A Practical Overview of Article 76 of the United Nations Convention on the Law of the Sea

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Abstract

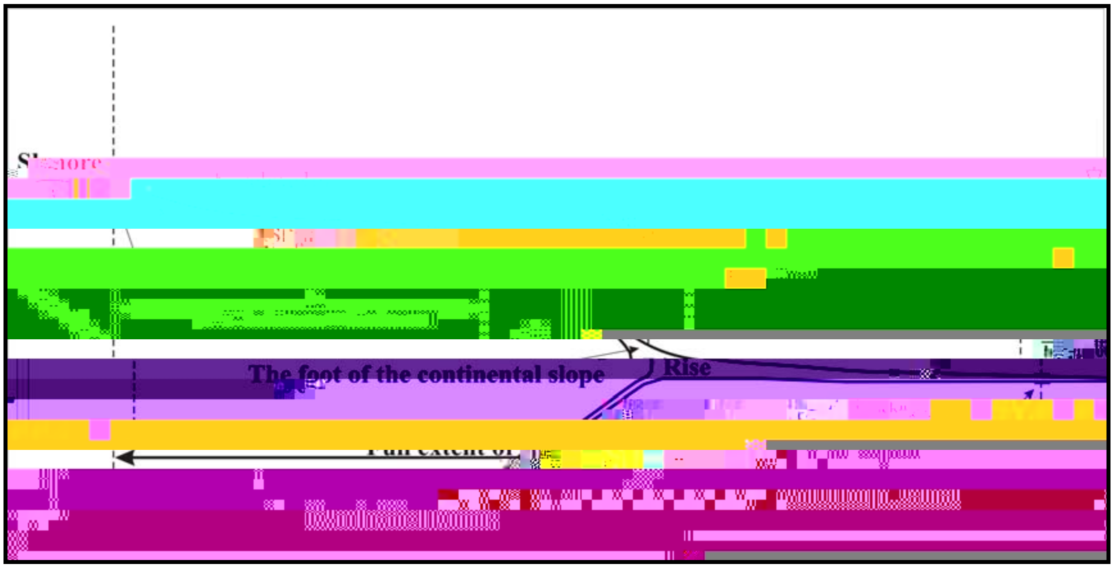
The United Nations Convention for the Law of the Sea, adopted in 1982, is the legal framework that sets out the rights and duties of States in the use and exploitation of the oceans. Article 76 through to article 85 in Part VI of the Convention is dedicated to provisions related to the continental shelf such as the determination and delineation of the outer limits of the extended continental shelf beyond 200 nautical miles and other rights of States over the continental shelf. The determination of the foot of the continental slope is one of the major features in the

provides specific and precise rules over certain issues while at the same time deal with other issues in a more general manner. It relies much on bilateral and multilateral international agreement for its proper implementation.

The Convention comprises of 17 Parts, 320 articles, 9 annexes and a final act. The major features of the Convention relate to the definition and regulation of the different maritime zones that coastal States are entitled to, such as, territorial sea, contiguous zone, archipelagic waters, exclusive economic zone and continental shelf. Other maritime zones like the high seas and

After the World War II and the creation of the United Nations (UN) in 1945, the International Law Commission was requested to consider the codification of existing customary International Law relating to the Oceans. Four separate draft conventions were prepared and adopted at the first UN Conference on the Law of the sea in 1958. The conventions dealt with the territorial sea created an early impression in the framer's minds that (i) all continental margins were of this type, (ii) the transitions from one zone to another were clearly delineated and thus would be relatively simple to map any of the features shown. Two persons namely, Hedberg and Gardiner, were among the rare people to understand the complexity of the margin and thus made different proposals for setting the outer limits.

