History and implications of the Nares Strait conflict

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The question "Did Greenland drift along Nares Strait?" has been debated for more than 70 years. There have been five periods, each represented by a consensus on one or the other extreme, or by a conflict.

At times opinions on the Strait have changed rapidly when a new global theory came in or went out. There is a possibility that at these times opinion on the Strait has been determined more by theory than by evidence.

At present there is a conflict. One group of earth scientists have worked on the shores of the Strait and have correlated stratigraphic and structural features across it. They conclude that a slight movement of some kilometres, but not exceeding 25 km, may have occurred. Another group have worked in the oceanic basins surrounding Greenland and their conclusion is that there has been 220 km or more of sinistral movement along the Strait.

The solution to the Nares Strait conflict appears to be clear-cut. We must determine whether displacement was a) less than 25 km orb) more than 220 km. There have been no serious suggestions about sinistral motion between these two extremes.

The origin of Nares Strait has enormous implications for tectonics. The Strait is an important element in tectonics of the northern hemisphere, and it is a key to the pre-drift position of Greenland. It is thereby an important feature in the reconstruction of the North Atlantic Ocean as well as the Arctic Ocean. If there has been hundreds of kilometres of sinistral displacement of Greenland along the Strait, then much support is given to the conventional plate tectonic theory which is widely accepted today. If displacement was minor, or non-existent, then plate tectonic theory is faced with a major problem: what are the origins of Baffin Bay and Labrador Sea?

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"Science should always try to follow the path of least astonishment" - Manik Talwani, 1981.

History of the conflict

Nares Strait (Fig. 1) has been a battleground for tectonic theories for more than 70 years. During this time the pendulum of scientific opinion concerning displacement along the Strait has swung back and forth. The history of discussion on the Strait is divided into five periods, each represented by a consensus on one or the other extreme, or by a conflict. It is interesting to note that the swings in opinion on Nares Strait have coincided with swings in popularity of global theories about horizontal displacements generally.

1. Original consensus

The earliest geological work along Nares Strait was done by the 19th century explorers, who were concerned primarily with geographical exploration (see Dawes & Christie, this volume). The Strait was shown on early geological maps (e.g. Feilden & De Rance 1878), but n mention was made of horizontal displacements. Early authors presumably took it for granted that the lands adjacent to the Strait were fixed geographically. This was part of an original consensus about the Earth, as yet unchallenged.

2. Continental drift emerges

The first published suggestion of great displacement along Nares Strait was made by F. B. Taylor (1910). He considered that Greenland had been fixed in position and that the surrounding lands had moved away from it. Alfred Wegener expanded Taylor's ideas in his theory of continental drift and publicised the theory widely (Fig. 2b) (Wegener 1915, 1922, 1924). Movement of Greenland along Nares Strait was a very important element of Wegener's theory.

The theory of continental drift was not accepted by the majority of earth scientists. Nevertheless, it was a serious challenge to conventional theories and had such

