qualité requise pour présenter une demande de liquidation et de dissolution, parce que l'alinéa 216a) du Companies Act 1948 n'entrait en jeu qu'une fois la liquidation et la dissolution prononcées.

59. D. Bronwyn BROADHURST, loc. cit., n. 50, page 807.

60. Lawrence Cecil B. GOWER, op. cit., n. 33, à la page 658, note 18, ainsi qu'aux pages 667 et 668.

61. Voir supra, note 10, paragraphes n° 209 et 212f), aux pages 77 et 78.

62. Letitia CRABB, loc. cit., n. 46, page 3.

63. F. Hodge O'NEAL, "Squeeze-outs" of minority shareholders; expulsion or oppression of business associates, Chicago, Callaghan & Company, 1975, page 620;

H. RAJAK, The oppression of minority shareholders, (1972) 35 Modern L Rev 169.

64. L. H. LEIGH, Companies Act 1967, (1968) 31 Modern L Rev 190.

65. David FOULKES, The supervision of companies- The Parliamentary commissioner's reports, (1974) J Bus L 25 et 26.

66. I1967I 1 WLR 711, 714 à 716; I1967I 2 All ER 606, 608 et 609 (Ch D), par le juge Pennycuick.

67. [1967] 1 W L R 799, 804 à 806; [1967] 2 All ER 615, 620-621 (Ch D), par le juge Pennycuick.

68. [1980] 1 W L R 948, 957 (Ch D), par le juge Browne-Wilkinson, commentée par John BOWERS et Richard SHELDON dans Evidence given to company inspectors, (1981) 97 L Quarterly Rev 218-220.

69. [1981] 1 W L R 1300, 1306; [1981] 3 All ER 270, 276 (Ch D), par le juge Dillon.

70. Le paragraphe 210(1) du Companies Act 1948 énonce: "the affairs of the company are being conducted in a manner oppressive to some part of the members (including himself)";

- Elder v. Elder & Watson Limited, [1952] SC 49, 55 et 56 (Court of Session), par le lord-président Cooper;

- Re H.R. Harmer Ltd., [1958] 3 All ER 689, 698 (CA), par lord Jenkins.

71. Le paragraphe 75(1) du Companies Act 1980 énonce: "the affairs of the company are being or have been conducted in a manner which is unfairly prejudicial to the interests of some part of the members (including at least himself)".

72. Elder v. Elder & Watson Limited, [1952] SC 49, 57 et 58 (Court of Session), par le lord-président Cooper et lord Keith;

. In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641, à la page 640;

. Re H.R. Harmer Ltd., I1958I 3 All ER 689, 698 (CA), par lord Jenkins;

. Re Bellador Silk Ltd., I1965I 1 All ER 667, 671 (Ch D), par le juge Plowman;

. Re Lundie Brothers Ltd., I1965I 2 All ER 692, 698 (Ch D), par le juge Plowman;

. Re Five Minute Car Wash Service Ltd., I1966I 1 All ER 242, 246 (Ch D), par le juge Buckley;

. Re Jermyn Street Turkish Baths ~~Ltd.~~, I1971I 3 All ER 184, 200 (CA), par lord Buckley;

. Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492, 505 (HL), par lord Cross of Chelsea.

73\. In re Rica Gold Washing Company, (1879) 11 Ch D 36, 42 et 43 (CA), par lord Jessel, maître des rôles;

. Re S.A. Hawken Ltd., I1950I 2 All ER 408, 411 et 412 (Ch D), par le juge Wynn-Parry;

. Re Bellador Silk Ltd., I1965I 1 All ER 667, 672 et 673 (Ch D), par le juge Plowman;

. Re Chase Plastics Ltd., (1966) 110 Sol J 564, 565 (Ch D), par le juge Pennycuick;

. Re Othery Construction Ltd., I1966I 1 All ER 145, 147 et 149; I1966I 1 WLR 69, 72, 74 et 75 (Ch D), par le juge Buckley;

. Re Expanded Plugs Ltd., I1966I 1 All ER 877, 884; I1966I 1 WLR 514, 522 (Ch D), par le juge Plowman;

. In re Chesterfield Catering Co. Ltd., I1977I Ch 373, 380 et 381 (Ch D), par le juge Oliver.

74. In re Chesterfield Catering Co. Ltd., I1977I Ch 373, 380 (Ch D), par le juge Oliver.

75. Ibid.

76. Re S.A.Hawken Ltd., I1950I 2 All ER 408, 411 et 412 (Ch D), par le juge Wynn-Parry.

77. Re Bellador Silk Ltd., I1965I 1 All ER 667, 672 et 673 (Ch D), par le juge Plowman.

77a. Voir, en ce sens, Re Fildes Bros. Ltd., I1970I 1 All ER 923, 927 et 928 (Ch D), par le juge Meggary, et Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66, 68 (HL), par lord Denning, qui semblent tous deux appuyer la distinction faite par l'auteur au sujet de la date à laquelle le demandeur doit établir la solvabilité de la société.

78. Re Lundie Brothers Ltd., I1965I 2 All ER 692, 699; I1965I 1 WLR 1051, 1058 (Ch D), par le juge Plowman.

79. Re Fildes Bros. Ltd., I1970I 1 All ER 923, 927 et 928 (Ch D), par le juge Meggary.

80. Voir les paragraphes 210(1) et (2) du Companies Act 1948;

- Elder v. Elder & Watson Limited, [1952] SC 49, 55 (Court of Session), par le lord-président Cooper;

- Company law: oppression of minorities, (1953) 216 Law Times 639.

81. Scottish Co-operative Wholesale Society Ltd. v. Meyer, [1958] 3 All ER 66, 74 (HL), par lord Morton of Henryton.

82. In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641, aux pages 639 et 641.

83. Re H.R. Harmer Ltd., décision non rapportée de la Chancery Division, rendue par le juge Roxburgh, dont un extrait est cité sur ce point à [1958] 3 All ER 689, 704 et 705 (CA). Ce même point a fait l'objet de commentaires de la part des trois juges de la Cour d'appel qui ont été saisi du litige, à [1958] 3 All ER 689, 698 (CA), par lord Jenkins; 706, par lord Romer; et 708, par lord Willmer.

84. Re Bellador Silk Ltd., [1965] 1 All ER 667, 671 (Ch D), par le juge Plowman.

85. Re Westbourne Galleries Ltd., [1970] 3 All ER 374, 385 (Ch D), par le juge Plowman.

86. <u>In re Hannetta Limited</u>, décision non rapportée de la <u>Chancery Division</u>, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé <u>Company law: oppression of minorities</u>, à (1953) 216 Law Times 639-641, à la page 639;

- <u>Scottish Co-operative Wholesale Society Ltd</u>. v. <u>Meyer</u>, I1958I 3 All ER 66, 88 (HL), par lord Denning;

- <u>Re H.R. Harmer Ltd</u>., décision non rapportée de la <u>Chancery Division</u>, rendue par le juge Roxburgh, dont un extrait est cité à I1958I 3 All ER 689, 705 (CA);

- <u>Re Bellador Silk Ltd</u>., I1965I 1 All ER 667, 671 (Ch D), par le juge Plowman;

- <u>Re Lundie Brothers Ltd</u>., I1965I 2 All ER 692, 698 (Ch D), par le juge Plowman;

- <u>Re Five Minute Car Wash Service Ltd</u>., I1966I 1 All ER 242, 243, 244 et 246 (Ch D), par le juge Buckley;

- <u>Re Jermyn Street Turkish Baths Ltd</u>., I1970I 3 All ER 57, 66 (Ch D), par le juge Pennycuick;

- <u>Re Jermyn Street Turkish Baths Ltd</u>., I1971I 3 All ER 184, 198 (CA), par lord Buckley;

- <u>Re Westbourne Galleries Ltd</u>., I1970I 3 All ER 374, 385 (Ch D), par le juge Plowman;

- <u>In re Stewarts (Brixton) Ltd</u>., décision non rapportée de la <u>Chancery Division</u>, rendue le 27 novembre 1981 par le juge Vinelott, et résumée à la page 11 de l'édition du 11 décembre 1981 du <u>Financial Times</u> de Londres. Cette décision est également résumée et commentée par John BIRDS, dans <u>Section 210 is not dead and buried</u>, (1982) 3 Co Law 77.

87. <u>Re Fildes Bros. Ltd</u>., I1970I 1 All ER 923, 927 et 928 (Ch D), par le juge Meggary.