Prof. Hedberg suggested the use of the base of the continental slope approximated to the boundary between oceanic and continental crust. The formulation proposed would be to utilise a boundary zone of an internationally accepted width seaward from the base of the slope, within which the coastal state could draw straight lines boundaries between fixed geographical coordinates. According to Gardiner, 1978, this proposition would have been inconsistent with the accepted scientific definition and the concept of natural prolongation of the landmass and that great variations in the width of margins that extend beyond the 200 M would make it impracticable. However, if based on the true geological sense, the natural boundary of the continental margin would be logically the outer limit of the continental rise and so the sediment


The foot of the continental slope
Rise

Evidence to the contrary to the general rule is interpreted by the Commission, through paragraph 6.3.1. of the Guidelines, as a provision designed to allow coastal States to use the best geological and geophysical evidence available to them to locate the foot of the continental slope at its base when the geomorphological evidence given by the maximum change in the gradient does not or can not locate reliably the foot of the continental slope.

The importance of the concept of the foot of the continental slope should be stressed as it is the unique feature that will enable any coastal State whose continental margin extends beyond the 200 M from the baseline from which the territorial sea is measured, to delineate the outer edge of the continental margin as per the provisions discussed above. Both the Irish and Hedberg formulas make use of the foot of the continental slope as the starting point for measurements.

Paragraph 5

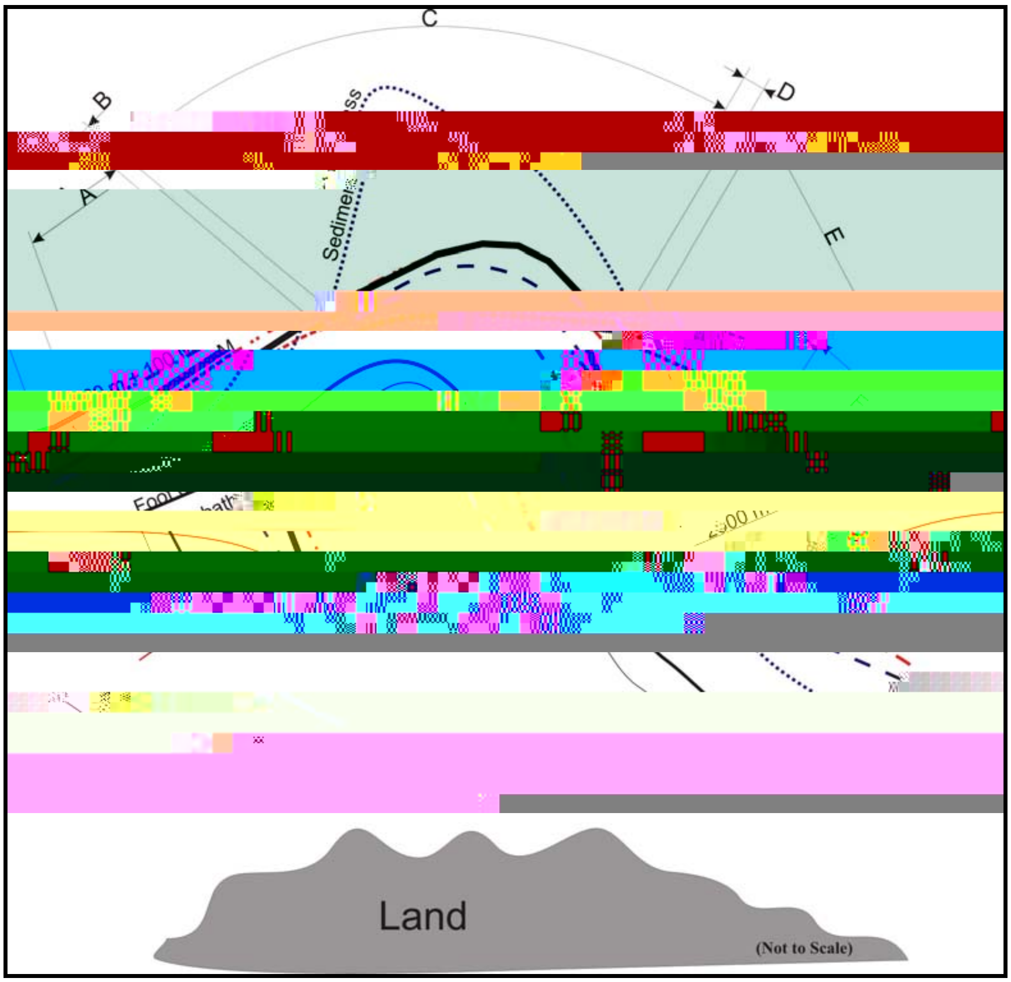
Paragraph 5 of article 76 sets the maximum limits of the entitlement of a country over the continental shelf. According to paragraph 5,