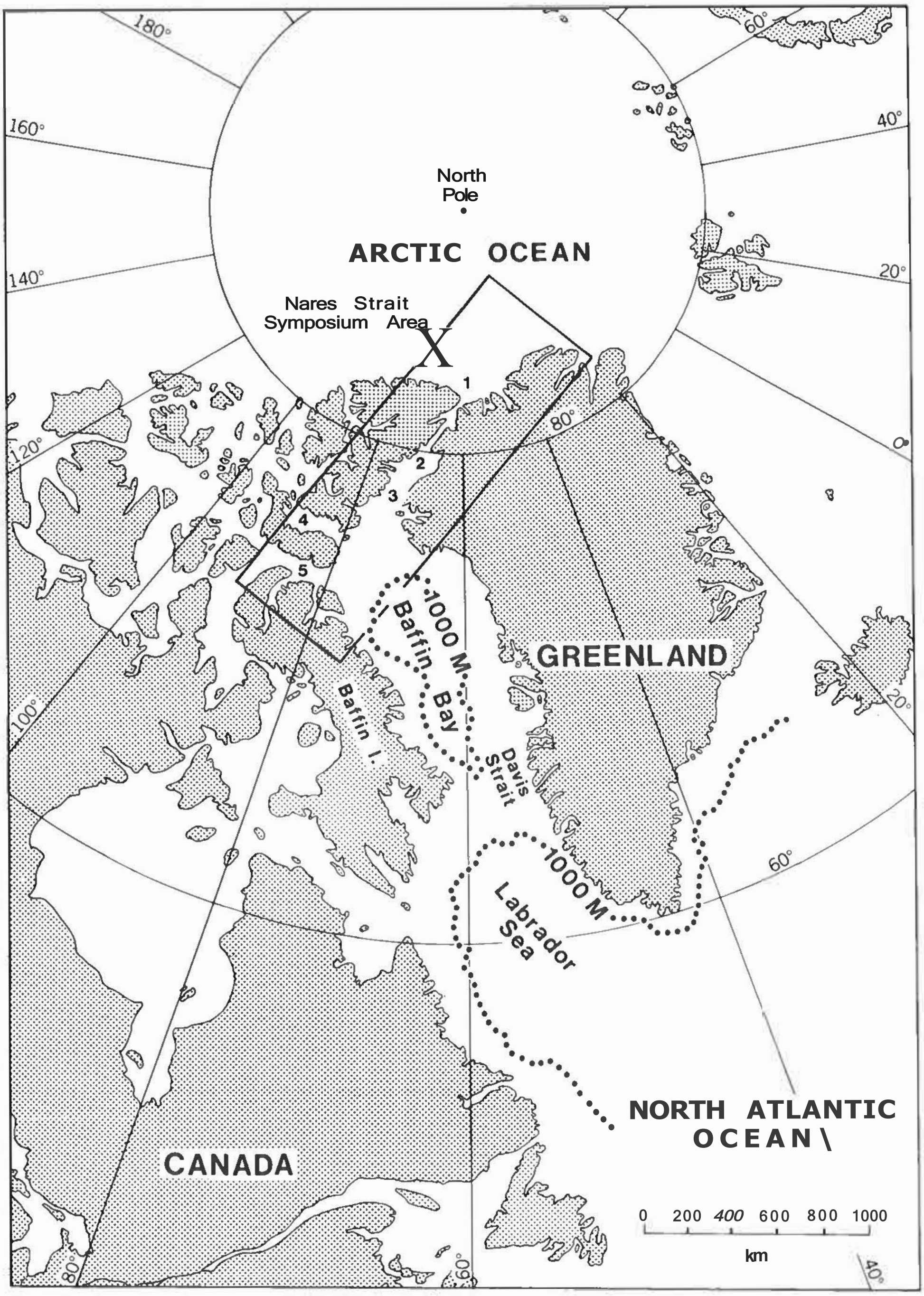

Fig. I. Present geography of the Nares Strait area. The amount of horizontal displacement that occurred in the Strait or nearby has a major bearing on the movement of Greenland and thereby on the origin of the North Atlantic and Arctic Oceans. I = Lincoln Sea, 2 "' Kane Basin, 3 = Smith Sound, 4 = Jones Sound, 5 = Lancaster Sound. Modified from Kerr (I980a).

a large following that two symposia were held to discuss it. The British Association for the Advancement of Science discussed the theory in London (Wright 1923) and the American Association of Petroleum Geologists discussed it in Tulsa (van Waterschoot van dcr Gracht et al. 1928). At both symposia the theory was slrongly criticised.

3. Drift discredited and ignored

Continental drift received considerable acceptance in the southern hemisphere, where du Toit (1937) supported it. Most geologists and geophysicists in the northern hemisphere, however, regarded the theory as outlandish and attacked it (Jeffreys 1929). Those papers and symposia in the 1920s that attacked it convinced the scientific communities in North America and Europe that Wegener's theory had been discredited and could be regarded as dead. For the next 30 years, geological papers rarely mentioned the subject. It is presumed that their authors considered that drift had not occurred. However, there were exceptions to this: for example Hilgenberg (1948) and Wegmann (1948).

While Wegener's global theory of continental drift was being discredited at international symposia, his more local theory of displacement along Nares Strait was being discredited on a more local level. Lauge Koch had worked on the entire coast of Greenland adjacent to Nares Strait, and his early work (Koch 1920) had been quoted by Wegener as supporting strike-slip displacement there. Koch in fact was opposed to drift along Nares Strait and considered that Wegener had misused his observations (Koch 1929). Koch suggested that Nares Strait could have formed by the erosion of a "Grabensenkung", related to Cretaceous-Tertiary faulting farther south, around Baffin Bay (see Dawes & Christie, this volume: fig. 14). Critics of Wegener curtailed discussion of continental drift globally. In the same way Koch's opposition curtailed discussion of drift along Nares Strait for an equal period of time.

After Koch's (1929) paper opposing it, the suggestion of drift along Nares Strait lay dormant for about 30 years. Many geologists visited Nares Strait and published on the adjacent coasts of Greenland and Canada (Wordie 1938, Bentham 1941, Munck 1941, Troelsen 1950, Kurtz & Wales 1951, Kurtz et al. 1952, Prest 1952, Davies et al. 1959, Cowie 1961, Nichols 1961, Christie 1962a, b, c, Davies et al. 1963, Thorsteinsson 1963, Fernald & Horowitz 1964). None of these papers mentioned Wegener or continental drift. One can only assume that the authors adhered to the unwritten assumption that there had not been strike-slip displacement along Nares Strait.

It is !ruly remarkable that continental drift generally and dnft along Nares Strait in particular could have received so little mention for about three decades. It appears that the two related phenomena were regarded as so obviously impossible that they were not seriously considered.

4. Continental drift revived

The idea of major displacement along Nares Strait was rejuvenated by S. W. Carey (1958, see Fig. 2c). This was ?part of h!s major effort to rejuvenate the theory of continental dnft world-wide. Again, as with Wegener, drift of Greenland along Nares Strait was an important lement of the global theory. Initial reaction to Carey's idea was unfavourable, but within a few years others modified his theory and the opposition was overcome.

The suggestion of great drift along Nares Strait suddenly became widely accepted. This occurred at about the same time and rate that continental drift became accepted globally. Wilson's papers (1963a, b, 1965a, b) were a major turning point for both the global and the local ideas, and after those papers acceptance of both ideas increased rapidly. By the mid-1970s, large displacements of continents were almost universally accep ed as part of the newly named theory of plate tectonics.

The change in scientific opinion accepting great displacements globally was so rapid and complete that it has been called a scientific revolution (Hallam 1973). Acceptance of great displacement along Nares Strait occurred with equal suddenness. It was a small revolution, just as plate tectonics had been.

Since the revival of continental drift many different map reconstructions have been published, showing Greenland moved back hundreds of kilometres and Baffin Bay closed (e.g. Carey 1958, King 1958, Bullard et al. 1965, Holmes 1965, Wilson 1965a, Hilgenberg 1966, Harland 1969, Tarling & Tarling 1971, Dewey 1972, Keen et al. 1972, Bridgwater et al. 1973, Churkin 1973, Hall 1973, Harland 1973, Hyndman 1973, Martin 1973, Roy 1973, Tailleur 1973, Herron et al. 1974, Lambert 1974, Vogt & Avery 1974, Beh 1975, Hallam 1975, Irving 1977, Newman 1977, Sclater et al. 1977, Windley 1977, Johnson 1978, Johnson et al. 1978, Srivastava 1978, Sweeney et al. 1978, Feden et al. 1979, Irving 1979, Churkin & Trexler 198I, Kent 198I, McWhae 1981, Miall 1981, Srivastava et al. 1981). A few. f these reconstructions are shown in Fig. 2. In add1t1on to the above papers in which actual map reconstructions were made, other papers, too numerous to mention here, specifically stated or assumed in passing that Greenland has drifted hundreds of kilometres along Nares Strait.

