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### **Steep Microbial-Dominated Platform Margins—Examples and Implications**

Seaward progradation of several km's or more has been documented mostly for low-angle carbonate platform slope systems with a dominant bank top sediment source. But steep and high-relief margins fronting deep basins can also prograde and as such are somewhat perplexing. Characteristics of prograding ancient examples, Permian and Carboniferous in age, provide a model, which may apply elsewhere.

The Capitan margin rimmed the Delaware Basin of west Texas and southeastern New Mexico during the Late Guadalupian (Capitanian). Information on the morphology and progradational history of this margin comes from subsurface seismic and well data, and also superb outcrops in the nearby Guadalupe Mountains. Although the margin was high-relief (300 to 550 m high) and steep (30 to over 70° dip), progradation extended the margin from 5 to 19 km. Outcrops of steep, high relief Serpukhovian to Moscovian margins in northern Spain serve as important analogs for subsurface hydrocarbon reservoirs in steep-sided isolated platforms of the Pricaspian Basin in western Kazakhstan. Seismic and well data corroborate the outcrop pattern, showing progradation of, respectively, more than 10 and up to 5 km despite the high-relief (up to 600 m) and steep (~ 20-32°) nature of these margins.

The examples share a highly productive microbial cement boundstone factory extending from the platform break to nearly 300 m depth and a lower slope dominated by (mega)breccias and grain flow deposits derived from the margin and slope itself. The broad depth range of microbial cement boundstone increases the potential for production during both lowstands and highstands of sea level and thereby facilitates progradation. Rapid in situ lithification of the boundstone provides stability to the steep slopes, but also leads to readjustment through shearing and avalanching. What controls the microbial cement boundstone formation remains a debate but its presence is a key factor in the progradational geometry of these and possibly other older, and younger, margins.