> The fixed points comprising the line of the outer limits of the continental shelf on the seabed, drawn in accordance with paragraph 4(a)(i) and (ii) shall not exceed 350 nautical miles from the baselines from which the breadth of the territorial sea is measured or shall not exceed 100 nautical miles from the 2,500 metre isobath, which is a line connecting the depth of 2,500 metres.

The Guidelines commonly calls these as the constraints. Paragraph 2.3.2 of the Guidelines states that whereas the application of at least one of the two formulae to determine a line beyond the 200 M suffices to provide the basis for entitlement to delineate the outer limits of an extended continental shelf, the application of all four rules may be necessary in order to actually delineate the outer limits of the continental shelf. It can be understood, and as discussed above, that either the Hedberg formula or the Irish formula can be used, or both alternately, to delineate the outer limit of the continental shelf, however these outer limits of the extended continental shelf should at no time go beyond the 350 M from the baseline from which the territorial sea is measured or 100 M from the 2500 meter isobath. It is good to point out that the 2500 meter isobath plus 100 M may result in a coastal State entitlement beyond 350 M from the baseline. In practice, a coastal State will have the possibility of choosing the constraint that will apply for a particular region and which is the most seaward and thus to its advantage, however the line delineating the outer limits of the extended continental shelf should at no time be further than that this chosen constraints. The eventuality of having more than one 2500-meter isobath off a coastal State's

- Submarine ridges (paragraph 6)
- Submarine elevations (paragraph 6)

Moreover the Commission acknowledges that the link between the terms ‘oceanic ridges’ of paragraph 3 and the ‘submarine ridges’ of paragraph 6 is unclear (paragraph 7.1.3. of the Guidelines). The ‘submarine ridges’ are subject to a maximum outer limit of 350 M from the baseline while the ‘submarine elevation’ can have an outer limits constrained by either the 350 M from the baseline or the 100 M from the 2500 meter isobath. On the other hand, ‘oceanic ridges’ do not provide any entitlement of extension beyond the 200 M from the baseline (paragraph 3). This shows that ‘oceanic ridges’ should be treated differently from ‘submarine ridges’. The distinction between the ‘submarine elevations’ and ‘submarine ridges’ or ‘oceanic ridges’ should not be based on their geographical denominations and names used so far in the preparation of the published maps and charts and other relevant literature (paragraph 7.1.8. of the Guidelines).



E: The outer limit is delineated by the sediment thickness line and constrained by both the 2500 m + 100M and the 350M limits.

F: The outer limit is delineated by the 200M line as the FOS + 60M and the sediment thickness line lies within 200M

Paragraph 7

Paragraph 7 states that

> The coastal State shall delineate the outer limits of its continental shelf, where that shelf extends beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured, by straight lines not exceeding 60 nautical miles in length, connecting fixed points, defined by coordinates of latitude and longitude.

This paragraph allows the coastal State to join the fixed points delineating its outer limits of the continental shelf resulting from the application of the formulas cited in paragraph 3 by lines not

Paragraph 8

Paragraph 8 states that

> Information on the limits of the continental shelf beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured shall be submitted by the coastal State to the Commission on the Limits of the Continental Shelf set up under Annex II on the basis of equitable geographical representation. The Commission shall make recommendations to coastal States on matters related to the establishment of the outer limits of their continental shelf. The limits of the shelf established by a coastal State on the basis of these recommendations shall be final and binding.

