

Geology of Modern and Ancient Oceanic Arcs

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Abstract

Recent years have seen major advances in understanding of the tectonic, volcanic, and sedimentary character of modern oceanic arcs, through the use of submersibles, ROVs, dredging, coring and geophysical studies. On-land studies of accreted oceanic arcs are highly complementary to this work because they provide much more complete, three-dimensional, time-integrated views of their geology; however, they are limited by the fact that the record is not in situ. For a comprehensive understanding of the geologic evolution of oceanic arcs, oceanographic and outcrop-based data sets must be integrated. The geology of the Izu-Bonin-Marianas arc is better known than any other modern oceanic arc system. Mesozoic oceanic arc rocks of Western Mexico are more extensive, better studied and, in Baja California, are arguably less deformed and better exposed than any other accreted oceanic arc rocks on Earth. The two systems are also very similar, making them ideal for comparative studies, interpreted in the context of global studies of modern and ancient oceanic arcs.

The following questions will be addressed in this lecture:

- What are the main igneous and sedimentary building blocks of oceanic arcs?
- What are the time scales for their construction, and how important are discrete (~15-20 million-year) flareups?
- How do volcano-bounded basins and fault-bounded basins form in oceanic arcs, and how can they be distinguished by their sedimentary and volcanic fill?
- Is the formation of volcanic and plutonic crustal sections coupled?
- The Izu rear arc is dominated by a series of basaltic to andesitic to rhyolitic seamount chains that strike at a high angle to the arc front, while arc front rocks are bimodal and less continental in affinity, consisting of mafic volcanoes and silicic calderas; can this asymmetry be recognized in ancient arc terranes?
- What is the importance of older oceanic arc rocks or continentally-sourced sediment systems in the basements of oceanic arc terranes, and what does this tell us about the fringing vs. exotic origins of accreted arcs?