It is interesting to note that during the period of revival nd acceptance of great displacement along Nares Strait there was only one new piece of evidence after Wegener's paper (I924) from the area of the actual Strait that was quoted to support strike-slip displacement. This was a linear fault of unspecified displacement but trending parallel to the Strait on Ellesmere Island, reported by Prest (I952) and Christie (1962a), and quoted first by Wilson (1963a, see this volume, Dawes & Christie: fig. 10, Mayr & de Vries: fig. 3). Although this evidence was supportive of transcurrent movement, Christie (1964) as the only geologist to have mapped the fault and its environs at that time, concluded that large-scale strike-slip displacement along that fault had not occurred (Christie 1967). The acceptance of great displacement along Nares Strait in the many reconstructions listed above was mainly because it fit with plate tectonic theory, and indeed was predicted by such theory.

When Wilson {1963a) supported the idea of great displacement along Nares Strait there was no compelling evidence to deny it, and in fact the general geology of the two coasts superficially appeared to support it, as initially noted by Wegener (1915). Soon thereafter strong contrary evidence was published, as discussed later (Kerr 1967a); however, that evidence was at first disputed and later disregarded. Few of the papers that made reconstructions of Nares Strait quoted evidence either for or against displacement there. Those that did quote evidence from the Strait itself normally quoted Wilson {1963a), or one another. In essence, then, the near universal acceptance of great strike-slip along Nares Strait occurred mainly because of the momentum of plate tectonic theory, which predicted that there ***must have been*** such displacement.

5. A challenge and a conflict

An interpretation of Nares Strait arguing that there was only minor displacement was proposed by this author (Kerr 1967a), using geological evidence from the actual Strait region. It suggested that there had been little strike-slip along the Strait, several kilometres at most. For a few years authors regarded that interpretation as incorrect, and many failed even to refer to it. Kerr's view {1967a) and apparently also the evidence were overshadowed by the great swing in opinion which was part of the momentum of the plate tectonic revolution.

Kerr's {1967a) paper was based mainly on his first-hand knowledge of the Canadian side of Nares Strait and comparison with the geology of the Greenland side. Some areas of the Greenland side had not been investigated since Koch's work in the early 1920s, and Kerr reinterpreted some of that work. However, most geologists concluded that while it was certainly not necessary to invoke any strike-slip motion to explain the regional geology of Nares Strait, detailed geological knowledge at that time, particularly of the Greenland side, was not sufficient to conclusively rule out appreciable transcurrent displacement of Greenland {Trettin et al. 1972, Dawes 1973).

Geological investigation on the Greenland side of Nares Strait gathered momentum in the 1970s and Koch's work was superseded. Gradually, the view that there was little or no strike-slip displacement along the Strait was confirmed by geological studies in the region (e.g. Christie et al. 1978, Frisch et al. 1978, Dawes 1979, Christie et al. 1981, Dawes & Peel 1981) as well as by some geophysical studies (e.g. Riddihough et al. 1973, Sobczak & Stephens 1974, Wetmiller 1974, Coles et al. 1976, Grant 1980). In contrast to this trend some authors still maintained that the geological data from the Strait (e.g. Newman 1977, Newman & Falconer 1978, Srivastava 1978) and from the general region (e.g. McWhae 1981, Miall 1981) indicated major strike-slip displacement.

The suggestion that drift along Nares Strait had not been great was a major challenge to conventional plate tectonic theories of that region. It has resulted in a conflict fundamental to plate tectonic studies of the Arctic.

Interpretations of Nares Strait

Interpretations of displacement along Nares Strait fall into three groups. The popularity of each interpretation has risen and fallen at various times. Since the conflict began {Taylor 1910), none of these has ever been universally accepted nor has any been universally rejected.

In recent years, since plate tectonic theory and associated major horizontal displacements have become widely accepted, many scientists have speculated on displacement in Nares Strait. A major conflict has developed, with opinions on the nature of the Strait being of three types. Those who adhere to conventional plate tectonic theories have required a great left-lateral fault along Nares Strait. Those with fixist views consider that there have been no plate movements in the Arctic, and implicitly suggest there was no lateral displacement along the Strait. The third group used evidence from the shores of the Strait to show that there has been little or no lateral displacement. These three interpretations arc outlined below.

Fixist theories

Fixists have largely stayed out of the Nares Strait conflict, for no one who has actually studied or written about Nares Strait recently appears to conclude that displacement there was nil. The debate has largely polarised between the other two camps, both of which accept plate tectonics in one form or another. Two notable opponents of hypotheses concerning horizontal displacements of continental blocks, and adherents of fixist theories, are A. A. Meyerhoff and V. V. Bcloussov. Meyerhoff (1970, 1973) favoured a fixist model for the Arctic and North Atlantic Oceans and suggested that continents there have occupied their present locations since Proterozoic time (Fig. 2a). A school of Russian geologists headed by V. V. Beloussov (1970, 1979) maintain that continents have not moved relative to each other. These fixist authors have not scrutinized Nares Strait particularly nor emphasised it in their papers, but fixist views implicitly suggest that plate movements have not occurred and therefore there has been no displacement along the Strait.