88. <u>Idem</u>, page 927.

89. <u>Elder</u> v. <u>Elder & Watson Limited</u>, I1952I SC 49, 55 (<u>Court of Session</u>), par le lord-président Cooper.

90. Voir <u>supra</u>, note 10, n^{o} 204, page 75.

91. <u>Elder</u> v. <u>Elder & Watson Limited</u>, I1952I SC 49, 60 (<u>Court of Session</u>), par lord Keith.

92. <u>Scottish Co-operative Wholesale Society Ltd</u>. v. <u>Meyer</u>, I1958I 3 All ER 66, 71 (HL), par le vicomte Simonds, et à la page 86, par lord Keith of Avonholm.

93. <u>Re Five Minute Car Wash Service Ltd</u>., I1966I 1 All ER 242, 247 (Ch D), par le juge Buckley.

94. <u>Re Jermyn Street Turkish Baths Ltd</u>., I1971I 3 All ER 184, 199 (CA), par lord Buckley.

95. I1958I 3 All ER 66, 89 (HL), par lord Denning.

96. I1958I 3 All ER 689, 704 (CA), par lord Jenkins.

97. Re H.R. Harmer Ltd., I1958I 3 All ER 689, 698 et 699 (CA), par lord Jenkins, et 708, par lord Willmer.

98. Elder v. Elder & Watson Limited, I1952I SC 49, 57 (Court of Session), par le lord-président Cooper;

Voir aussi, sur le refus d'enregistrer la cession des actions du demandeur, l'obiter du juge Cross dans Charles Forte Investments Ltd. v. Amanda, I1963I 2 All ER 940, 951; I1964I Ch 240, 263 (CA).

99. Elder v. Elder & Watson Limited, I1952I SC 49, 59 et 60 (Court of Session), par lord Keith.

100. Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66, 70 et 71 (HL), par le vicomte Simonds; aux pages 72 et 73, par lord Morton of Henryton qui cite des extraits de la décision rendue en première instance par le lord-président Clyde à I1957I SC 110, 121 et 122 (Court of Session); ainsi qu'aux pages 83 et 86, par lord Keith; et à la page 88, par lord Denning.

101. Re H.R. Harmer Ltd., [1958] 3 All ER 689, 704 (CA), par lord Jenkins, et 710, par lord Willmer.

102. Idem, aux pages 703 et 704, par lord Jenkins; à la page 706, par lord Romer; et à la page 709, par lord Willmer.

103. Re Five Minute Car Wash Service Ltd., [1966] 1 All ER 242, 247 et 248 (Ch D), par le juge Buckley.

104. Voir supra, note 31.

105. Elder v. Elder & Watson Limited, [1952] SC 49, 57 (Court of Session), par le lord-président Cooper.

106. Elder v. Elder & Watson Limited, [1952] SC 49, 59 et 60 (Court of Session), par lord Keith.

107. Elder v. Elder & Watson Limited, [1952] SC 49, 58, 60 et 61 (Court of Session), par lord Keith;

- Voir aussi, au même effet, les propos du lord-président Cooper dans Elder v. Elder & Watson Limited, [1952] SC 49, 57 (Court of Session);

- Lord Jenkins, dans Re H.R. Harmer Ltd., [1958] 3 All ER 689, 699, 700 et 701 (CA), cite avec approbation les propos tenus par le lord-président Cooper et lord Keith dans Elder v. Elder & Watson Limited, selon lesquels la destitution d'un administrateur et le renvoi ou la mise à la retraite forcée d'un employé, ne permettent pas d'invoquer le recours de l'article 210 du Companies Act 1948;

- Dans Re Lundie Brothers Ltd., I1965I 2 All ER 692, 698 et 699; I1965I 1 WLR 1051, 1057, 1058 et 1059 (Ch D), le juge Plowman a décidé que la destitution d'un administrateur et le renvoi d'un employé, ne permettent pas d'invoquer l'article 210 du Companies Act 1948, mais justifient, dans les circonstances de l'affaire dont il a été saisi, la liquidation et la dissolution de la société en cause, pour des motifs de justice et d'équité, conformément à l'alinéa 222f) du Companies Act 1948;

- Dans Re Westbourne Galleries Ltd., I1970I 3 All ER 374, 378, 384 et 385 (Ch D), le juge Plowman énonce les mêmes principes que ceux qu'il a formulés dans Re Lundie Brothers Ltd., et rend une décision identique où il rejette le recours de l'article 210, mais accueille celui de l'alinéa 222f) du Companies Act 1948. Le demandeur n'a pas fait appel du rejet de son recours fondé sur l'article 210 du Companies Act 1948 (voir I1972I 2 All ER 492, 495, par lord Wilberforce), mais la Chambre des lords a confirmé à l'unanimité que les faits justifient la liquidation et la dissolution de la société, pour des motifs de justice et d'équité (voir Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492, 501 et 502 (HL), par lord Wilberforce; aux pages 505 et 506, par lord Cross of Chelsea);

Voir, en _obiter_, les propos du juge Plowman dans _Bentley-Stevens_ v. _Jones_, [1974] 2 All ER 653, 655 (Ch D), qui signale qu'en certaines circonstances, la destitution d'un administrateur peut justifier, pour des motifs de justice et d'équité, la liquidation et la dissolution d'une société.

108. _In re Hannetta Limited_, décision non rapportée de la _Chancery Division_, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé _Company law: oppression of minorities_, à (1953) 216 Law Times 639-641, à la page 639;

Un acte isolé ne peut constituer de l'oppression au sens de l'article 210 du _Companies Act 1948_, lequel requiert une ligne de conduite oppressive qui s'est prolongée dans le temps jusqu'à la date de la présentation de la demande en justice: voir _Re Westbourne Galleries Ltd._, [1970] 3 All ER 374, 385 (Ch D), par le juge Plowman.

109. _Re H.R. Harmer Ltd._, [1958] 3 All ER 689, 706 (CA), par lord Romer.

110. _Re Five Minute Car Wash Service Ltd._, [1966] 1 All ER 242, 246 et 247 (Ch D), par le juge Buckley.

111. _Re Jermyn Street Turkish Baths Ltd._, [1971] 3 All ER 184, 197, 198, 200 et 201 (CA), par lord Buckley.

112. Re Fildes Bros. Ltd., [1970] 1 All ER 923, 926 (Ch D), par le juge Meggary;

. Ebrahimi v. Westbourne Galleries Ltd., [1972] 2 All ER 492, 500 et 502 (HL), par lord Wilberforce qui fait état de la timidité avec laquelle les tribunaux ont parfois interprété leurs pouvoirs d'intervention, et qui juge qu'ils ne sauraient se restreindre aux seuls cas où les administrateurs ont fait preuve de mauvaise foi dans leurs décisions;

. Re St Piran Ltd., [1981] 3 All ER 270, 277 (Ch D), par le juge Dillon.

113. Ebrahimi v. Westbourne Galleries Ltd., [1972] 2 All ER 492, 496; [1973] AC 360, 374,375 (HL), par lord Wilberforce;

. Voir par contraste les décisions judiciaires suivantes qui établissent que l'article 210 du Companies Act 1948, ne couvre que l'oppression que subit le demandeur dans ses droits d'actionnaire:

. Elder v. Elder & Watson Limited, [1952] SC 49, 57 (Court of Session), par le lord-président Cooper, et à la page 60, par lord Keith;

. In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641, à la page 640;

. Re H.R. Harmer Ltd., [1958] 3 All ER 689, 698 et 703 (CA), par lord Jenkins; à la page 706, par lord Romer; et à la page 710, par lord Willmer;

. Re Bellador Silk Ltd., [1965] 1 All ER 667, 671 (Ch D), par le juge Plowman;

. Re Lundie Brothers Ltd., [1965] 2 All ER 692, 698 et 699 (Ch D), par le juge Plowman;

. Re Five Minute Car Wash Service Ltd., [1966] 1 All ER 242, 246 (Ch D), par le juge Buckley;

. Re Jermyn Street Turkish Baths Ltd., [1971] 3 All ER 184, 200 (CA), par lord Buckley.

114. Re Fildes Bros. Ltd., [1970] 1 All ER 923, 927 (Ch D), par le juge Meggary;

. Ebrahimi v. Westbourne Galleries Ltd., [1972] 2 All ER 492, 500 (HL), par lord Wilberforce, et 504, par lord Cross of Chelsea.

115. Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492, 500 (HL), par lord Wilberforce, et 504, par lord Cross of Chelsea.

116. Elder v. Elder & Watson Limited, I1952I SC 49, 54 (Court of Session), par le lord-président Cooper.

117. Voir, à titre d'exemple, Elder v. Elder & Watson Limited, I1952I SC 49, 55 (Court of Session), par le lord-président Cooper.

118. Elder v. Elder & Watson Limited, I1952I SC 49, 55 (Court of Session), par le lord-président Cooper;

. Voir aussi les propos de lord Wilberforce dans <u>Ebrahimi</u> v. <u>Westbourne Galleries Ltd</u>., I1972I 2 All ER 492, 500, 501 et 502 (HL), où il ordonne la liquidation et la dissolution d'une société à la suite de la destitution tout à fait légale d'un administrateur, de même que les propos de lord Cross of Chelsea dans le même arrêt, à la page 506;

. Voir également l'explication que donne de l'arrêt <u>Ebrahimi</u> v. <u>Westbourne Galleries Ltd</u>., le juge Plowman dans <u>Bentley-Stevens</u> v. <u>Jones</u>, I1974I 2 All ER 653, 655 (Ch D).

119. <u>Ebrahimi</u> v. <u>Westbourne Galleries Ltd</u>., I1972I 2 All ER 492, 496; I1973I AC 360, 374,375 (HL), par lord Wilberforce.

120. <u>Ebrahimi</u> v. <u>Westbourne Galleries Ltd</u>., I1972I 2 All ER 492, 501 et 502 (HL), par lord Wilberforce;

. Lawrence Cecil B. GOWER, <u>op.cit</u>., n. 33, page 662.

121. Voir <u>supra</u>, note 115.

122. <u>Ebrahimi</u> v. <u>Westbourne Galleries Ltd</u>., I1972I 2 All ER 492, 500 (HL), par lord Wilberforce.

123. Voir, pour plus de détails, Lawrence Cecil B. GOWER, <u>op. cit</u>., n. 33 , aux pages 662 à 664.

124. <u>Elder</u> v. <u>Elder & Watson Limited</u>, I1952I SC 49, 55 et 56 (<u>Court of Session</u>), par le lord-président Cooper , et aux pages 58 et 61, par lord Keith;

Re H.R. Harmer Ltd., I1958I 3 All ER 689, 698 (CA), par lord Jenkins, et à la page 707, par lord Romer.

125. Elder v. Elder & Watson Limited, I1952I SC 49, 61 (Court of Session), par lord Keith.

126. Entre 1948 et 1981, les recueils judiciaires ne font état que de deux instances où des actionnaires opprimés se sont prévalus avec succès du recours de l'article 210 du Companies Act 1948: il s'agit des arrêts Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66 (HL); et Re H.R. Harmer Ltd., I1958I 3 All ER 689 (CA). A ces deux arrêts, il faut peut-être ajouter l'affaire In re Stewarts (Brixton) Ltd., une décision non rapportée de la Chancery Division sur une requête préliminaire pour rejet du recours fondé sur l'article 210 du Companies Act 1948, rendue le 27 novembre 1981 par le juge Vinelott, et résumée à la page 11 de l'édition du 11 décembre 1981 du Financial Times de Londres. Cette décision est également résumée et commentée par John BIRDS, dans Section 210 is not dead and buried, (1982) 3 Co Law 77.
On peut d'autre part noter la décision rendue dans Re a company, I1981I 2 All ER 1007, 1007 et 1008 (Ch D), où le juge Vinelott fait état de la transaction conclue entre les parties à un recours fondé sur l'article 210 du Companies Act 1948, transaction qui met fin au litige et prévoit l'acquisition des actions du demandeur par la société ou ses actionnaires majoritaires ;

- Par contre, au cours de la même époque, les recueils judiciaires font état de trois décisions où le tribunal a prononcé, pour des motifs de justice et d'équité, la liquidation et la dissolution de la société en cause, mais refusé les autres conclusions du demandeur axées sur le recours de l'article 210 du Companies Act 1948: il s'agit des décisions Re S.A. Hawken Ltd., I1950I 2 All ER 408 (Ch D), par le juge Wynn-Parry; Re Lundie Brothers Ltd., I1965I 2 All ER 692 (Ch D), par le juge Plowman; et Re Westbourne Galleries Ltd., I1970I 3 All ER 374; I1970I 1 WLR 1378 (Ch D), par le juge Plowman, confirmé en appel par la Chambre des lords sous le nom de Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492; I1973I AC 360 (HL);

- Enfin, pour la même période, les recueils judiciaires contiennent cinq décisions où le tribunal a débouté le demandeur du recours de l'article 210 du Companies Act 1948: il s'agit des décisions Elder v. Elder & Watson Limited, I1952I SC 49 (Court of Session), par le lord-président Cooper, lord Keith, lord Carmont et lord Russell; In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641; Re Bellador Silk Ltd., I1965I 1 All ER 667 (Ch D), par le juge Plowman; Re Five Minute Car Wash Service Ltd., I1966I 1 All ER 242 (Ch D), par le juge Buckley; Re Jermyn Street Turkish Baths Ltd., I1971I 3 All ER 184 (CA), par Lord Buckley, lord Russell et lord Cairns.

127. <u>Elder</u> v. <u>Elder & Watson Limited</u>, I1952I SC 49, 55 (<u>Court of Session</u>), par le lord-président Cooper, ainsi qu'aux pages 58 et 61, par lord Keith.

128. <u>In re Yenidje Tobacco Company Limited</u>, I1916I 2 Ch 426, 432 et 433; I1916-17I All ER Rep 1050, 1052 et 1053 (CA), par lord Cozens-Hardy, maître des rôles, avec lequel souscrit lord Pickford, à la page 433; 1053.

129. <u>Ibid</u>;

- Voir aussi, dans le même arrêt, les propos de lord Warrington, à I1916I 2 Ch 426, 435;

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[1916-17] All ER Rep 1050, 1053 (CA), lequel estime, entre autres motifs, que la société doit être liquidée et dissoute lorsqu'il est impossible de régler, par le biais d'une assemblée générale des actionnaires, les problèmes engendrés par les querelles des deux actionnaires et administrateurs;

Voir enfin, en même effet, les propos de lord Shaw of Dunfermline dans <u>Loch</u> v. <u>John Blackwood Limited</u>, [1924] AC 783, 787 et 788; [1924] All ER Rep 200, 203 (PC), lequel signale que le tribunal, dans sa décision d'ordonner, pour des motifs de justice et d'équité, la liquidation et la dissolution d'une société, tiendra compte de ce qu'il s'agit du seul recours dont disposent les demandeurs pour mettre fin à l'état de fait qui règne dans la société, notamment parce que le convocation d'une assemblée générale des actionnaires, où les demandeurs ne possèdent pas la majorité du droit de vote, ne peut régler le litige qui oppose les parties.

130. Voir, en ce sens, la remarque de lord Keith dans <u>Elder</u> v. <u>Elder & Watson Limited</u>, [1952] SC 49, 60 (<u>Court of Session</u>).

131. <u>Baird</u> v. <u>Lees</u>, [1924] SC 83, 92 (<u>Court of Session</u>), par le lord-président Clyde.

132. <u>Ibid</u>;

Le tribunal hésitera à ordonner la liquidation et la dissolution d'une société, pour des motifs de justice et d'équité, s'il existe d'autres actionnaires qui ne sont pas parties au litige et qui risquent de subir un préjudice à la suite de l'ordonnance du tribunal. Voir en ce sens <u>Charles Forte Investments Ltd</u>. v. <u>Amanda</u>, I1963I 2 All ER 940, 948; I1964I Ch 240, 247 et 248 (CA), par lord Willmer; aux pages 951; 262 et 263, par le juge Cross.

133. <u>Loch</u> v. <u>John Blackwood Limited</u>, I1924I AC 783, 788; I1924I All ER Rep 200, 203 (PC), par lord Shaw of Dunfermline.

134. <u>Ibid</u>.

135. <u>Ibid</u>, cité avec approbation par lord Cross of Chelsea dans <u>Ebrahimi</u> v. <u>Westbourne Galleries Ltd</u>., I1972I 2 All ER 492, 503 (HL).

136. <u>Thompson</u> v. <u>Drysdale</u>, I1925I SC 311, 315 (<u>Court of Session</u>), par le lord-président Clyde.

