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THE SHELFBREAK: SOME LEGAL ASPECTS[1]

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ABSTRACT

Conferences on Law of the Sea have had the objective of increasing the area of ocean floor subject to control by adjacent coastal countries. These extensions of jurisdiction have paid little attention to carefully defined and relatively easily identified geological boundaries such as the shelfbreak. Indeed, a geological term often is used in a legal sense that far exceeds the geological meaning, resulting in unnecessary confusion. The recently concluded Third United Nations Conference on the Law of the Sea adds an area of the ocean subject to national control equal to that of the land area of the world. Certain aspects of the remaining area of deep-ocean floor, such as mining, will also be controlled and taxed by an international authority. It is possible future oceanographers may have little opportunity for research without permission and regulation by governments of either coastal nations or the United Nations. One result could be increased research and knowledge of the ocean floor that is under the jurisdiction of industrialized countries and decreased effort in the rest of the ocean.

INTRODUCTION

Geologists have taken considerable care to define the major physiographic features of the earth, including those of the seafloor (see, for example, Heezen et al., 1959). Attention to detail has helped in the understanding of such features. Unfortunately, at least for the ocean, those in the legal and political arena have shown little concern for the terminology that has been carefully evolved. This is especially true for the continental shelf and outer continental margin (Emery, 1981). Such actions have led to confusion as well as a failure to develop a logical scenario for defining the legal boundaries of the continental margin and the deep ocean. This chapter discusses the above as it relates to the shelfbreak or shelfedge, and whether the shelfbreak, especially for marine scientific research, has any legal status in the Draft Convention from the Third United Nations Conference on the Law of the Sea (UNCLOS III).

BACKGROUND

According to Shepard (1973, p. 277) the continental shelf averages about 75 km (40 nautical miles) in width. The greatest change in slope occurs at a depth of 130 m (71 fathoms). As is well-known both to geologists, and more recently to lawyers, these values have a considerable range.

The shelfbreak (or shelfedge) marks the boundary between the continental shelf and continental slope and is the most evident physiographic feature of the ocean floor. It has been known for more than two centuries. Following the *Challenger* Expedition, it was stated that the 100-fathom line represents the outer limit of the continental shelf (Murray and Renard, 1891, p. 185). This 100-fathom depth, and its translation to about 200 meters, often have been used as general depths for the shelfbreak, even though the actual shelfbreak depths range between less than 50 and more than 400 m.

A common, although sometimes hard to apply, definition of the shelfbreak is the first major increase in gradient at the outermost part of the continental shelf (Dietz and Menard, 1951; Wear et al., 1974; Vanney and Stanley, 1983). As a physiographic feature, the shelfbreak is essentially ubiquitous, being found on all continental margins in all oceans. However, its depth, shape, and distance from shore can vary depending on the structural characteristics of a given continental margin and the region's geological and sedimentary history.

Echo-sounding and continuous seismic profiling throughout the world show that the shelfbreak region may (or may not) mark the position of a change in the deep underlying structure, but essentially it separates the very flat continental shelf from the slightly steeper continental slope of less than 5 degrees. It should be appreciated that most echo-sounding and seismic profiles have large vertical exaggerations (usually more than 10 times) that accentuate the slope differences between the continental shelf and slope. Without such a vertical exaggeration, a shelfbreak occasionally can be difficult to clearly identify. Various methods have helped to identify the position of the shelfbreak, and several are shown in Figure 1. The choice of shelfbreak can be especially unclear if a region has a series of terraces or step-like breaks in slope (see for example, profiles C, D, E and F on Fig. 1). In plan view, the shelfbreak can vary from being sinuous, cren-

