Stratigraphic-sedimentological framework for the Late Jurassic-Early Cretaceous carbonate system in the northern part of the East Black Sea

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Outcrop data from Crimea and the Caucasus, supplemented by time-equivalent analogs are used to constrain the time-stratigraphic and facies development of the Late Jurassic-Earliest Cretaceous carbonates on the buried Shatsky platform-ramp setting.

The onset of carbonate deposition occurred as part of a shallowing upward trend that was initiated during the middle part of the Oxfordian, following an offshore marine transgression. The establishment of a firm substrate over the underlying Lower Oxfordian marine shales is likely to have followed the classical mode of colonization by platy microsolenid corals, as documented from Crimea (Koba-Kaya) and from larger swaths of the Tethyan epicontinental seas. Platform and reefal carbonates were quickly established on microsolenid biostroms, and were able to keep pace with significant tectonic subsidence rates, such that carbonate sequences exceeding a kilometer thickness were formed within a time frame of roughly 10Ma.

Crimean outcrops such as Ai-Petry illustrate the combined build-up mechanism of algae-microencrusters, sponges-stromatoporoids and corals, including branching and ramose types. Such associations of framework-building organisms are typical for many Upper Jurassic carbonate systems, where corals are generally minor constituents. Hence, calcitic-shelled organisms dominate the make up of Upper Jurassic carbonate systems; the relative paucity of aragonitic-shelled organisms has important implication for secondary porosity development in such systems.

While internal stratigraphic discontinuities and unconformities have been identified within the shallow marine carbonate sequences, the lack of age-diagnostic fossils and other chronostratigraphic tools precludes a correlation, even at stage level. Seismic data over the Shatsky Ridge (Maria structure) indicate that the carbonate system was offlapping at times, but mostly vertically aggrading. Based on limited data, some authors have tentatively recognized a subaerial unconformity at the top of the Kimmeridgian and at the top of the Berriasian. At this moment, a relative sea-level curve cannot be established with any level of confidence.

The Alchak-Kaya outcrop on the Eastern coast of Crimea exposes the uppermost part of carbonate system. Here, a marine transgression of early Berriasian age results in the deposition of offshore shales, which are overlain by a shallow marine carbonate system, some 30-50m thick. This widespread carbonate system was terminated within the Berriasian; the causes for exceeding thresholds of biological stress on carbonate ecosystems are likely a combination of factors, including increasing eutrophism, climate shifts and significant and prolonged exhumation of the carbonate platform. A multiphase paleokarst system is developed over large parts of Crimea and the Greater Caucasus; breccias and terra rossa indicative of an arid climate characterize probable Kimmeridgian-Tithonian paleokarsts, while associated green shales at the roof of the carbonate system, possibly a Berriasian paleokarst are indicative of a humid climate.