137. <u>Thompson</u> v. <u>Drysdale</u>, I1925I SC 311, 316 (<u>Court of Session</u>), par lord Skerrington.

138. Voir <u>supra</u>, note 126, pour le bilan des décisions où un actionnaire opprimé a invoqué sans succès le recours de l'article 210 du <u>Companies Act 1948</u>.

139. <u>Re Fildes Bros. Ltd</u>., I1970I 1 All ER 923, 927 et 928 (Ch D), par le juge Meggary.

140. Voir, en ce sens, <u>Scottish Co-operative Wholesale Society Ltd</u>. v. <u>Meyer</u>, I1958I 3 All ER 66, 88 (HL), par lord Denning.

141. Voir, à titre d'exemple, Re St Piran Ltd., [1981] 3 Al ER 270, 273 (Ch D), par le juge Dillon;

- Voir aussi, sur l'obligation du demandeur d'avoir eu une conduite irréprochable, Ebrahimi v. Westbourne Galleries Ltd., [1972] 2 All ER 492, 507 (HL), par lord Cross of Chelsea;

- A noter que l'obligation de présenter sa demande de bonne foi, dans le but d'obtenir du tribunal les conclusions demandées, et non dans un but subsidiaire, tel l'exercice de pressions sur les administrateurs de la société pour qu'ils acceptent de rembourser des prêts que le demandeur a consenti à celle-ci, s'applique également à une demande présentée dans le cadre de l'article 210 du Companies Act 1948. Voir à cet effet Re Bellador Silk Ltd. [1965] 1 All ER 667, 671 et 672 (Ch D), par le juge Plowman.

142. Voir le paragraphe 225(2) du Companies Act 1948;

- In re Yenidje Tobacco Company Limited, [1916] 2 Ch 426, 432; [1916-17] All ER Rep 1050, 1052 (CA), par lord Cozens-Hardy, maître des rôles, avec lequel souscrivent lord Pickford, à la page 433; 1053, et lord Warrington, à la page 435; 1053;

- Loch v. John Blackwood Limited, [1924] AC 783, 787; [1924] All ER Rep 200, 203 (PC), par lord Shaw of Dunfermline;

. <u>In re Davis and Collett Limited</u>, [1935] 1 Ch 693, 702 et 703; [1935] All ER Rep 315, 318 (Ch D), par le juge Crossman qui fait remarquer qu'en l'absence d'entente entre les parties pour éviter la liquidation et la dissolution judiciaires de la société, il doit prononcer pareille ordonnance.

143. <u>In re Yenidje Tobacco Company Limited</u>, [1916] 2 Ch 426, 430 et 432 (CA), par lord Cozens-Hardy, maître des rôles;

. <u>Re Lundie Brothers Ltd.</u>, [1965] 2 All ER 692, 697; [1965] 1 WLR 1051, 1056 (Ch D), par le juge Plowman;

. <u>Re Westbourne Galleries Ltd.</u>, [1970] 3 All ER 374, 384 (Ch D), par le juge Plowman;

. <u>Ebrahimi</u> v. <u>Westbourne Galleries Ltd.</u>, [1972] 2 All ER 492, 506 et 507 (HL), par lord Cross of Chelsea.

144. A titre d'exemple, le juge Pennycuick, dans <u>Re Jermyn Street Turkish Baths Ltd.</u>, [1970] 3 All ER 57, 67 et 68 (Ch D), cite les précédents suivants: <u>Archbold</u> v. <u>Scully</u>, (1861) 9 HL Cas 360, 383; 11 ER 769, 778 (HL), par lord Wensleydale; <u>The Lindsay Petroleum Company</u> v. <u>Hurd</u>, (1873-74) LR 5 PC 221, 239 et 240, par sir Barnes Peacock; <u>Erlanger</u> v. <u>The New Sombrero Phosphate Company</u>, (1878) 3 App Cas 1218, 1279-1280; [1874-1880] All ER Rep 271, 286 (HL), par lord Blackburn; <u>Weld</u> v. <u>Petre</u>, [1929] 1 Ch 33, 50 à 52; [1928] All ER Rep 564, 568 et 569 (CA), par lord Lawrence.

De ces arrêts se dégagent les principes suivants: en l'absence de prescription légale, de présomption de libération d'une obligation ou de renonciation tacite à l'exercice d'un droit, le tribunal doit déterminer s'il y a lieu de rejeter la demande au motif d'acquiescement, de délai ou d'inexécution en temps voulu d'une chose nécessaire à l'exercice d'un droit. Lorsque le tribunal est saisi d'une défense qui invoque le délai ou l'inexécution en temps voulu d'une chose nécessaire à l'exercice d'un droit, sa décision repose toujours sur la diligence dont doit faire preuve le demandeur, et sur la modification intervenue dans la situation juridique des parties.

En l'absence de prescription légale, si seul le délai est invoqué, le tribunal doit tenir compte de la longueur du délai écoulé et du caractère des actes posés dans l'intervalle, lesquels peuvent tous deux affecter la situation juridique de chacune des parties et faire pencher la balance en faveur de l'une d'elles.

Si, par contre, le défendeur allègue l'inexécution en temps voulu d'une chose nécessaire à l'exercice d'un droit, le tribunal tiendra compte du laps de temps écoulé et du délai couru pour rejeter une demande, s'il est injuste de l'accueillir, parce que la conduite du demandeur a laissé croire qu'il renonçait implicitement à exercer son recours, ou que, sans renoncer à l'exercice de son recours, la conduite ou la négligence du demandeur ont déraisonnablement placé l'autre partie dans une situation intenable au cas où le demandeur choisit par la suite d'exercer son recours.

Enfin, l'acquiescement va plus loin que l'inexécution en temps voulu d'une chose nécessaire à l'exercice d'un droit. L'acquiescement constitue une permission implicite donnée par le demandeur qui, par son silence, ne s'objecte pas à ce que le défendeur engage une dépense dans l'accomplissement d'un acte ou modifie autrement sa situation juridique.

Outre la prescription légale, la présomption de libération d'une obligation ou la renonciation tacite à l'exercice d'un droit, la personne qui demande, pour des motifs de justice et d'équité, la liquidation et la dissolution d'une société, pourra se voir opposer la défense de délai, celle de l'inexécution en temps voulu d'une chose nécessaire à l'exercice de son droit et, enfin, la défense de l'acquiescement. Toutes ces défenses ont en commun le temps qu'aura laissé s'écouler le demandeur avant de saisir le tribunal de sa demande.

145. En première instance, le principe a été discuté par le juge Pennycuick dans <u>Re Jermyn Street Turkish Baths Ltd</u>., [1970] 3 All ER 57, 66 à 69 (Ch D), alors qu'en appel, à [1971] 3 All ER 184, 196, 198 et 200 (CA), lord Buckley a estimé en <u>obiter</u> que le laps de temps écoulé depuis que se sont produits les agissements attaqués en justice, pourrait suffire à faire rejeter la demande.

146. Baird v. Lees, [1924] SC 83, 84 à 88 et 90 à 92 (Court of Session), par le lord-président Clyde.

147. Loch v. John Blackwood Limited, [1924] AC 783, 786 et 787; [1924] All ER Rep 200, 202 et 203 (PC), par lord Shaw of Dunfermline.

148. Idem, aux pages 786 et 794 à 797; 203 et 206 à 208.

149. Thompson v. Drysdale, [1925] SC 311, 313 à 315 (Court of Session), par le lord-président Clyde.

150. In re Davis and Collett Limited., [1935] 1 Ch 693, 694 et 700 à 702; [1935] All ER Rep 315, 316 à 318 (Ch D), par le juge Crossman.

151. [1958] 3 All ER 66 (HL).

152. [1958] 3 All ER 689 (CA).

153. Voir supra, note 31.

154. Voir supra, note 126, pour le nom des trois affaires dont s'agit.

155. Re S.A. Hawken Ltd., [1950] 2 All ER 408, 408 à 411 (Ch D), par le juge Wynn-Parry.

156. Re Lundie Brothers Ltd., [1965] 2 All ER 692, 693 à 696 (Ch D), par le juge Plowman.

157. Ebrahimi v. Westbourne Galleries Ltd., [1972] 2 All ER 492, 495, 501 et 502 (HL), par lord Wilberforce; aux pages 505 et 506, par lord Cross of Chelsea.