Conventional plate tectonic theories

Plate tectonics is now very widely accepted by earth scientists. This theory is the successor of a rejuvenated

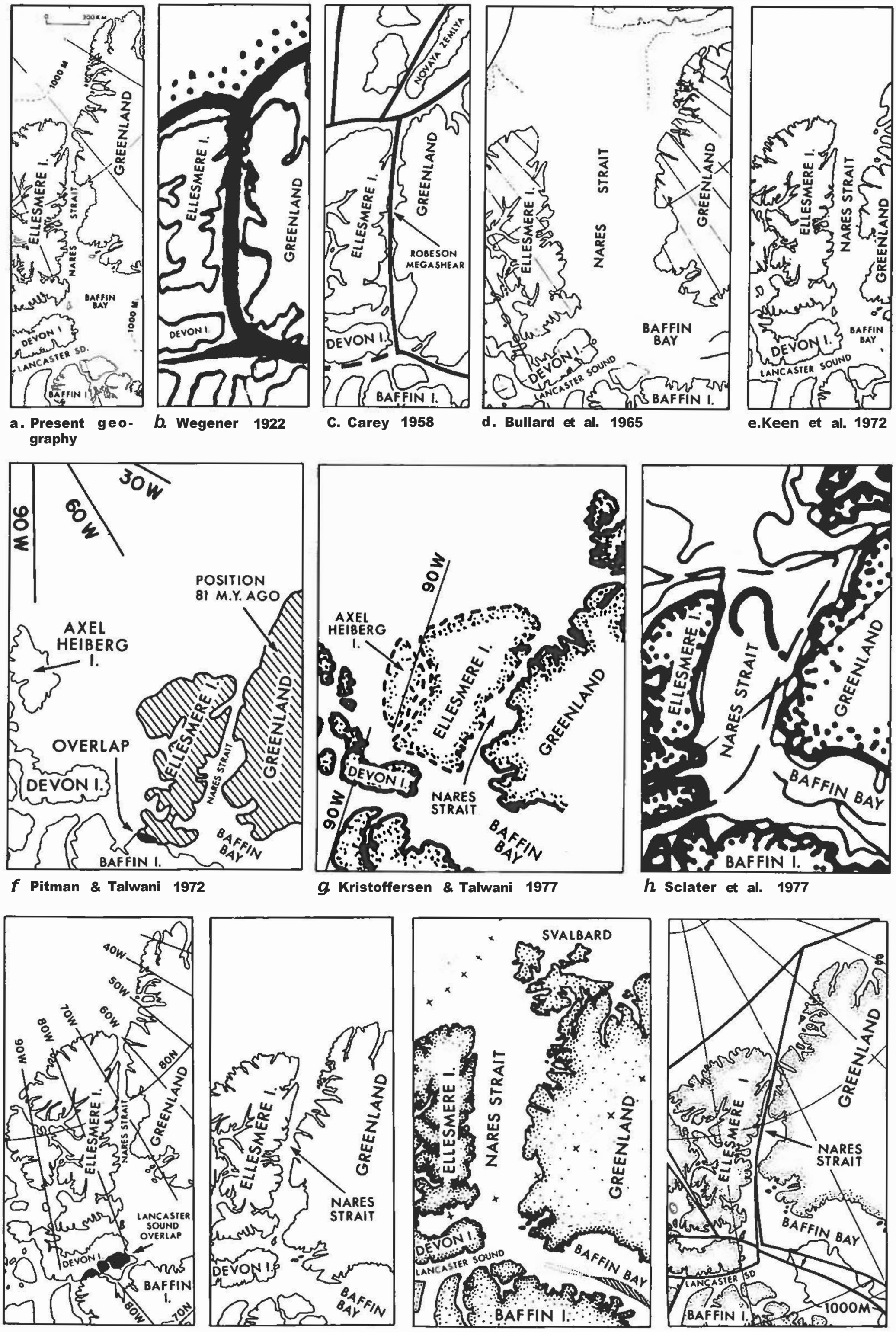

Fig. 2. The Nares Strait region and some reconstructions that have been suggested: a, present geography, representing fixist theories; b, strike-slip displacement of about 350 km (Wegener 1915, 1922); c, strike-slip displacement of about 400 km (Carey 1958); d, oblique displacement (Bullard et al. 1965); e, strike-slip displacement of about 220 km (Keen e, al. 1972); f, no displacement, but great oblique displacement farther west (Pitman & Talwani 1972); g, about 100 km of transverse displacement taken up farther west, combined with about 90 km of strike-slip oblique to Nares Strait (Kristoffersen & Talwani 1977); h, great oblique displacement (Sclater et al. 1977); i, no displacement along the Strait, but movement northward and westward of a larger block that includes Ellesmere and Devon Islands (Le Pichon et al. 1977); j, left-lateral displacement of 250 km (Newman 1977); k, an oblique approach of Greenland toward Ellesmere Island (Srivastava 1978, Srivastava et al. 1981), involving two phases, the first compressive (oblique, 50 to 220 km), and the second left-lateral (250 km);/, minor strike-slip displacement, minor rotational opening and major foundering (Kerr 1967a, b, 1981a). Slightly modified from Kerr (1980a).

theory of continental drift which burst upon the scene in the late 1950s, went through variations called the new global tectonics, sea-floor spreading, and then finally reached its present understanding as plate tectonics. In all, this was a very revolutionary process and has been called "a revolution in the earth sciences" (Hallam 1973). Now, however, the theory of plate tectonics is so widely accepted that the revolution is over and the theory has become quite conventional. *Its opponents are now the revolutionaries.* Certainly, there are differences between the many interpretations of plate motions governed by conventional plate tectonic theory, but these are minor compared to the overwhelming agreement and uniformity amongst them. The conventional group includes nearly all those writing on plate tectonics, and many of those who made reconstructions involving Nares Strait have been quoted earlier.

Conventional plate tectonic theory requires that there has been a great left-lateral fault along Nares Strait in order to explain the oceanic crust in Baffin Bay by a mechanism that is acceptable to that theory. The adherents of this conventional scenario looked at the global situation first and reached a conclusion on how ocean basins formed. They looked at Nares Strait later and attempted to explain the Strait in terms that were compatible with the conclusions reached earlier about the ocean basins.

Nares Strait is an important element of conventional plate tectonic theories (Dewey 1972). The usual reconstruction of Nares Strait is that of Wilson (1965a) which restores about 350 km of left-lateral offset. Wilson (1965b) introduced the concept of transform faults and suggested that one existed along Nares Strait.