The Conference negotiators during the drafting of the Convention decided to create a Commission that would have recommendatory powers. It is good to point out that the Commission does not establish the outer limits of the continental shelf as this remains the function and responsibility of the coastal State. The Commission will make recommendations following the submission of information pertaining to the definition of the outer limits of the continental shelf by a coastal State. If the recommendations of the Commission are accepted by the coastal State, then the coastal State may establish the outer limits according to the recommendations of the Commission. These limits would be final and binding.

Paragraph 9

Paragraph 9 read as follows:

> The coastal State shall deposit with the Secretary-General of the United Nations charts and relevant information, including geodetic data, permanently describing

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Annex II of the Convention

Annex II of the Convention elaborates the particulars of the Commission on the Limits of the Continental Shelf as provided for in article 76.

Article 4 of Annex II provides a time frame for a coastal State to make a submission to the Commission. According to the article, a coastal State which intends to establish, in accordance with article 76, the outer limits of the continental shelf beyond the 200 M, shall submit for a zone in which judgement must be applied to determine the most likely location of the feature which is taken to mark the edge of the continent.

The Commission is aware of the difficulties arising from the determination of the foot of the continental slope and the edge of the continental margin from a geological perspective. Continental crust is compositionally distinct from oceanic crust, but the boundary between these two crustal types may not be clearly defined. Simp

The main advantage of using echograms and digital data is that the information is crude and has not been subject to any filtering and/or smoothing. The disadvantage is that the data has been collected, in most cases, at random following ship tracks, without prior knowledge of the slope and for the purpose of computing the foot of the slope, the profile should be perpendicular to the slope. The resolving power of the instruments used should be given due consideration and depending on the beam width, smaller features might be masked.

(c) Production of slope maps from multibeam surveys

The main advantage of using data from multibeam surveys is that they provide complete coverage of the area. The foot of the slope will be apparent in some places while at other place, different techniques might be used to determine its location. Multibeam data could also ensure that the identified feature is indeed the break in the slope and could confirm that it is continuous.

The main disadvantage of using such data is that there is not yet an extensive coverage available on a worldwide scale. These data should be collected from ships and multibeam data are expensive to collect and process. Another disadvantage is that multibeam data at times can be too detailed and or localized and so making the determination of the foot of the slope difficult.

(d) Use statistical techniques based on raw sou

The conventional rock type classification separates sedimentary rocks, example those derived from physical and chemical weathering and transportation or from biological processes, from igneous rocks of intrusive and extrusive origin and metamorphic rocks which are originally igneous or sedimentary rocks that were subsequently changed by the effect of temperature or

Once maps of two-way travel time to various horizons and average velocities between the formations are established, depth values or isopach

- Reduction of all data observations to a consistent set of processing parameters (velocity of sound in seawater, seasonal variation of sound velocity)

Sediment thickness information is needed if a coastal State wishes to invoke paragraph 4(a)(i) of article 76 which permits the definition of the outer limits of the continental shelf as the location the method applied and the bathymetric measurements used to produce the cartographic and analogue sources from which it stems (paragraph 5.2.4. of the Guidelines).

Data Sources

Several methods exist for deriving bathymetry amongst which the most widely used is the sonar. Airborne electromagnetic methods (for example electromagnetic induction, red-green lasers and inversion of sea surface radar) can rarely determine depth in excess of 40 m. The only other potentially useful method for deriving deeper water bathymetry is through the inversion of sea surface altimetry obtained from satellites.

The Commission states, through paragraph 5.2.2. of the Guidelines, that the bathymetric

topography is predicted from downward-continued satellite gravity measurement. Over the short-wavelength band, the topography-to-gravity ratio is regionally calibrated using available soundings. This method relies on a number of underlying assumptions or simplifications about the density structure of the seafloor and underlying crust and mantle. These assumptions are reflection data may also be provided at all times by coastal States as supplementary source of evidence (paragraph 8.2.4. of the Guidelines).