158. Re Westbourne Galleries Ltd., [1970] 3 All ER 374, 385 (Ch D), par le juge Plowman. Il faut noter que le demandeur n'a pas fait appel du rejet de ses conclusions fondées sur l'article 210 du Companies Act 1948. Voir à cet effet les propos de lord Wilberforce dans Ebrahimi v. Westbourne Galleries Ltd., [1972] 2 All ER 492, 495 (HL).

159. Bentley-Stevens v. Jones, [1974] 2 All ER 653, 655 (Ch D), par le juge Plowman.

160. Re A & BC Chewing Gum Ltd., [1975] 1 All ER 1017, 1017 à 1020, ainsi que 1027 et 1028 (Ch D), par le juge Plowman.

161. Re St Piran Ltd., [1981] 3 All ER 270, 277 (Ch D), par le juge Dillon.

162. Voir supra, note 7, n° 60, page 30.

163. Elder v. Elder & Watson Limited, [1952] SC 49, 54 (Court of Session), par le lord-président Cooper;

Company law: oppression of minorities, (1953) 216 Law Times 639.

164. Elder v. Elder & Watson Limited, [1952] SC 49, 55 (Court of Session), par le lord-président Cooper;

Scottish Co-operative Wholesale Society Ltd. v. Meyer, [1958] 3 All ER 66, 69 (HL), par le vicomte Simonds qui estime que le préjudice injuste est évident à la lumière des faits de cet arrêt; aux pages 88 et 89, par lord Denning qui explique que les demandeurs se sont prévalus du recours de l'article 210 du Companies Act 1948 parce qu'une demande de liquidation et de dissolution de la société leur aurait injustement causé préjudice en ne leur permettant de recouvrer que la valeur liquidative de leurs actions;

Re H.R. Harmer Ltd., [1958] 3 All ER 689, 698 (CA), par lord Jenkins;

Re Jermyn Street Turkish Baths Ltd., [1970] 3 All ER 57, 67 (Ch D), par le juge Pennycuick qui déclare, sans plus de détail, être convaincu que les demandeurs subiraient un préjudice injuste s'il ordonnait la liquidation et la dissolution de la société.

165. Ce point a fait l'objet d'un court commentaire du juge Plowman, en obiter de sa décision dans Re Westbourne Galleries Ltd., [1970] 3 All ER 374, 385 (Ch D).

166. William GOODHART, Will s. 75 operate retrospectively?, (1980) 1 Co Law 292 et 293.

167. John BIRDS, Section 210 is not dead and buried, (1982) 3 Co Law 77.

168. D.J. BAKIBINGA, When s. 75 comes into operation, (1981) 2 Co Law 221-222.

169. Victor JOFFE et Andrew HOCHHAUSER, The Companies Act 1980: a practical guide, London, Oyez Publishing, 1980, n^{o} 12.210.

170. Letitia CRABB, loc. cit., n. 46, page 3;

- Anthony J. BOYLE, The Companies Act 1980 (4); Power of Court to grant relief on a petition alleging unfair practice, (1980) 1 Co Law 280.

171. Roger GREGORY, The section 20 contract, (1981) 44 Modern L Rev 526.

172. Ibid;

- Anthony J. BOYLE, loc.cit., n. 170, page 282;

- Diane M. HARE, Companies Act 1980-X; Miscellaneous matters, (1980) 124 Sol J 654.

173. Anthony J. BOYLE, loc. cit., n. 170, page 282.

174. Diane M. HARE, loc. cit., n. 172, page 653.

175. Diane M. HARE, <u>loc.cit</u>., n. 172, page 654.

176. André TUNC, <u>La loi britannique de 1980 sur les sociétés anonymes</u>, (1981) 33 Revue int de droit comp 97.

177. Roger GREGORY, <u>loc. cit</u>., n. 171, page 526.

178. Clive M. SCHMITTHOFF, <u>Editorial</u>, (1978) J Bus L 311.

179. Robert F.C. LAWRIE, <u>The potential for corporate 'freezeouts' under English law</u>, (1982) 3 Co Law 164.

180. Diane M. HARE, <u>loc. cit</u>., n. 172, page 654.

181. Ralph INSTONE, <u>The duty of directors</u>, (1979) J Bus L 228;

Anthony J. BOYLE, <u>loc. cit</u>., n. 170, pages 281 et 283, souligne que la mauvaise gestion d'une société, causée par la négligence des défendeurs, devrait permettre au demandeur d'obtenir l'autorisation d'intenter un recours dérivé, conformément aux nouvelles dispositions de l'article 75 du <u>Companies Act 1980</u>. Quant au recours de l'article 210 du <u>Companies Act 1980</u>, Boyle affirme qu'il n'aurait sans doute pu être invoqué en pareil cas, alors que le juge Buckley a déjà rejeté un recours semblable, fondé sur l'article 210 du <u>Companies Act 1948</u>, dans <u>Re Five Minute Car Wash Service Ltd</u>., I1966I 1 All ER 242, 247 et 248 (Ch D), au motif que la négligence dans l'administration d'une société ne constitue aucunement de l'oppression.

182. Il s'agit ici du <u>Corporate freezeout</u>, une question qui a retenu l'attention et occupé les législateurs de différents pays, dont ceux des Etats-Unis d'Amérique;

- Robert F.C. LAWRIE, <u>loc.cit.</u>, n.179, page 164.

183. Anthony J. BOYLE, <u>loc. cit.</u>, n. 170, page 281.

184. Letitia CRABB, <u>loc. cit.</u>, n.46, page 3.

185. Anthony J. BOYLE, <u>loc.cit.</u>, n. 170, page 281.

186. <u>Ibid</u>.

187. <u>Ibid</u>.

188. Letitia CRABB, <u>loc. cit.</u>, n.46, page 3.

189. <u>Idem</u>, aux pages 3 et 4;

- Robert F.C. LAWRIE, <u>loc. cit.</u>, n. 179, page 164.

190. Letitia CRABB, <u>loc. cit.</u>, n. 46, page 3.

191. 1981 U. K., c.62, ci-après cité seulement sous son titre "<u>Companies Act 1981</u>".

192. Diane M. HARE, <u>Companies Act 1981 (part 6)</u>, (1982) 126 Sol J 256.

193. Robert F.C. LAWRIE, loc. cit., n. 179, page 164.

194. Sir Robert MEGGARY et P.V. BAKER, Snell's principles of equity, 27e éd., London, Sweet & Maxwell Limited, 1973, page 6.

195. George W. KEETON et L.A. SHERIDAN, Equity, 2e éd., Milton, Professional Books Limited, 1976, aux pages 23 et 29.

196. Sir Robert MEGGARY et P.V. BAKER, op. cit., n. 194, aux pages 5 et 27.

197. Idem, aux pages 5 et 6.

198. (1843) 2 Hare 461; 67 ER 189.

199. Il s'agit ici de la "doctrine of fraud on the minority", un ensemble de principes jurisprudentiels qui régissent le droit d'un actionnaire minoritaire d'intenter un recours dérivé, en certaines circonstances et par exception au principe formulé par l'arrêt Foss v. Harbottle, (1843) 2 Hare 461; 67 ER 189.

200. Robert F.C. LAWRIE, loc. cit., n. 179, page 164.

201. Letitia CRABB, loc. cit., n. 46, page 3, note 3.

202. Allen v. Gold Reefs of West Africa Ltd., [1900] 1 Ch 656, 671; [1900-03] All ER Rep 746, aux pages 749 et 750 (CA), par lord Lindley, maître des rôles;

. Voir aussi Re H.R. Harmer Ltd., I1958I 3 All ER 689, 703 à 705 (CA), par lord Jenkins, à la page 706, par lord Romer, et à la page 710, par lord Willmer.

203. Elder v. Elder & Watson Limited, I1952I SC 49, 55 (Court of Session), par le lord-président Cooper.

204. Roger GREGORY, loc. cit., n. 171, aux pages 526 et 527;

. Letitia CRABB, loc. cit., n. 46, page 3, note 5a).

205. Anthony J. BOYLE, loc. cit., n. 170, page 281.

206. Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492, 501 et 502 (HL), par lord Wilberforce;

. Lawrence Cecil B. GOWER, op. cit., n. 33, page 662.

207. Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492, 500 (HL), par lord Wilberforce;

. Lawrence Cecil B. GOWER, op. cit., n. 33, aux pages 660 et 661.