Integrated plate tectonic theory

This theory, put forth by Kerr (1967a, b) and elaborated upon later (Kerr 1980b, c, 1981a, b) began as an attempt to find a solution to the Nares Strait conflict. Kerr (1967a) looked first at Nares Strait itself and reached a conclusion on how it formed, after which he studied the nearby oceanic basins and attempted to explain them in terms that were compatible with that conclusion. His theory concluded that some displacement has occurred along Nares Strait; it probably was only several kilometres, and almost certainly less than 25 km (Kerr 1981a), which is the amount shown in Fig. 2/.

This theory is called an integrated theory because it integrates and is a compromise between two opposing views - fixism and conventional plate tectonics. The suggestion in this theory that there was only small displacement along Nares Strait is incompatible with the origins of Baffin Bay and Labrador Sea that are generally accepted by conventional plate tectonic theory. One of these theories on Nares Strait, Baffin Bay and the Labrador Sea must be wrong.

The integrated plate tectonic theory suggested that Baffin Bay and Labrador Sea had much less lateral spread than conventional plate tectonic theories have suggested. Nevertheless, these basins still formed by a mechanism which is a form of plate tectonics. The new theory does not in any way intend to overthrow plate tectonics, which it regards as in many ways correct. Instead it considers that plate tectonics and fixist theories can be integrated and reconciled, and Nares Strait is the place that shows this is possible.

Implications of drift along Nares Strait

The implications of drift along Nares Strait have been discussed earlier (Kerr 1980a) and are briefly reviewed here. Nares Strait is the key to the pre-drift position of Greenland, and thereby is an important feature in reconstruction of the North Atlantic Ocean, as well as the Arctic Ocean (Fig. 1). **If** indeed there have been hundreds of kilometres of displacement of Greenland along Nares Strait or in that region, as many authors contend (Fig. 2b-k), then a pre-drift reconstruction bring Greenland back by juxtaposing the continental shelf edges represented approximately by the 1000 m lines (Fig. 1). **If** Nares Strait or the nearby region had such great displacement and the conventional restoration of Greenland is possible, then further support is given to the conventional plate tectonic theory that is widely accepted today. Thus Baffin Bay and Labrador Sea can he readily explained as they have been in the past (Pitman & Talwani 1972, Srivastava 1978, Srivastava et al. 1981), viz. as oceanic basins lying between continental blocks that moved apart and were formerly joined at the continental shelf edges or approximate 1000 m lines.

If Greenland has not moved along Nares Strait at all as fixists maintain (Fig. 2a), then conventional plate tectonic theory is faced with a major problem: what arc the origins of Baffin Bay and Labrador Sea?

If Greenland moved only a short distance along Nares Strait, however, and there has been slight rotational separation only, as suggested by Kerr (Fig. 2/, 1967a, b, 1981a, b), plate tectonic theory is still faced with a major problem concerning Baffin Bay and Labrador Sea. Baffin Bay is quite wide, with the 1000 m lines in most places about 250 km apart (Fig. I). It contains oceanic crust with magnetic striping (Keen et al. 1972. 1974, Pelletier et al. 1974, Srivastava 1978, Jackson et al. 1979, Srivastava et al. 1981). Yet, without great strike-slip in Nares Strait, Baffin Bay cannot be closed in a reconstruction in which the opposing 1000 m lines are brought adjacent to each other. A small rotation back in Nares Strait produces only minor closing of Baffin Bay. Labrador Sea is even wider, with the 1000 m lines in most places about 600 km apart. Labrador Sea also contains a very wide region of oceanic crust with magnetic striping (Hyndman 1973, Hood & Bower 1975, Kristoffersen & Talwani 1977, Srivastava 1978, Srivastava et al. 1981). A small rotation of Nares Strait back to a former position produces moderate closure of Labrador Sea, but still leaves the shelf edges or 1000 m lines several hundred kilometres apart.

If Baffin Bay and Labrador Sea did not form through sea-floor spreading, the continental shelf edges cannot be brought back together in the manner suggested by the conventional plate tectonic theory (Wilson 1963a, 1965a, b, Dewey 1972, Sclater et al. 1977). Thus, how *did* these seaways form? The alternatives are 1) they are original seaways that existed before the suggested plate tectonic episode, in accordance with fixist model of Meyerhoff (1970, 1973); 2) they formed by foundering and oceanisation of continental crust with no lateral separation, in accordance with fixist model of Beloussov (1970, 1979); or 3) they formed by widespread stretching, thinning, and foundering of continental crust, with only slight to moderate lateral separation of plates by rotation, as in the model put forth by Kerr (1967b, 1981a).

Grant (1975) suggested that in the Davis Strait area the sea-floor may be underlain mainly by continental crust. In the case of Labrador Sea, subsided continental material may extend far from shore as suggested by van der Linden (1975, 1977), Umpleby (1979), and Grant (1980). In addition, there may be a remnant of continental crust beneath the dormant mid-Labrador Sea ridge structure as originally suggested by Kerr (1967b). Kerr's model involves a combination of plate tectonics and oceanisation; a small lateral separation (plate tectonics) combined with widespread thinning and foundering (and oceanisation) of a large segment of intervening continental crust that now lies beneath the continental shelves and axis of Labrador Sea. Such originally continental material, now thinned and altered, may also underlie much of Baffin Bay.

If it can be proven that Greenland did drift 220 to 400 km along Nares Strait, then conventional plate tectonic theory will have successfully overcome another major challenge. If Greenland moved an order of magnitude less or not at all, then one of the three alternatives outlined above is correct in this case and conventional plate tectonic theory needs major modification because of problems related to the formation of Baffin Bay and Labrador Sea.

Labrador Sea, a branch of the North Atlantic Ocean, is a deep oceanic basin with depths exceeding 3500 m over a wide area (Fig. 1). It has a well expressed axial zone that may be a dormant mid-ocean ridge (Wilson 1963b, Kerr 1967b, Hyndman 1973, Kristoffersen & Talwani 1977, Srivastava 1978, Srivastava et al. 1981). If the conventional plate tectonic origin of Labrador Sea is incorrect then the widely accepted origin of much of the North Atlantic Ocean is also questionable. Thus, the Nares Strait conflict has far-reaching implications for tectonics, particularly for reconstructions of the North Atlantic Ocean north of lat. 60°N, where that ocean is rather narrow (Fig. 1).