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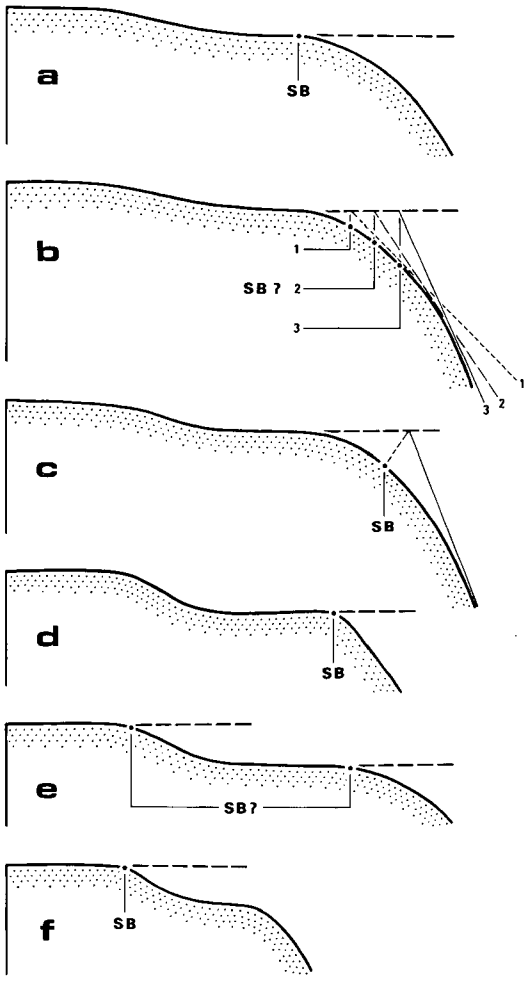

FIG. 1.—Methods used to define the shelfbreak (*a*, method used in this volume; *b-c* two other possible methods; *d-f*, more complex situations due to terraces at or near the shelfbreak = SB). Note that vertical scale is highly exaggerated. From Vanney and Stanley (this volume) who modified it from Wear et al. (1974) and Southard and Stanley (1976).

ulated or even discontinuous (see Farre et al., 1983; Vanney and Stanley, 1983).

STATUS OF THE SHELFBREAK PRIOR TO UNCLOS III

The concept of a shelfbreak in legal or political usage is relatively modern but an infrequent one. Since the 17th century, a basic feature used in legal aspects of the ocean is the territorial sea which was long held to extend to 3 miles off a country's coast; within this territorial sea the coastal state had almost complete sovereignty. This concept, however, was never officially ratified by any international agreement. The area beyond the territorial sea, called the high seas, was considered as *res nullius* or belonging to no one. The width of the shelf or depth of the shelfbreak was irrelevant.

After World War II, interest in the ocean increased, mainly because of the discovery of marine resources by private companies of industrial nations. One of the first major challenges to the 3-mile territorial sea came from United States' President H. S. Truman in 1945. Truman made two policy statements (called the Truman Proclamations). The first concerned the natural resources of the seabed and subsoil (legal jargon for the ocean floor and underlying sediments and rock), and said that "the Government of the United States regards the natural resources of the subsoil and seabed of the continental shelf beneath the high seas but contiguous to the coasts of the United States as appertaining to the United States, subject to its jurisdiction and control." The second proclamation concerned conservation zones for fishing in the water column.

Truman's Proclamations did not actually define the continental shelf, although a White House press statement released at the same time said that the continental shelf is generally considered as that submerged land which is contiguous to the continent and which is covered by no more than 100 fathoms of water. So, by inference, the shelfbreak was considered to be 100 fathoms or less and the shelf was given a depth definition. Defining the shelf by depth is a good approach for a nation having a wide, shallow shelf. However, other countries not so well endowed also were anxious to extend their jurisdiction (Truman's Proclamation actually never really extended U.S. jurisdiction over an area but just focused on resources; this subtlety was lost or not considered by others). In particular, Peru, Chile, and Ecuador in 1947 extended their jurisdiction and sovereignty over the water, seabed and subsoil out to 200 nautical miles from their coasts; they essentially declared a 200-mile territorial sea (Chile did not go quite as far as the others). This claim far exceeds the width of their continental shelves but takes into account that these countries border the Peru-Chile trench and have a very narrow shelf. It would not have been in their interest to make a claim based on depth; likewise, there is nothing special about 200 nautical miles perhaps other than that it is a nice round number like 200 meters.