208. Voir en ce sens, Letitia CRABB, loc. cit., n. 46, aux pages 3 et 4;

. B.M. HANNIGAN, Statutory protection for minority shareholders; Section 75 of the Companies Act 1980, (1982) 11 Anglo-Am L Rev 22 à 24, souhaite que les tribunaux britanniques innovent en permettant à un actionnaire de recourir à l'article 75 du <u>Companies Act 1980</u> s'il se voit privé de ses fonctions au sein d'une société, rejetant ainsi l'interprétation restrictive donnée à l'article 210 du <u>Companies Act 1948</u>;

. Barry A.K. RIDER, <u>Extending the scope of s. 75</u>, (1981) 2 Co Law 26, fait état du voeu du <u>Law Society's Company Law Committee</u> de voir conférer au tribunal le pouvoir de prononcer une ordonnance en vertu de l'article 75 du <u>Companies Act 1980</u>, lorsque les faits justifient la liquidation et la dissolution d'une société conformément à l'alinéa 222f) du <u>Companies Act 1948</u>. L'auteur est toutefois d'avis que le tribunal possède déjà ce pouvoir lorsque l'actionnaire-demandeur fonde son recours sur les faits imputables à la société, puisqu'il doit subir un préjudice injuste pour pouvoir se prévaloir, à son choix, de l'alinéa 222f) du <u>Companies Act 1948</u> ou de l'article 75 du <u>Companies Act 1980</u>.

209. Lawrence Cecil B. GOWER, <u>op. cit.</u>, n. 33, page 669;

. Anthony J. BOYLE, <u>loc. cit.</u>, n. 170, page 282;

. Roger GREGORY, <u>loc. cit.</u>, n. 171, pages 526 et 527;

. Barry A.K. RIDER, <u>loc. cit.</u>, n. 208, page 26;

. Susan J. BURRIDGE, <u>Wrongful rights issues</u>, (1981) 44 Modern L Rev 61 et 62, souligne le danger de voir le tribunal interpréter de manière stricte et restrictive le recours de l'article 75 du <u>Companies Act 1980</u>;

- Ralph INSTONE, Unfair prejudice to shareholders, (1981) 131 New L J 1317;

- Voir également les craintes exprimées par B.M. HANNIGAN, loc. cit., n. 208, aux pages 22 à 24, ainsi qu'à la page 35.

210. Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492, 501 et 502 (HL), par lord Wilberforce.

211. Elder v. Elder & Watson Limited, I1952I SC 49, 57 et 58 (Court of Session), par le lord-président Cooper et lord Keith;

- In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641, à la page 640;

- Re H.R. Harmer Ltd., I1958I 3 All ER 689, 698 (CA), par lord Jenkins;

- Re Bellador Silk Ltd., I1965I 1 All ER 667, 671 (Ch D), par le juge Plowman;

- Re Lundie Brothers Ltd., I1965I 2 All ER 692, 698 (Ch D), par le juge Plowman;

. Re Five Minute Car Wash Service Ltd., I1966I 1 All ER 242, 246 (Ch D), par le juge Buckley;

. Re Jermyn Street Turkish Baths Ltd., I1971I 3 All ER 184, 200 (CA), par lord Buckley;

. Dans l'arrêt Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492 (HL), les quatre lords qui constituent la majorité des lords saisis de l'appel, ne se sont pas prononcés sur ce point parce que le demandeur n'a pas fait appel du rejet de sa demande fondée sur l'article 210 du Companies Act 1948 (voir à cet effet I1972I 2 All ER 492, 495 (HL), par lord Wilberforce). Seul lord Cross of Chelsea se prononce sur ce point (voir I1972I 2 All ER 492, 505 (HL)) et affirme que l'actionnaire minoritaire doit subir un préjudice en sa qualité d'actionnaire. Ces propos de lord Cross n'ont toutefois que la valeur d'un obiter parce qu'il n'était saisi d'aucun recours fondé sur l'article 210 du Companies Act 1948, et n'a reçu l'appui d'aucun des lords saisi de l'appel.

212. Elder v. Elder & Watson Limited, I1952I SC 49, 57 (Court of Session), par le lord-président Cooper, et à la page 61, par lord Keith;

. Re H.R. Harmer Ltd., I1958I 3 All ER 689, 700 et 701 (CA), par lord Jenkins qui cite avec approbation les propos tenus par le lord-président Cooper dans Elder v. Elder & Watson Limited, I1952I SC 49, 57 (Court of Session);

- Re Fildes Bros. Ltd., I1970I 1 All ER 923, 924 et 927 (Ch D), par le juge Meggary.

213. Elder v. Elder & Watson Limited, I1952I SC 49, 57 (Court of Session), par le lord-président Cooper, et aux pages 58 et 61, par lord Keith;

- Re H.R. Harmer Ltd., I1958I 3 All ER 689, 700 et 701 (CA), par lord Jenkins qui cite avec approbation les propos tenus par le lord-président Cooper dans Elder v. Elder & Watson Limited, I1952I SC 49, 57 (Court of Session);

- Re Bellador Silk Ltd., I1965I 1 All ER 667, 671 (Ch D), par le juge Plowman;

- Re Lundie Brothers Ltd., I1965I 2 All ER 692, 698 et 699 (Ch D), par le juge Plowman;

- Re Five Minute Car Wash Service Ltd., I1966I 1 All ER 242, 246 (Ch D), par le juge Buckley;

- Re Westbourne Galleries Ltd., I1970I 3 All ER 374, 378 et 385 (Ch D), par le juge Plowman.

214. Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492, 496; I1973I AC 360, 374 (HL), par lord Wilberforce.

215. Ibid;

- M.J. TREBILCOCK, A new concern for the minority shareholder; Ebrahimi v. Westbourne Galleries Ltd. (In re Westbourne Galleries Ltd.): I1972I 2 WLR 1289 (HL), (1973) 19 McGill LJ 108 et 113, souhaitait que les tribunaux britanniques adoptent le même raisonnement à l'égard du recours de l'article 210 du Companies Act 1948;

- Voir, au même effet, F. Hodge O'NEAL, op. cit., n. 63, page 634;

- B.M. HANNIGAN, loc. cit., n. 208, aux pages 23 et 24, déclare que les tribunaux britanniques devront accorder la même interprétation au recours de l'article 75 du Companies Act 1980, afin de lui permettre de jouer pleinement son rôle auprès des actionnaires minoritaires.

216. In re Davis and Collett Limited, I1935I 1 Ch 693, 702 (Ch D), par le juge Crossman;

- Re Lundie Brothers Ltd., I1965I 2 All ER 692, 698 (Ch D), par le juge Plowman;

- Re Westbourne Galleries Ltd., I1970I 3 All ER 374, 384 (Ch D), par le juge Plowman, confirmé en appel par la Chambre des lords sous le nom de Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492, 501 et 502 (HL), par lord Wilberforce;

- <u>Bentley-Stevens</u> v. <u>Jones</u>, I1974I 2 All ER 653, 655 (Ch D), par le juge Plowman;

- <u>Re A & BC Chewing Gum Ltd</u>.; <u>Topps Chewing Gum Inc</u>. v. <u>Coakley</u>, I1975I 1 All ER 1017, 1027 et 1028 (Ch D), par le juge Plowman.

217. <u>Ebrahimi</u> v. <u>Westbourne Galleries Ltd</u>., I1972I 2 All ER 492, 495 (HL), par lord Wilberforce.

218. Voir, en ce sens, M.J. TREBILCOCK, <u>loc. cit</u>., n. 215, aux pages 108 et 113.

219. Voir, pour plus de détails, Lawrence Cecil B. GOWER, <u>op. cit</u>., n. 33, aux pages 662 à 664.

- Dans <u>Ebrahimi</u> v. <u>Westbourne Galleries Ltd</u>., I1972I 2 All ER 492, 503 (HL), lord Cross of Chelsea signale que l'improbité justifie la liquidation et la dissolution d'une société pour des motifs de justice et d'équité, mais rapporte qu'il n'est pas nécessaire que la conduite des défendeurs soit injuste et inéquitable pour justifier pareille ordonnance du tribunal.

220. Allen v. Gold Reefs of West Africa Ltd., I1900I 1 Ch 656, 671; I1900-03I All ER Rep 746, 749 et 750 (CA), par lord Lindley, maître des rôles.