Labrador Sea and Baffin Bay and associated parts of the Nares Strait region (Lancaster Sound, Jones Sound, Smith Sound, Kane Basin and Lincoln Sea) contain thick sedimentary successions. These are of promising hydrocarbon potential and many areas already are being actively explored. Thus, the Nares Strait conflict also has very important economic implications (McMillan 1973, this volume).

Summary of the Nares Strait conflict

The Nares Strait conflict can be summarised very briefly and simply. It is epitomised by Figs 3 and 4, and the conflict can be visualised by examining them together.

One group of scientists have examined the stratigraphy and structures on the shores of the Strait in detail. They conclude that the evidence from correlations across it indicates that displacement along it has been minor, probably close to zero or less than several kilometres and certainly less than 25 km (Kerr 1967a, 1981a, Christie et al. 1981). The main proponent of this view has then looked at the adjacent oceanic basins (Kerr 1967b, 1981a, b) and interpreted them in a way that does not conflict with his ideas on Nares Strait.

Several geological features which continue across the Strait without apparent offset were described by Kerr (1967a), the most accurately defined of which at that time were Silurian facies belts (Fig. 3). As geological knowledge of the region increased in the last decade, many additional features have been recognised, which range in age from Precambrian to Cenozoic. These so-called markers are described in several papers in the volume and they are considered to confirm that any displacement was minor. The case for minor displacement along Nares Strait relies mainly on evidence such as the correlation illustrated by Kerr (1967a) and reproduced here as Fig. 3. If there were great displacement along the Strait, then correlations such as these must have a different explanation. There have been no serious attempts by proponents of great displacement along the Strait to present alternative correlations.

Another group interpreted from studies of the oceanic areas surrounding Greenland that there has been great displacement along Nares Strait. The strongest datum to support this conclusion is the existence of oceanic crust with magnetic striping in Baffin Bay and Labrador Sea. The striping has been shown by Srivastava et al. (1981) and Srivastava & Falconer (this volume) and is reproduced here as Fig. 4.

Magnetic anomalies are youngest along the axes of mid-oceanic ridges and they become increasingly older towards the coasts. The anomalies in Baffin Bay and Labrador Sea were presumed to have formed successively as Greenland drifted physically north-eastward, and as new oceanic crust formed in its wake (Srivastava 1978, Srivastava et al. 1981). Before the onset of plate

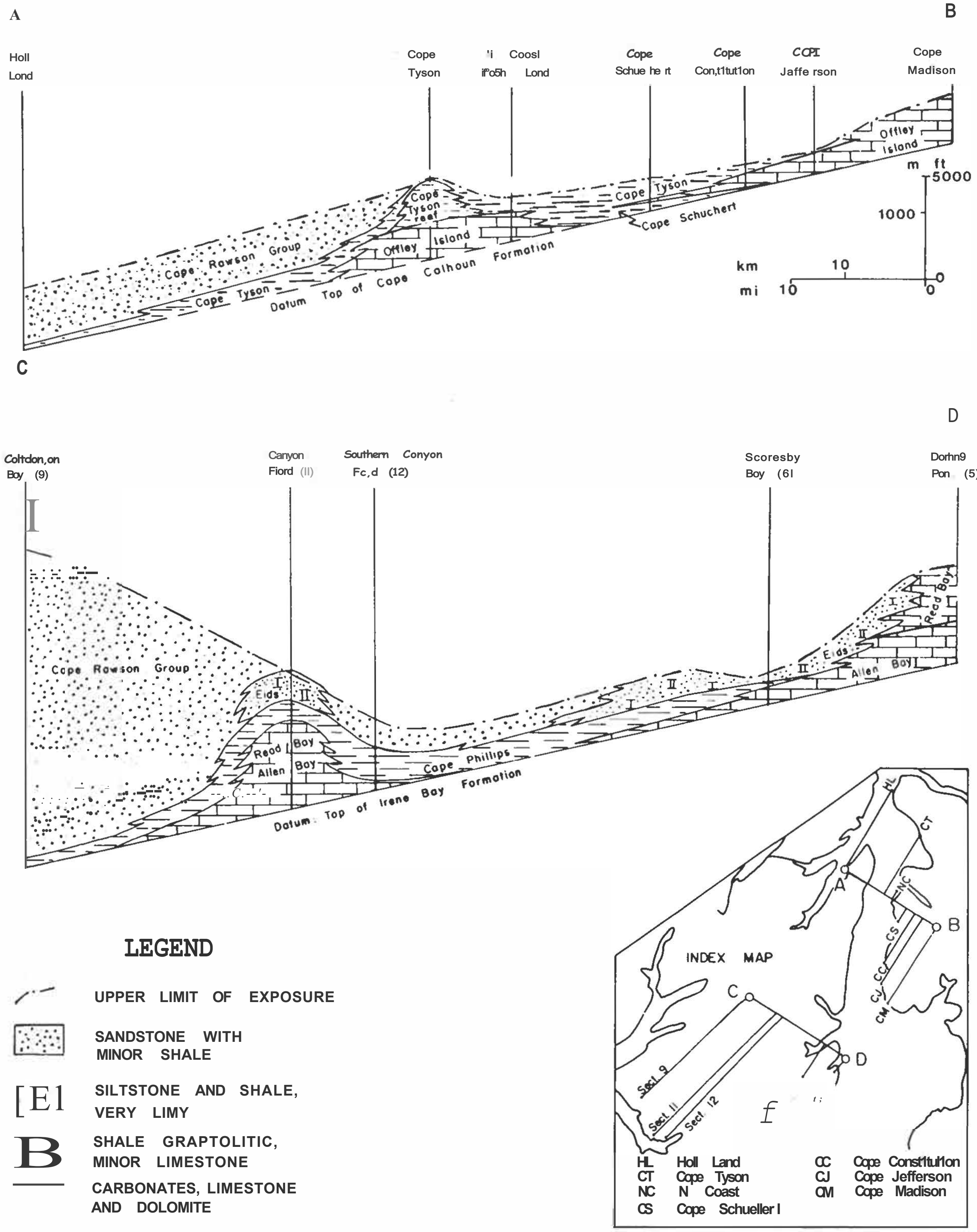

Fig. 3. On-strike correlation of Lower Palaeozoic facies of the Ellesmere Island side of Nares Strait with rocks of the same age on Greenland. Correlations such as these are the main type of evidence in the case against major displacement along Nares Strait. From Kerr (1967a).

