

Seafloor geomorphology and geology of the Kingman Reef-Palmyra Atoll region, Central Pacific Ocean

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Kingman Reef and Palmyra Atoll are the exposed summits of two seamounts within the Line Islands Volcanic Chain in the Central Pacific Ocean. Both are U.S. Territories, and the Exclusive Economic Zone around the islands was partially surveyed in 1991 with GLORIA sidescan sonar and seismic reflection profiling. New multibeam swath sonar surveys were conducted in 2010, 2015, and 2016 around the islands, in support of U.S. Extended Continental Shelf investigations. Numerous transits through the region by research vessels have collected additional multibeam swath sonar data. We present new, detailed maps of bathymetry, sidescan sonar imagery, geology, and sediment isopachs of the seafloor surrounding the islands, and how these have informed our understanding of the islands' margins.

The islands are the last subaerial remnants of a complex, horse-shoe-shaped volcanic platform spanning roughly 200 km in diameter. The elevated platform from which the seamounts arise comprises at least 10 individual volcanic centers that have heights exceeding 3000m above the nearby abyssal plains. Gravity modeling suggests that the elevated platform is compensated by thickened crust. Strong carbonate caps and voluminous sediment accumulations flanking the platform indicate that the volcanoes were once shallow-water or emergent systems. These systems produced vast quantities of carbonate sediment that were shed to a deep interior basin to the east of Palmyra Atoll, and to nearby abyssal plains. The identification of mass failures, sediment reworking and bed-forms, and channel networks provide evidence for extensive sedimentary processes around these volcanic centers. Analysis of the seamounts atop the elevated platform and in the seamount province to the northwest shows that flat-topped seamounts ("guyots") are principally found at depths shallower than 1300 meters, while peaked seamounts are almost exclusively found at greater depths. This constrains the amount of regional subsidence that has occurred since guyot formation.