Seismic refraction survey

The marine seismic reflection method uses near-vertical reflected waves to determine reflectors in the crust. In contrast, the refraction method uses mostly horizontally propagated waves to accurately determine apparent velocity. In a reflection survey, the reflected signal is measured as a function of vertical travel time for a round trip from source to reflector to receiver. In a refraction survey, the arrival time of waves is measured as a function of distance from the source. Seismic refraction surveying is an effective method for obtaining information on the deep structures and seismic velocities of deep layers. On the other hand, reflection surveys have advantages in the acquisition of detailed shallower crust and in the detection of horizontal heterogeneity.

The refraction profile is obtained using the two-ship technique, where one ship provides the controlled explosive sources and the other records seismic signals via towed hydrophones sensors with pressure detectors. Since the 1960s, ocean bottom seismographs (OBS) and/or ocean bottom hydrophones (OBH) have been employed as receivers in refraction surveys, instead of the hydrophone towed beneath the surface.

Seismic refraction methods, including wide-angle reflection methods, give information on the transmission velocities and the nature of subsurface rock layers. The two main features of the wide angle method are that

(a) it employs rather low frequency sources
(b) the seismic rays are projected obliquely through the geological structures.

The low frequencies allow good penetration. The oblique angles allow the detection and measurement of velocity gradient zones as well as the more abrupt changes, which show up well on reflection profiles. In typical marine wide-angle reflection surveys on continental margins, the recording stations, ocean bottom seismographs, are placed typically 5 km to 10 km apart, providing a corresponding moderate accuracy of the ray trace modelling solutions, velocity and depths estimates. Full details of the sources of the data and the processing methods utilized are required in order to determine the validity of the interpretation presented (paragraph 8.2.7. of the Guidelines).

Planning a seismic survey to determine sediment thickness

The most practical and most efficient way to determine the thickness of sediments involves a combination of seismic reflection sur96w[h9fc5-T8.7(eterm)7.9(ine the th)]001-1.ell TD05ac00751 Tw.9(tion su

