MAPPING THE ANAXIMANDER MOUNTAINS WITH EM12D SWATH MAPPING

J.M. Woodside

Geomarine Centre, Free University, De Boelelaan 1085, 1081 HV Amsterdam, The Netherlands

Key-words : swath mapping, Mediterranean Ridge

The Dutch ANAXIPROBE Project to determine the origin and evolution of the Anaximander Mountains in the eastern Mediterranean was based on five days of Simrad EM12D swath mapping. This type of surveying, carried out at a rate of about 20 km^2 per hour, at the depths found in this area (about 2000 m), provides not only highly accurate bathymetric data but also acoustic backscatter information related to the type of sedimentary cover as well as the morphology and fine scale relief of the seafloor. Rudimentary sedimentology is a development from such mapping to be expected in the near future. With the addition of seismic reflection profiles, gravity and magnetic anomalies, and low frequency echo-sounder profiles along the same lines, the survey data set is a rich and detailed source of information which is both daunting in its vast size and demanding in the level of analysis which it warrants.

The data from this 1995 survey aboard the French research vessel *L'Atalante* were used for detailed follow-up work in 1996 aboard the Russian research vessel *Gelendzhik*. The high backscatter data in areas of steep bathymetry indicated slopes where it might be possible either to sample hard rock outcrops or coarse talus from the exposed bedrock. High backscatter from circular targets with low relief (about 50 to 200 m relief and diameters of 500 m to 2 km) was inferred to be caused by mud breccia erupted at mud volcanoes, and therefore potential sources of rock samples from basement rocks at depth. The high backscatter had been shown previously (1) to be caused by volume scatterers in the upper metre or so of seafloor sediments (*i.e.* bedrock clasts in the mud breccia typical of mud volcanoes). Sampling of these targets successfully confirmed the basic assumption of mud volcano deposits; and the sampling programme successfully confirmed the hypothesis that the Anaximander Mountains are a continuation of the Tauride geology of southwestern Turkey, as reported elsewhere in this congress. Detailed deep tow sidescan sonar and subbottom profiler data from the follow-up survey clarified many of the swath mapping results, allowed the sampling targets to be determined with greater precision, and indicated the presence of gassy sediments in large parts of the survey area, but did not change the general expectations issuing from the original survey.

The combination of detailed bathymetry and backscatter "'imagery" is a powerful tool in neotectonic studies such as this. Subtle neotectonic deformations of the seafloor are visible to such swath mapping methods while they may remain invisible or at best ambiguous in the more traditional surveying methods (using, for example, single profiles of even high resolution subbottom profilers). The human eye (and computer methods) can resolve linear features related to seafloor structures and sedimentary deformation as well as small changes in backscatter strength related to changes in sedimentary facies, when these patterns are reinforced within the large volume of data. (For example, although a single pixel of data related to the crossing of a deep sea telephone cable would normally not be noticed, when the single pixel is accompanied by many such pixels the eye is easily able to correlate the pixels as a linear feature; this is the benefit of accurate and repetitive data forming broad swaths.)

The ANAXIPROBE EM12D swath mapping data in combination with similar EM12D data from the 1998 PRISMED-II expedition in adjacent areas show neotectonic deformation which must be explained in any interpretation. It is clear that there are important northeast-southwest trends across the area which are probably related to the Strabo Trench/Pliny Trench trends forming the transpressional plate boundary along the eastern Hellenic Arc. These cross-cutting trends cause offsets in the general northwest-southeast orientation of the eastern Anaximander Mountains and the Florence Rise. The northeast-southwest trends are clearly related to a direction of compression across the mountains also because there is a clearly imaged fold belt in the Antalya Basin which appears to have been created by the northeastward movement of the Anaximander Mountains into the Antalya Basin.

Acknowledgements

The swath mapping carried out during project ANAXIPROBE was financed by the Netherlands Geosciences Foundation (Stichting GOA) under project number 750.195.02. The cooperation within this research of colleagues from France, Russia, and Turkey is also gratefully acknowledged.

References

(1) Volgin, A.V., and Woodside, J.M., 1996, Sidescan soar images of mud volcanoes from the Mediterranean Ridge: possible causes of variations in backscatter intensity. *Marine Geology*, 132:39-53.