DEEP SEA MEGA-GEOMORPHOLOGY: PROGRESS AND PROBLEMS

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Historically, marine geologists have always worked with mega-scale morphology. This is a consequence both of the scale of the ocean basins and of the low resolution of the observational remote sensing tools available until very recently. In fact, studies of deep sea morphology have suffered from a serious gap in observational scale. Traditional wide-beam echo sounding gave images on a scale of miles, while deep sea photography has been limited to scales of a few tens of meters. Recent development of modern narrow-beam echo sounding coupled with computer-controlled swath mapping systems, and development of high-resolution deep-towed side-scan sonar, are rapidly filling in the scale gap. These technologies also can resolve morphologic detail on a scale of a few meters or less. As has also been true in planetary imaging projects, the ability to observe phenomena over a range of scales has proved very effective in both defining processes and in placing them in proper context.

At the same time, the new technology has placed new demands on researchers trained in remote sensing rather than in observational field geology. In some cases this leads to "rediscovery" of phenomena familiar to land geologists. Indeed, as more detail becomes available, many of the supposed differences between subaerial and submarine morphologic development have disappeared.

The discovery of unique deep sea life forms associated with active hot springs on the sea floor was a completely unexpected by-product of the increased emphasis on deep sea imaging programs. Such discoveries provide hope for similar discoveries in the alien environments of other planets. Feedback between observation of seafloor morphology and comparable features on land has stimulated much new research on ophiolite complexes and ancient Archean basalt terrains; some of this in turn suggests analogies with volcanic events on other planets. Important inter-relationships are emerging between morphologic and tectonic features on the seafloor, and the geochemistry of associated volcanic rocks. These discoveries point to the need for more inter-disciplinary communication between morphologists, petrologists, and geophysicists.

Studies in comparative planetology require a reasonable consistency in scales and quality of imagery used for comparison, for maximum success. This must include _vertical_ feedback among observations at different scales for best understanding of processes within a given environment, and _horizontal_ feedback between comparable types of images, at similar scales, in different environments. Deep sea imaging technology has benefitted from many of the lessons learned in space, and we are just now becomming able to observe more than two-thirds of the surface of the Earth, on the same scale and in the same detail with which we have already observed the Moon, Mercury, Mars, and the moons of several distant planets. Clearly, a major challenge remains to observe the details of volcanic, tectonic, and erosional features of our own planet's "inner space", and to understand the processes operating there.