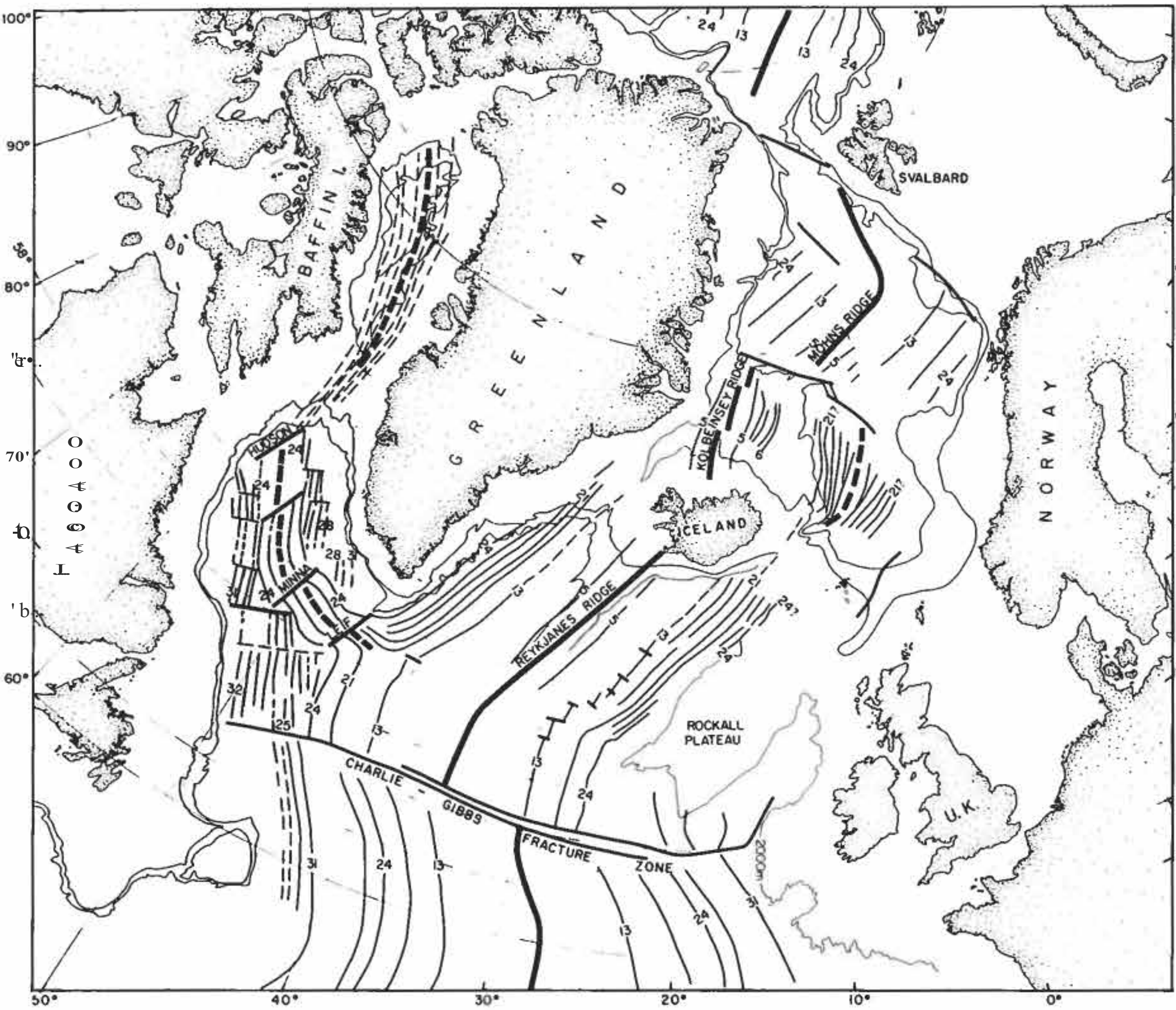

Fig. 4. Magnetic patterns in the oceanic basins surrounding Greenland. The presence of oceanic crust and the arrangement of magnetic striping in Baffin Bay and the Labrador Sea have been the main evidence in the case for major displacement along Nares Strait. From Srivastava et al. (1981). The interpretations that have been made of this Fig. and Fig. 3 are in conflict with each other, and they epitomise the Nard Strait debate.

movement, Greenland was farther south-west, such that the oldest anomaly on the Greenland side of Baffin Bay lay immediately adjacent to an anomaly of similar age near Baffin Island. Likewise, the oldest anomalies in the Labrador Sea (anomaly 31) are near Labrador and Greenland, and these also were originally adjacent. After reaching the conclusion that Greenland moved hundreds of kilometres away from Baffin Island and Labrador, it was logical to interpret that this motion was accommodated by strike-slip along Nares Strait (Keen et al. 1972, Srivastava 1978, Srivastava et al. 1981).

These workers, who use conventional plate tectonic theory, have studied the ocean basins and reached a conclusion on their origin. Nares Strait has been a secondary topic and has been interpreted by them in a way that does not conflict with their ideas on the oceans.

Both approaches outlined above are similar. The authors first made interpretations of their primary study area, after which they proceeded to make an interpretation of the area they had studied less well. A conflict between the two groups resulted. Solution of the conflict was the purpose of the Nares Strait symposium and of this volume.