221. Letitia CRABB, loc.cit., n.46, page 4;

Robert F.C. LAWRIE, loc. cit., n.179, page 163.

222. Letitia CRABB, loc.cit., n. 46, page 4.

223. Ibid.

224. Robert F.C. LAWRIE, loc. cit., n. 179, page 163.

225. Clemens v. Clemens Bros. Ltd., I1976I 2 All ER 268, 282 (Ch D), par le juge Foster.

226. Letitia CRABB, loc.cit., n. 46, aux pages 4 à 11.

227. Idem, aux pages 6, 7 et 8.

228. Idem, aux pages 8 et 11.

229. Foss v. Harbottle, (1843) 2 Hare 461;67 ER 189.

230. Allen v. Gold Reefs of West Africa Ltd., I1900I 1 Ch 656, 676; I1900-03I All ER Rep 746, 752 (CA), par lord Vaughan Williams.

231. Shuttleworth v. Cox Brothers and Company (Maidenhead) Limited, I1927I 2 KB 9, 18 (CA), par lord Bankes; à la page 23, par lord Scrutton; et à la page 27, par lord Atkin.

232. <u>Greenlagh</u> v. <u>Ardene Cinemas Ltd</u>., I1950I 2 All ER 1120, 1126 (CA), par lord Evershed, maître des rôles.

233. <u>Sidebottom</u> v. <u>Kershaw, Leese and Company Limited</u>, I1920I 1 Ch 154, 164 et 165 (CA), par lord Sterndale, maître des rôles; à la page 171, par lord Warrington; ainsi qu'aux pages 173 et 174, par le juge Eve.

234. Letitia CRABB, <u>loc. cit</u>., n. 46, page 7.

235. <u>Scottish Co-operative Wholesale Society Ltd</u>. v. <u>Meyer</u>, I1958I 3 All ER 66 (HL).

236. <u>Re H.R. Harmer Ltd</u>., I1958I 3 All ER 689 (CA).

237. <u>Re Five Minute Car Wash Service Ltd</u>., I1966I 1 All ER 242 (Ch D), par le juge Buckley.

238. Voir <u>supra</u>, notes 82 à 85.

239. Voir <u>supra</u>, note 87.

240. Anthony J. BOYLE, <u>loc. cit</u>., n. 170, page 280.

241. Voir les arrêts <u>Scottish Co-operative Wholesale Society Ltd</u>. v. <u>Meyer</u>, I1958I 3 All ER 66 (HL), et <u>Re H.R. Harmer Ltd</u>., I1958I 3 All ER 689 (CA).

242. Lawrence Cecil B. GOWER, <u>op. cit</u>., n. 33, page 670, telle que modifiée par le <u>Principles of modern company law; supplement to the fourth edition</u>, London, Stevens & Sons, 1981.

243. Lawrence Cecil B. GOWER, op. cit., n.33 , page 668;

. Robert F. C. LAWRIE, loc.cit., n. 179, page 164.

244. In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641, à la page 639.

245. Re Westbourne Galleries Ltd., I1970I 3 All ER 374, 384 et 385 (Ch D), par le juge Plowman.

246. Anthony J. BOYLE, loc. cit., n. 170, page 281.

247. Re Five Minute Car Wash Service Ltd.; I1966I 1 All ER 242 (Ch D), par le juge Buckley.

248. Anthony J.BOYLE, loc.cit., n. 170, page 281.

249. Lawrence Cecil B. GOWER, op. cit., n. 33, page 668.

250. Susan J. BURRIDGE, loc.cit., n. 209, page 62.

251. Northern Counties Securities Ltd. v. Jackson & Steeple Ltd., I1974I 1 WLR 1133, 1144; I1974I 2 All ER 625, 635 (Ch D), par le juge Walton;

. Susan J, BURRIDGE, loc.cit., n. 209 , page 63.

252. Susan J. BURRIDGE, loc. cit., n. 209 , aux pages 63 et 64.

253. Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66, 71 et 72 (HL), par le vicomte Simonds; à la page 74, par lord Morton of Henryton; à la page 85, par lord Keith of Avonholm; et à la page 88, par lord Denning.

254. In re Stewarts (Brixton) Ltd., décision non rapportée de la Chancery Division, rendue le 27 novembre 1981 par le juge Vinelott, et résumée à la page 11 de l'édition du 11 décembre 1981 du Financial Times de Londres. Cette décision est également résumée et commentée par John BIRDS, dans Section 210 is not dead and buried, (1982) 3 Co Law 77.

255. Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66, 74 (HL), par lord Morton of Henryton.

256. Voir supra, note 10, n° 208, page 77, et n° 212d), page 78.

257. Re Antigen Laboratories Ltd., I1951I 1 All ER 110 (Ch D), par le juge Roxburgh.

258. In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641, à la page 641.

259. Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66, 86 (HL), par lord Keith of Avonholm, ainsi qu'à la page 89, par lord Denning.

260. Re H.R. Harmer Ltd., I1958I 3 All ER 689, 698 et 699 (CA), par lord Jenkins.

261. Re H.R. Harmer Ltd., I1958I 3 All ER 689, 710 (CA), par lord Willmer.

262. Re Bellador Silk Ltd., I1965I 1 All ER 667, 672 (Ch D), par le juge Plowman.

263. Scottish Co-operative Wholesale Society Ltd. v. Meyer I1958I 3 All ER 66, 86 (HL), par lord Keith of Avonholm.

264. Diane M. HARE, loc. cit., n. 172, page 654.

265. Ibid.

266. Re H.R. Harmer Ltd., I1958I 3 All ER 689, 704 (CA), par lord Jenkins;

In re Stewarts (Brixton) Ltd., décision non rapportée de la Chancery Division, rendue le 27 novembre 1981 par le juge Vinelott, et résumée à la page 11 de l'édition du 11 décembre 1981 du Financial Times de Londres. Cette décision est également résumée et commentée sur ce point par John BIRDS, dans Section 210 is not dead and buried, (1982) 3 Co Law 77.

267. Charles Forte Investments Ltd. v. Amanda, I1963I 2 All ER 940, 948 (CA), par lord Willmer; à la page 950, par lord Danckwerts; et à la page 951, par le juge Cross.

268. Re Jermyn Street Turkish Baths Ltd., I1971I 3 All ER 184, 200 et 201 (CA), par lord Buckley.

269. In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641, à la page 641;

- Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66, 72 (HL), par le vicomte Simonds, et à la page 89, par lord Denning;

- Re Jermyn Street Turkish Baths Ltd., I1970I 3 All ER 57, 67 (Ch D), par le juge Pennycuick.

270. In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641, à la page 641.

271. Re S.A. Hawken Ltd., I1950I 2 All ER 408, 411 (Ch D), par le juge Wynn-Parry;

- Re Lundie Brothers Ltd., I1965I 2 All ER 692, 694 et 699 (Ch D), par le juge Plowman;

- Re Westbourne Galleries Ltd., I1970I 3 All ER 374, 375, 384 et 385 (Ch D), par le juge Plowman, confirmé en appel par la Chambre des lords sous le nom de Ebrahimi v. Westbourne Galleries Ltd., I1972I 2 All ER 492, 495, 501 et 502 (HL), par lord Wilberforce; et à la page 506, par lord Cross of Chelsea;

- Re Jermyn Street Turkish Baths Ltd., I1971I 3 All ER 184, 196 (CA), par lord Buckley;

- Re St Piran Ltd., I1981I 3 All ER 270, 272 et 273 (Ch D), par le juge Dillon.

272. In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641, à la page 641. Dans cette décision, le juge Roxburgh signale que la nomination d'un inspecteur ne peut par elle-même mettre fin à l'oppression des demandeurs; c'est pourquoi il rejette leur recours fondé sur l'article 210 du Companies Act 1948, tout en évoquant la possibilité d'ordonner cette mesure à titre accessoire seulement.

273. In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641, à la page 641. Dans cette décision, le juge Roxburgh se déclare incompétent pour nommer un séquestre judiciaire à la demande d'un actionnaire minoritaire;

. Re Bellador Silk Ltd., I1965I 1 All ER 667, 668 (Ch D), par le juge Plowman.

274. In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities, à (1953) 216 Law Times 639-641, à la page 641. Dans cette décision, le juge Roxburgh refuse de nommer un administrateur au motif que les actionnaires de la société peuvent le destituer. Ce motif n'est toutefois guère péremptoire parce que le juge Roxburgh aurait facilement pu y pallier.