This extension and several others led to the First (1958) and Second (1960) United Nations Conferences on the Law of the Sea. These were legal procedures, and physiography and other fields of geology were not seriously considered. Among the goals of these meetings were the definitions of widths of the territorial sea and of the continental shelf; they failed on both counts. Concerning the territorial sea, it stated "the outer limit of the ter-

ritorial sea is the line every point of which is at a distance from the nearest point of the baseline equal to the breadth of the territorial sea" (Article 6, United Nations 1958b Convention on the Territorial Sea and Contiguous Zone). A contiguous zone (which included the territorial sea) was defined as not extending beyond 12 nautical miles from the coast. Thus, the territorial sea cannot be more than 12 nautical miles wide. The question of the width or depth of the continental shelf was considered in the United Nations (1958a) Convention of the Continental Shelf and the results were even less satisfying. In this latter document, the shelf was defined as "the seabed and subsoil of the submarine areas to a depth of 200 meters, or beyond that limit, to where the superadjacent waters, admits of the exploitation of the natural resources of the said areas." Thus, a combination of depth and distance was applied—200 meters—and as far beyond as exploitation can occur. Coastal states were given sovereign rights over the shelf for natural resources and consent was needed for scientific research. These poorly defined terms, combined with further extensions of claims and increased interest in revenue from marine resources (manganese nodules, in particular), led to the Third Conference—UNCLOS III—that began in the early 1970s and ended in 1982. As an aside, one cannot help but compare the over-enthusiasm for the economics of nodules that existed in the 1960s with that for ocean-ridge sulfides in the early 1980s. The result of the former has been an increase in coastal state jurisdiction over the ocean; the sulfide enthusiasm (often exaggerated in the press) could lead to similar consequences.

Following the first two Conferences, the question for United States marine scientists was, where can or cannot one work and under what regulations? The conditions for marine research are strongly influenced by the official position of the United States Government. For example, the United States Government presently (May, 1982) recognizes a 3-mile wide territorial sea, unless the research concerns living resources. For research on the continental shelf, the Department of State for many years required foreign permission for work in depths less than 200 m; more recently, this has been extended (actually restricted is a better word) to 600 m (perhaps recognizing the ability to exploit deeper). These shelf restrictions do not apply to research in the water column, as for most types of physical oceanography where territorial-sea limits apply. Seismic profiling and echo-sounding is considered water column research (by the U.S. Department of State); bottom sampling isn't and permission of the coastal country is needed for the territorial sea and beyond. For fisheries research using commercial gear or taking resources in commercial quantities, permission is required from the coastal country out to 200 nautical miles from its coast. Note, however, that the United States' position might be quite different from that of foreign coastal countries—putting a researcher in a dilemma. In any case, the lack of satisfactory resolution of several issues, including those previously mentioned, led to UNCLOS III.

UNCLOS III

In the Draft Convention resulting from UNCLOS III the continental shelf, as stated in Article 76, "comprises the sea-bed and subsoil of the submarine areas that extend beyond its (a coastal states') territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance." This definition clearly does not make any geological sense, since the so-called "legal continental shelf" can contain the geological shelf, slope, rise, ridges, plateaus, and even trenches and portions of the abyssal plain. Likewise, the "natural prolongation of its land" should not extend to the continental rise or trenches whose geology and structure is typical of the oceans and not of land (see, in particular, Emery, 1981 for a detailed discussion of this point for the Atlantic Ocean). It becomes even more confusing! In subsequent parts of Article 76 the continental margin is defined as comprising "the submerged prolongation of the land mass of the coastal state and consists of the sea-bed and subsoil of the shelf, the slope and the rise. It does not include the deep-ocean floor with its oceanic ridges . . ." If the continental margin extends beyond 200 nautical miles, its outer edge is established by a complex (and very difficult to establish) series of criteria, but it may not be more than 350 nautical miles (some exceptions for particular countries permit an even further extension) from the baseline from which the territorial sea is measured. This is referred to as the outer limits of the continental shelf, which we agree doesn't make any sense; these points are summarized in Figure 2.