There is an onus on proponents of minor displacement along Nares Strait to give a reasonable interpretation of the crustal structure and magnetic striping of Baffin Bay and Labrador Sea which is compatible with the observations reported there. This has been attempted by the integrated plate tectonic theory (Kerr 1967b, 1981a, b). There is an equal onus on proponents of great displacement along Nares Strait to give a reasonable alternative explanation of the stratigraphic and

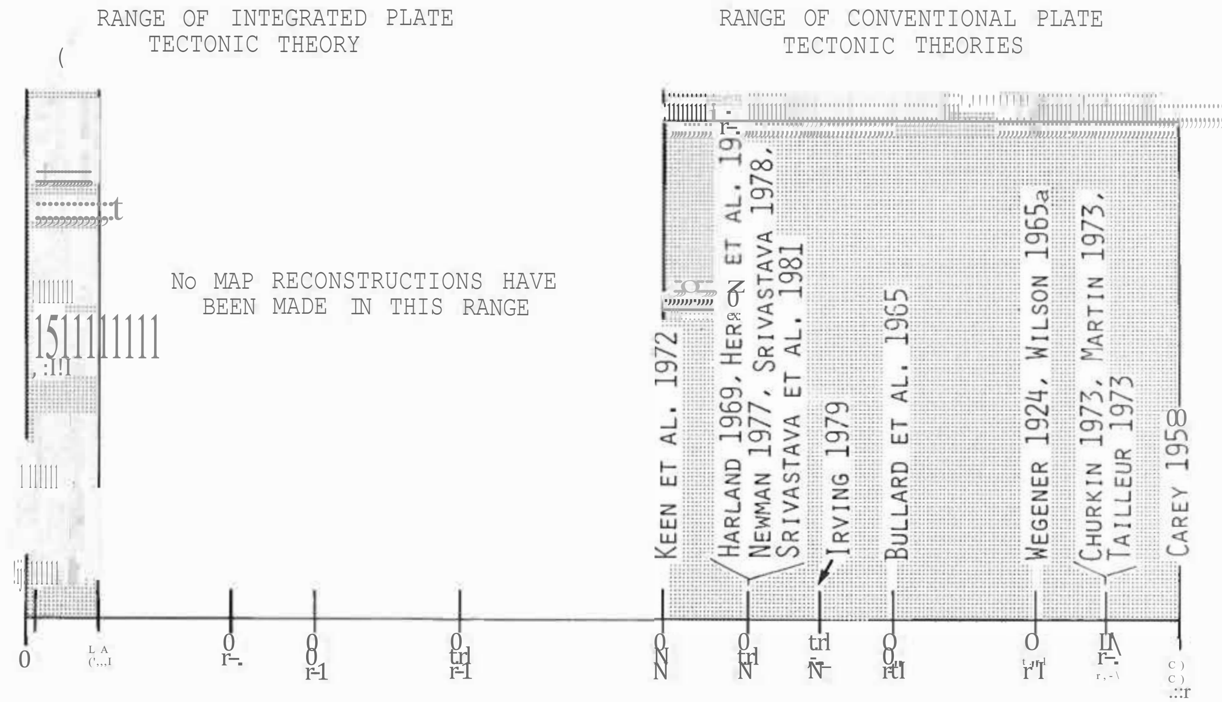

Fig. 5. The sinistral lateral displacements that have been suggested along Nares Strait in map reconstructions. The Nares Strait conflict may be solved by determining in which of the two shaded ranges the actual strike-slip displacement can be placed.

structural correlations that have been suggested across Nares Strait.

Solution to the conflict

It is likely that movement along Nares Strait can never be measured precisely. Even without a precise measure of movement, however, the conflict can still be resolved. This will be done if earth scientists can simply agree upon which of two distance ranges sinistral strike-slip displacement falls in. The displacements that have been suggested along Nares Strait are shown in Fig. 5.

The range on the right, 220 to 400 km, includes nearly all conventional plate tectonic reconstructions. The range on the left, less than 25 km, includes the integrated plate tectonic theory. There is an enormous gap between the two ranges, extending from 25 to 220 km.

Only a few papers have suggested that displacement occurred in the intermediate range. Keen et al. (1972) suggested in their text that displacement along the Strait was 150 km; however, their map reconstruction showed about 220 km of restoration. Pitman & Talwani (1972) showed no displacement on their map reconstruction. They moved Ellesmere Island with Greenland and obtained an otherwise conventional reconstruction of Baffin Bay and Labrador Sea. Le Pichon et al. (1977) suggested in their text that displacement might have been a maximum of 100 km; however, they referred to Kerr's (1967a) paper and showed no displacement on their map reconstruction. Kristoffersen & Talwani (1977) also considered that Greenland and Ellesmere Island had travelled together, with the displacement being largely taken up farther west. They considered that those lands reached their present positions in two stages, first travelling about 100 km in a direction normal to the Strait, and later about 90 km oblique to the Strait with some left-lateral displacement. However, the latter three papers suggesting intermediate displacement, introduced displacements farther west in the Arctic which are considered unreasonable. When these three papers and that of Keen et al. (1972) are eliminated because the displacements discussed were not actually used on the maps, or because they rely on unreasonable displacement elsewhere, the range 25 to 220 km is empty (Fig. 5). The reason for this is that movement in that particular range does not provide an explanation which is satisfactory to either side of the conflict.

Because there are no serious suggestions of displacement between 25 and 220 km, the views on the Strait are polarised and the solution to the Nares Strait conflict is greatly simplified. The debate should concentrate only on determining in which of the two ranges the displacement along Nares Strait falls, less than 25 km or more than 220 km. The papers in this volume should focus on that objective.

Summary

The Nares Strait conflict should not be regarded as a negative thing in any way. Regardless of the outcome it will have a constructive impact on science. It has forced all of us to look at our own data far more critically than we otherwise would have done. It has inspired communication between colleagues widely separated by geography or discipline in an attempt to work together to solve a fascinating problem. Surely the final outcome, regardless of who is right, will be a better understanding of the history of the Earth.

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