275. Re H.R. Harmer Ltd., I1958I 3 All ER 689, 692 et 705 (CA), par lord Jenkins;

. Re Bellador Silk Ltd., I1965I 1 All ER 667, 668 (Ch D), par le juge Plowman.

276. Re Lundie Brothers Ltd., I1965I 2 All ER 692, 696 (Ch D), par le juge Plowman.

277. Dans la décision Clemens v. Clemens Bros. Ltd., I1976I 2 All ER 268, 270 (Ch D), le juge Foster prononce l'annulation de trois résolutions de l'assemblée générale des actionnaires de la société en cause, au motif d'oppression. En l'espèce, la demanderesse a choisi de procéder par voie d'une simple action en annulation des trois résolutions visées, à cause des difficultés liées au recours de l'article 210 du Companies Act 1948.

278. In re Hannetta Limited, décision non rapportée de la Chancery Division, rendue le 2 novembre 1953 par le juge Roxburgh, qui fait l'objet d'un commentaire intitulé Company law: oppression of minorities à (1953) 216 Law Times 639-641, à la page 641. Dans cette décision, le juge Roxburgh refuse d'annuler une cession d'actions au motif que la nullité prétendue de la cession d'actions empêche celle-ci de constituer de l'oppression, et au motif que l'annulation de la cession d'actions ne permettrait pas au demandeur de devenir actionnaire majoritaire et de mettre fin à l'oppression qu'il allègue.

279. Re S.A. Hawken Ltd., I1950I 2 All ER 408, 409 (Ch D), par le juge Wynn-Parry.

280. Re a company, I1981I 2 All ER 1007, 1007 et 1008 (Ch D), par le juge Vinelott.

281. Voir, pour plus de détails, Leon GETZ, Court ordered company meetings, (1969) 33 Conveyancer 399-409, en particulier aux pages 405 et 406.

282. Voir, pour une discussion complète de cette question, Patricia BALFOUR, A shareholder's action in tort: the difficulty in assessing damages, (1981) 19 W Ont L Rev 273-279.

283. Idem, page 278.

284. Idem, pages 276 et 278.

285. Dans Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66, 89 (HL), lord Denning semble dire que le recours de l'article 210 du Companies Act 1948 ne permet pas d'obtenir des dommages-intérêts pour compenser des fautes passées. Après avoir établi que le recours doit mettre fin à l'oppression reprochée, lord Denning poursuit toutefois son raisonnement en déclarant que le rachat des actions qui appartiennent aux demandeurs, permet en fait au tribunal d'accorder une compensation monétaire aux actionnaires qui ont subi l'oppression. En effet, lorsque le tribunal fixe le prix de rachat des actions, il leur attribue une valeur qui ne reflète pas leur cours réel à la date de l'institution du recours ou du jugement, mais le cours présumé de ces actions à la date de l'institution du recours si ce cours n'avait pas été diminué à la suite des agissements

oppressifs reprochés. L'écart entre le cours réel des actions et leur cours présumé constitue en fait une compensation monétaire pour le préjudice dont les défendeurs sont responsables, même s'il ne s'agit pas à proprement parler de dommages-intérêts.

286. Re H.R. Harmer Ltd., I1958I 3 All ER 689, 692 (CA), par lord Jenkins, lord Romer et lord Willmer;

- Anthony J. BOYLE, loc.cit., n. 170, page 283.

287. Re Lundie Brothers Ltd., I1965I 2 All ER 692, 694 (Ch D), par le juge Plowman.

288. Re Antigen Laboratories Ltd., I1951I 1 All ER 110 (Ch D), par le juge Roxburgh.

289. Re H. R. Harmer Ltd., I1958I 3 All ER 689, 692 (CA), par lord Jenkins, lord Romer et lord Willmer;

- Re Jermyn Street Turkish Baths Ltd., I1970I 3 All ER 57, 69 (Ch D), par le juge Pennycuick;

- In re Stewarts (Brixton) Ltd., décision non rapportée de la Chancery Division, rendue le 27 novembre 1981 par le juge Vinelott, et résumée à la page 11 de l'édition du 11 décembre 1981 du Financial Times de Londres. Cette décision est également résumée et commentée par John BIRDS, dans Section 210 is not dead and buried, (1982) 3 Co Law 77.

290. Re S. A. Hawken Ltd., I1950I 2 All ER 408, 409 (Ch D), par le juge Wynn-Parry;

. Re Lundie Brothers Ltd., I1965I 2 All ER 692, 696 (Ch D), par le juge Plowman;

. Re Five Minute Car Wash Service Ltd., I1966I 1 All ER 242, 243 (Ch D), par le juge Buckley;

. Re Jermyn Street Turkish Baths Ltd., I1970I 3 All ER 57, 69 (Ch D), par le juge Pennycuick;

. Re Westbourne Galleries Ltd., I1970I 3 All ER 374, 375 (Ch D), par le juge Plowman;

. Re a company, I1981I 2 All ER 1007, 1007 (Ch D), par le juge Vinelott.

291. Elder v. Elder & Watson Limited, I1952I SC 49, 49 et 50 (Court of Session), par le lord-président Cooper, lord Carmont, lord Russel et lord Keith;

. Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66, 67, 69 et 72 (HL), par le vicomte Simonds; et à la page 89, par lord Denning;

. Re a company, I1981I 2 All ER 1007, 1007 (Ch D), par le juge Vinelott.

292. Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66, 72 (HL), par le vicomte Simonds.

293. Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66, 86 (HL), par lord Keith of Avonholm, et à la page 89, par lord Denning;

. Re Jermyn Street Turkish Baths Ltd., I1970I 3 All ER 57, 67 et 69 (CH D), par le juge Pennycuick;

. Anthony J. BOYLE, loc. cit., n. 170, aux pages 282 et 283.

294. Anthony J. BOYLE, loc. cit., n. 170, page 282.

295. Scottish Co-operative Wholesale Society Ltd. v. Meyer, I1958I 3 All ER 66, 89 (HL), par lord Denning.

296. Voir supra, notes 289 à 291.

297. Elder v. Elder & Watson Limited, I1952I SC 49, 58 (Court of Session), par le lord-président Cooper;

. Voir aussi, un peu dans le même sens, Re a company, I1981I 2 All ER 1007, 1007 et 1008 (Ch D), où le juge Vinelott accepte d'entériner les termes de la transaction intervenue entre les parties au litige, laquelle prévoit entre autres le rachat des actions du demandeur.

298. Re H.R. Harmer Ltd., I1958I 3 All ER 689, 692 (CA), par lord Jenkins, lord Romer et lord Willmer.

299. Re Lundie Brothers Ltd., I1965I 2 All ER 692, 696 (Ch D), par le juge Plowman.

300. Re H.R. Harmer Ltd., I1958I 3 All ER 689, 692 et 705 (CA), par lord Jenkins; à la page 707, par lord Romer; et à la page 710, par lord Willmer.

301. Re Lundie Brothers Ltd., I1965I 2 All ER 692, 696 (Ch D), par le juge Plowman.

302. Re S.A. Hawken Ltd., I1950I 2 All ER 408, 411, 412 et 413 (Ch D), par le juge Wynn-Parry.

303. Idem, page 413.

304. André TUNC, loc. cit., n.176, page 97.

305. Wallersteiner v. Moir (No2), I1975I 1 All ER 849, 862 (CA), par lord Denning, maître des rôles; aux pages 868 et 869, par lord Buckley; et à la page 871, par lord Scarman;

- D. SUGARMAN, The minority shareholder, (1975) 91 L Quarterly Rev 482 à 487;

- Harry RAJAK, Costs and the minority shareholder, (1975) 125 New LJ 1109 à 1111;

- Roger LANE-SMITH, Minority shareholders' action, (1976) 120 Sol J 155 et 156.

306. Diane M. HARE, <u>loc. cit</u>[illegible]72, page 654;

Anthony J. BOYLE, <u>loc. cit</u>., n. 170, page 282.

307. Anthony J. BOYLE, <u>loc. cit</u>., n. 170, page 283.

308. <u>Ibid</u>.

309. <u>Ibid</u>.

310. Robert F.C. LAWRIE, <u>loc. cit</u>., n. 179, aux pages 164 et 165.

311. <u>Percival</u> v. <u>Wright</u>, I1902I 2 Ch 421, 426 (Ch D); par le juge Swinfen Eady.

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