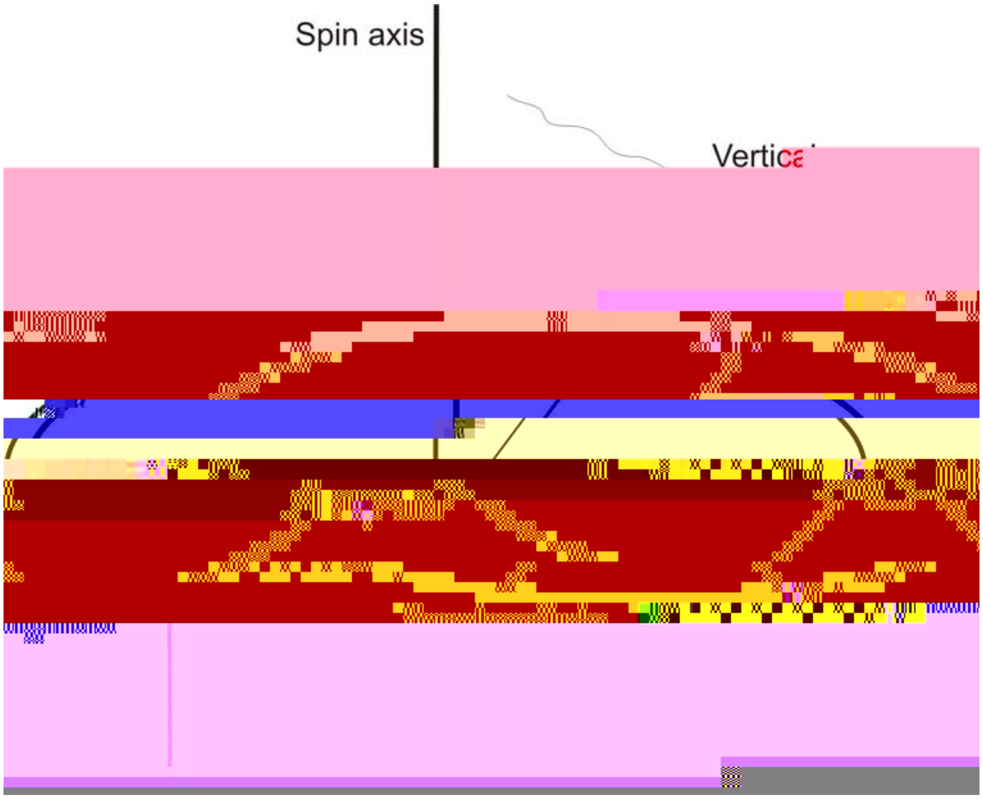

Figure 7: Astronomical coordinates, adapted from Dodson and Moore 2000

Geodetic (Ellipsoidal) coordinates

The geodetic position of a point on Earth is defined by the ellipsoidal coordinates of the lv4oo(d Moo)-5.7(r)-5(e 0 TDh is 1ns 1n el0 TDDh ist 9ucy(d)-5.7(r)ns 1n e 5(e) Tw[lipso)5(d Moo)-5vie)6.3T

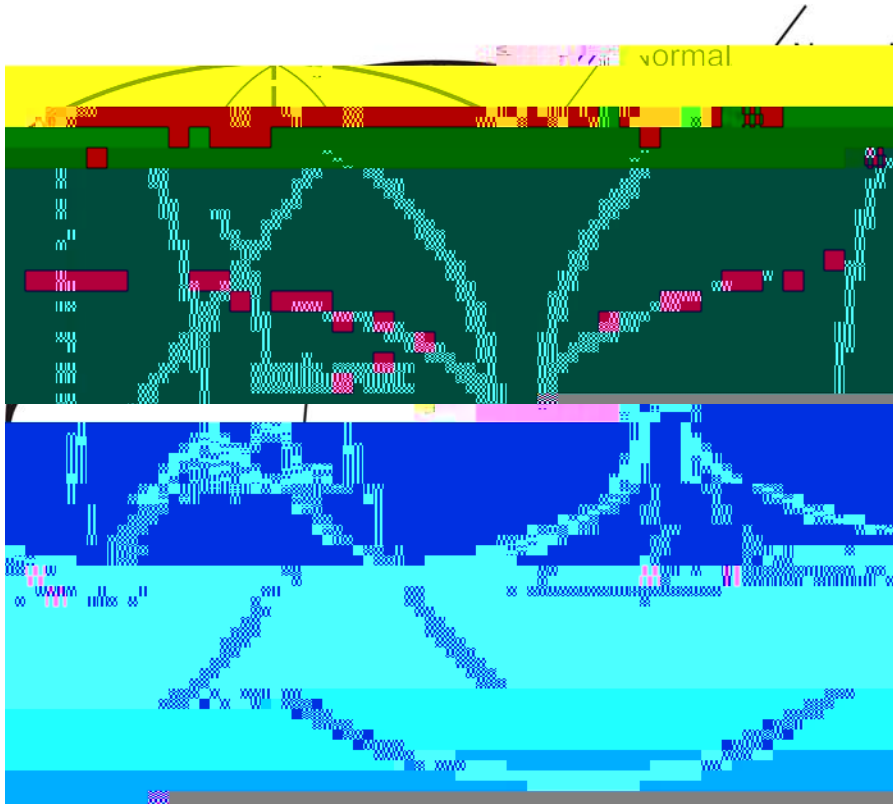

Figure 8: Geodetic (Ellipsoidal) coordinates, adapted from Dodson and Moore 2000

Cartesian coordinates

A more useful and more popular alternative to using the angular measurements of latitude and longitude is to describe the position of a point, or indeed above or below the Earth's surface in terms of Cartesian coordinates. Conventionally, the axes form a left hand triad; with the Z-axis in the direction perpendicular to the equator, the X-axis in the direction of the zero meridian and the Y-axis perpendicular to the other two (see figure 9). The origin of such a Cartesian system may be either the centre of the associated reference ellipsoid or the implied mass centre of the Earth

