SUBSURFACE ONONDAGA BIOHERMAL BANKS: PALEOGEOGRAPHY, FACIES, AND RESERVOIR FEATURES

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Several gas-producing biohermal banks, popularly known as pinnacle reefs, have been discovered in the Middle Devonian Onondaga Limestone of south-central New York. These subsurface carbonate buildups are distinguished from bioherms known in the Onondaga outcrop belt by their paleogeographic separation from the latter, their far greater size (36 to 63m in thickness and 1200 to 3200m in diameter) and their continued growth throughout Onondaga deposition. Subsurface biohermal banks were initiated as coral-crinoid mounds in the Edgecliff Member and were located on the seaward margins of isolated platforms surmounting the ramp sloping into the basin in south-central New York. Although surrounded by deep-water Moorehouse facies upon subsidence of the platforms, these banks continued vertical and lateral accretion, and persisted even while euxinic Marcellus Shale was replacing upper Moorehouse carbonates to the south. The northernmost build-ups continued growth as Seneca carbonates, overlying the Moorehouse, were further confined by the Marcellus transgression. Bank growth was terminated either by gradual foundering under progressive transgression or by anoxic waters accompanying encroaching Marcellus deposition, but not by terrigenous mud influx. Extinct biohermal banks remained unburied for millenia until gradually onlapped by the Marcellus and Skaneateles Shales.

Study of five subsurface biohermal banks demonstrates their faunal and facies kinship to outcrop Onondaga bioherms, despite the differences mentioned above. Both exhibit broadly domed external structures initiated as bafflestone formed of Acinophyllum-Cladopora thickets, succeeded by alternating Cylindrophyllum and Acinophyllum-Cladopora bafflestones, capped by bryozoan-Cladopora wackestones, and flanked by crinoid-coral rudstone, rich in Emmonsia and Favosites, that grades laterally into deep-water facies. Neither outcrop nor subsurface Onondaga structures were wave-resistant reefs. They formed at considerable water depths probably below the effective photic zone. Algae and stromatoporoids are virtually absent from Onondaga bioherms, despite the equatorial paleolatitude of the northern Appalachian basin, bordering the circumtropical Hercynian Sea, and despite the role of stromatoporoids and calcified algae as prime constructors of other Devonian reef complexes which occupied similar or less favorable paleolatitudes.

These structures are sealed by the overlying Marcellus and Skaneateles Shales which undoubtedly also served as hydrocarbon sources. Most existing porosity consists of primary intraskeletal, intergranular, and growth framework voids. Cementation by calcite spar was halted by invasion of liquid hydrocarbons, presently existing as a tar residue lining the voids. Calcite and chalcendony cementation is virtually

complete in the lower, water-saturated parts of bioherms. All of the seven known subsurface biohermal banks have shown initial production tests of 10 to 18 million cfgd. Wyckoff Reef in Steuben County has produced more than 5 billion cfg since its discovery in 1967.

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