Relative changes in Cretaceous sea level as recorded on guyots of the Mid-Pacific Mountains

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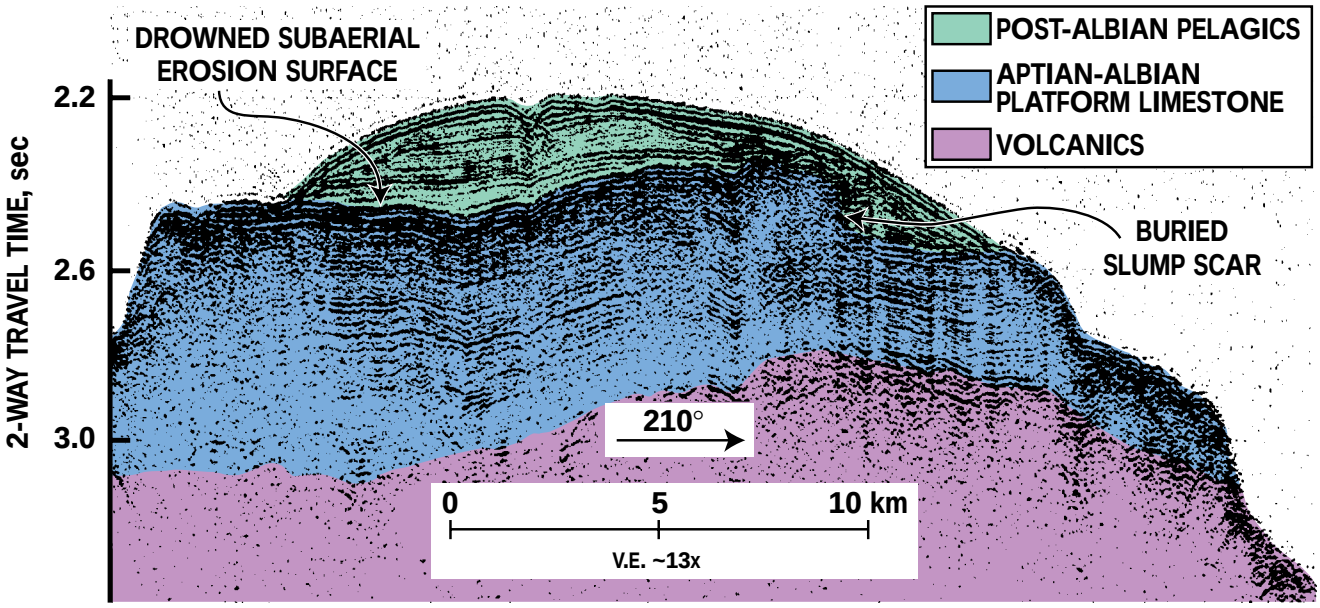
Leg 143 drilled two (Resolution, Allison) of the many sunken Early Cretaceous carbonate capped guyots in the Mid-Pacific Mountains to: 1) establish a history of Early Cretaceous sea level fluctuations far from the Atlantic margins where the eustatic hypothesis was developed, and 2) gather data on the timing and causes of guyot drowning.

Shallow-water carbonate accumulation began around volcanic islands as they formed near the equator about 130 million years ago, and continued as volcanic islands were added progressively eastward. Upward building by lime- secreting organisms paced sea level as the foundations subsided, resulting in limestone as much as 1600 m thick (Resolution). Cores and logs show hundreds of meter-scale shallowing-upward successions showing that water depths over the interior of the platforms fluctuated mainly from a few meters subtidal to intermittently subaerial. A paucity of close-spaced time markers precludes establishing conclusively the relative roles of eustatism, tectonics and autocylclic shifting of environments in regulating depth fluctuations or of orbital cycles in their frequency.

About 100 million years ago, Western Pacific carbonate banks became emergent by as much as 200 m, exposing them to erosion by rain and waves. On some banks, karstic, atoll-like topography formed and waves cut perimeter terraces. The magnitude and areal extent of the fall suggest that regional tectonic uplift played a role. Within a few million years, exposed banks subsided beneath the sea, but no more shallow-water carbonates accumulated; instead, pelagic sediments buried the erosional surface as the guyots drifted northward to their present latitude.



Seismic profile across Allison Guyot, a few km east of Leg 143 drill site 865. The volcanic basement (purple) was eroded by streams and waves to a surface of low hills over which shallow-water carbonate sediments (blue) were deposited. As the volcanic foundations subsided, carbonates paced sea level until 500-1500 m of limestone had accumulated. Exposure of the platform in mid-Cretaceous time resulted in a karstic topography on which pelagic sediments (green) were deposited and shaped by currents following resubmergence. Large slumps during Cenozoic time removed limestone from the right side of the guyot. Arching of the limestone is due to differential compaction over the buried volcanic topography.