



## Science and the Law of the Sea in the Arctic: consensus and controversy

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Article 76 (A76) of the United Nations Convention on the Law of the Sea (UNCLOS) defines the legal process for delineation of the outer limits of the “continental shelf” of a coastal state. Under the specified geological conditions and subject to various constraints, this “continental shelf” can extend the coastal state’s sovereign rights to the seabed and subsoil beyond 200 M. Coastal states perform data collection, analysis, and interpretation for evaluation by the Commission on the Limits of the Continental Shelf (CLCS). After consideration of the information submitted, the CLCS issues final and binding recommendations on the coastal state’s outer limits of the continental shelf.

In the Arctic, the five coastal states (Russia, Canada, Denmark, United States, and Norway) all have the potential for delineation of continental shelf beyond their 200 M. The work of the Arctic UNCLOS programs has led to extensive bathymetric and geophysical data acquisition and analysis, including significant collaborative efforts such as the joint seismic collection of Canada and the US. One state (Norway) has received CLCS recommendations; two (Russia and Denmark) have submitted but have not yet received recommendations. Canada and the US have not yet submitted.

While the full process of A76 delineation includes legal and scientific complexity, one can broadly simplify the scientific portion into three general topics: (1) identification of the base of the slope (BOS); (2) seismic mapping of the thickness of sedimentary rocks above basement for the region seaward of the BOS; and (3) development of a broad geologic and tectonic understanding of the region within the BOS.

A consensus has developed among the Arctic coastal states on the identification of a regional BOS. This common understanding is the result of collection and analysis of high-resolution multibeam bathymetry and positive interactions between scientists. One of us (Mørk) is currently organizing a joint publication on the regional Arctic BOS. The need for modern seismic mapping of the Arctic basin sedimentary section has resulted in significant new collection (including collaborative ice-breaker work) of seismic data. Although the seismic line coverage in much of the Arctic is still relatively sparse compared to more accessible regions, the new data provide good regional coverage. Some work remains in the development of velocity functions for robust time/depth conversion for some portions of the Arctic.

Controversies remaining for UNCLOS studies of the Arctic relate to the understanding of deep structure and tectonic development of the Arctic. Although many interesting models have been proposed and some consensus is emerging, the tectonic complexity of the Arctic combined with relatively sparse observations and data continues to confound complete understanding. However, geologic and tectonic models are arguably not primary requirements of A76, instead playing a supporting role in “natural component” discussion related to application of the constraints specified in A76(paragraph 6). The interpretation of this A76 requirement is the topic of continuing scientific and legal discussion, both in the Arctic and elsewhere.