We have found no reference to the shelfbreak or shelfedge in the Draft Convention, although a rather confusing term—the foot of the continental slope—plays an important role in the above criteria. It is defined as "in the absence of evidence to the contrary, the foot of the continental slope shall be determined as the point of maximum change in the gradient at its base." Again, the definition is poor and open to considerable interpretation (see, in particular, Hedberg, 1979 and references therein). These above points, although perhaps somewhat humorous on first reading, really are quite important. Within the legal continental shelf (which can

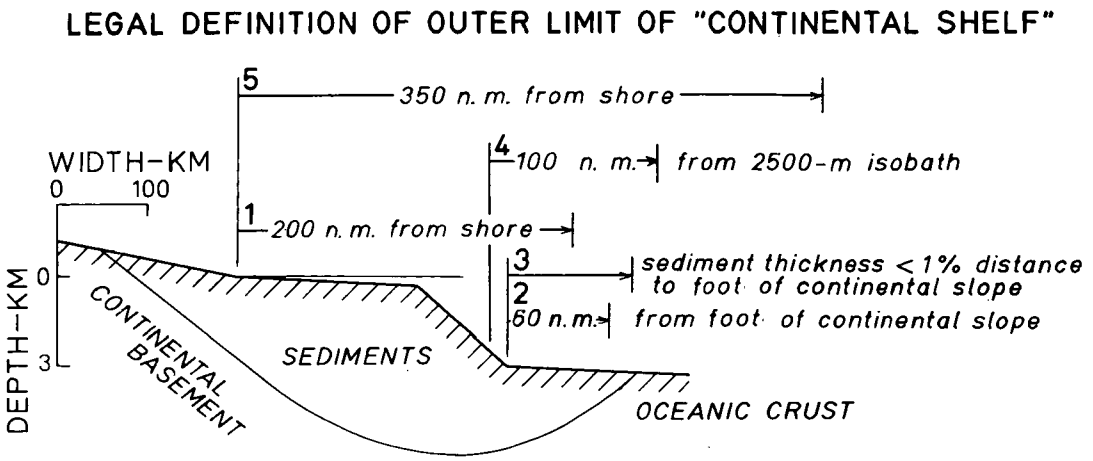

FIG. 2.—Five components of the legal definition of the outer limit of the "legal continental shelf" as presented in Article 76 of the Draft Convention on the Law of the Sea (modified from Emery, 1981).

cover about 42 percent of the ocean and thus slightly more than the world's land area) there are considerable constraints on marine scientific research. These restraints have been detailed elsewhere (Ross, 1982) and will not be repeated here other than to say that a consent regime for marine scientific research, with certain obligations, exists in most of this region.

Certainly, in the scientific sense, it would have been valuable to define the legal boundaries of the ocean following basic geological concepts. Being realistic, one must appreciate the difficulty since some countries would get less, or more, than others—a point that is politically unacceptable. Considering this, it is unfortunate that the well-established physiographic terms had to be "re-defined" (and very poorly so) to justify in part new enclosure of the ocean by the countries of the world.

As marine scientists, we may suffer restraints in our activities in the name of world economics, if oceanographic activities are restricted in the 42 percent of the ocean comprising the "legal continental shelf." Ironically, this situation is a partial result of our successful research which has led to many of the marine mineral discoveries. The finding of such deposits then has led to restriction or enclosure by nations that have made no ocean-floor studies and whose politicians have little knowledge or interest in the ocean other than as a possible source of unearned income. A likely result is increased concentration of study within regions of ocean floor bordering industrial nations and focus on the shelf-to-slope sector as defined by marine scientists. Probable new and unexpected findings of possible economic value will be made in these regions.

SUMMARY

Although geologists have taken considerable care in defining the major physiographic features of the earth, including the shelf and shelfbreak, lawyers have often severely misused these definitions. This is particularly true for the continental shelf, which in the legal sense (of UNCLOS III) can include the continental shelf, continental slope, continental rise and indeed even parts of the deep sea such as the abyssal plain. The shelfbreak, or shelfedge, has unfortunately not been used in such discussions—usually a combination of depth and distance were applied to define the edge of the shelf.

In the recently concluded UNCLOS III the legal continental shelf (which for marine science comes under coastal state control) can include as much as 42 percent of the ocean. The consent regime for marine science could restrict research opportunities to areas off industrial or developed nations that have their own marine science capability.

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