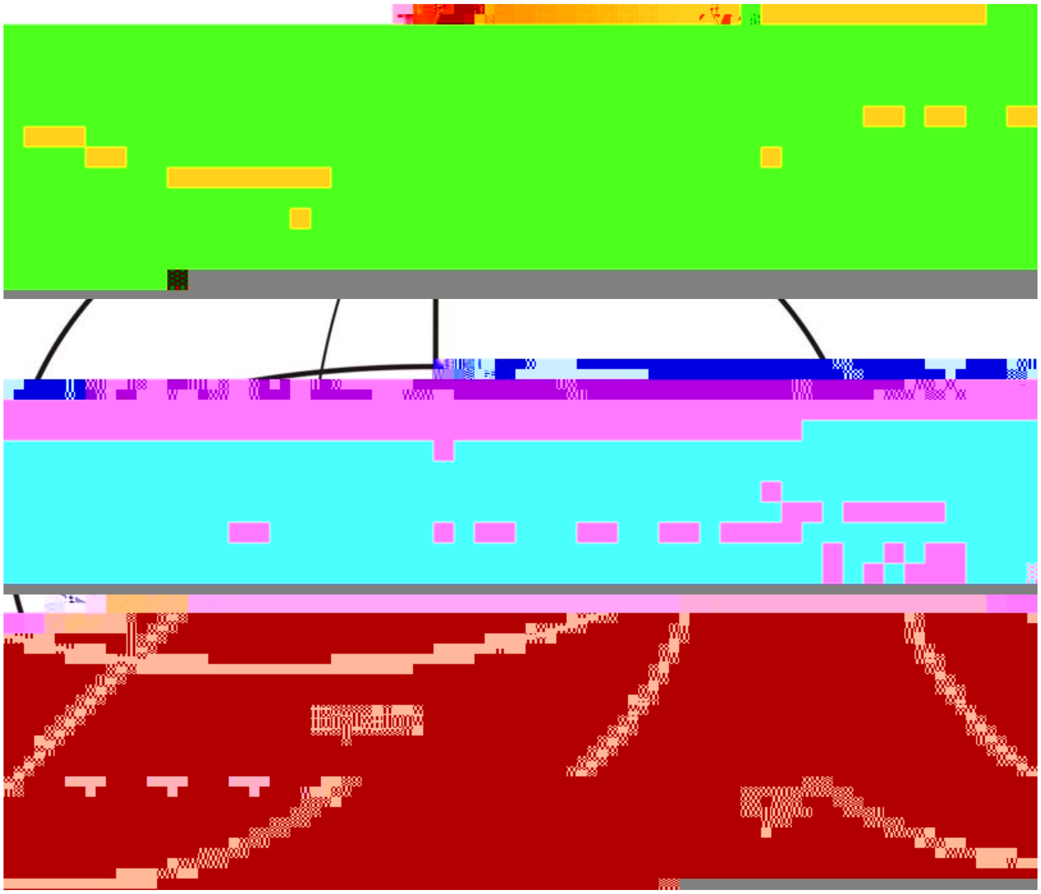

Figure 9: Cartesian coordinates, adapted from Dodson and Moore 2000

Datum transformations

A multitude of both local and global datums exist and are in use around the world. It is almost common practice to transform coordinates from one datum to another. A number of procedures are available for performing coordinate transformation. The merits and drawbacks of the available techniques should be considered with respect to accuracy requirements and computational simplicity. Of the many techniques used for datum transformation, three formulas are worth considering namely the Helmert transformations, the Molodenskii formulas and the Multiple-Regression formulas.

Distance determination

Article 76 requires the delineation of outer limits in terms of distances from the baselines from which the breadth of the territorial sea is measured. Where such distances exceed 200 M, the delineation is to be by straight lines not exceeding 60 M in length connecting the fixed points, defined by coordinates of latitude and longitude. It is also required that the coastal State shall deposit with the Secretary-General of the United Nations charts and relevant information, including geodetic data, permanently describing the outer limits of its continental shelf.

These requirements necessitate an understanding of the definition of latitude and longitude and geodetic datums and also the definitions of units such as the meter and the nautical mile and also of what constitute a straight line.

The Guidelines, through paragraph 3.2.1., state that the current international definition of the meter as that used in the Convention is the definition adopted by the Conference Générale des

Poids et Mesures of 1983. This defines the meter as

- Blunders which are an inevitable consequence of human fallibility, but the use of careful observational procedures and in particular the use of independent checks on observations should largely reduce their effect.

Precision, accuracy and reliability

The concepts of precision, accuracy and reliability have been a matter of debate for many years. They may be considered as directly relating to the types of error present in the observations. Precision is a quantity representing repeatability of a measurement and therefore only includes an assessment of random errors, whereas accuracy is considered to be an overall estimate of the error in a quantity, including the systematic effects. The ability of a measurement scheme to detect and hence eliminate blunders leads to the concept of reliability. An observation which is reliable is unlikely to contain undetected blunder, and conversely, a blunder is unlikely to be detected in an unreliable observation.

Given the limitations in collecting marine survey data and the potential ambiguity in their interpretation, it would be unrealistic in many, if not most, cases to expect that the accuracy and precision of the outer limit of the continental shelf will be comparable to those of boundaries that define the more conventional limits of national jurisdiction. The following table puts into perspective the potential levels of uncertainty that are inherent in each operation that is stipulated implicitly or explicitly by article 76 and which impact upon the final position of the outer limit (Macnab, 2000).

Operation	Parameter	

resources of the seabed and subsoil together with living organisms belonging to sedentary species, that is to say, organisms which at the harvestable stage are either immobile on or under the seabed or are unable to move except in constant physical contact with the seabed and subsoil.

Information that describes the resources of the seabed and subsoil beyond the 200 M is not the Convention. The payments and contributions shall be made annually with respect to all production at a site after the first five years of production at that site. For the sixth year, the rate of payment or contribution shall be 1 per cent of the value or volume of production at the site. The rate shall increase by 1 per cent for each subsequent year until the twelfth year and shall remain at 7 per cent thereafter. The payments or contributions shall be made through the Authority, which shall distribute them to States Parties to the Convention, on the basis of equitable sharing criteria, taking into account the interests and needs of developing States, particularly the least develope which are parties to a land or maritime dispute (paragraph 5 of Annex I of the Rules of Procedure).

The case of disagreement between a coastal State and the Commission has been addressed in a paper by Eiriksson, 2003. Elferink, 2003, discusses the case where there exists a dispute between coastal States over a region which is subject to a claim for an extended continental shelf. The discussions in the two papers have been found appropriate and the avid reader is encouraged to go through them.

Summary

The present paper has attempted to provide an overview of the provisions of article 76 and associated articles of the United Nations Convention for the Law of the Sea. This was achieved through a review of the numerous publications on the subject. The key issues in the article have been discussed so as to give a general sense of the factors that need to be considered when preparing a submission to the Commission. A brief on the history of the Convention along with the difficulties in drafting article 76 during the negotiation stage was presented. The implications in the preparation of a submission for an extended continental shelf by a coastal State were discussed as well as the methods and techniques that can be used in the determination of the foot of the slope and the sediment thickness. The importance of the resources of the continental shelf in the preparation of a submission and boundary delimitation was also addressed.

Acknowledgement

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