AAPG Search and Discovery Article #90049©2000 AAPG/EAGE International Research Conference, El Paso, Texas, October 1-5, 2000 (2005)

Paleontological and Lithological Variability in the Upper Capitan Limestone, Southeastern New Mexico: Significance to Petroleum Exploration

CROW, CHRISTOPHER J., University of Alabama, Tuscaloosa, AL, USA; SCOTT BRANDE, University of Alabama at Birmingham, Birmingham, AL, USA

Significant details about the depositional setting of the Capitan Reef (Guadalupian) have been debated in the literature for nearly a century. The earliest statements calling it a reef noted the important contribution made by algae. Later the Newell Group interpreted a wall reef setting using numerous lines of evidence. During the vadose pisolite era the Capitan was thought to have been deposited as a marginal mound. This down slope setting placed it outside the influence of strong current activity. Recent work emphasized the importance of cryptic habitats roofed by sponges and bryozoans, and suggested that much of the Capitan taxa were obligate cryptobionts. The most recent work has reported that a significant percentage of sponge fossils were preserved in place, and concluded that deposition occurred in a reef setting where surface occupation was dominant over crypt occupation. In that these surface exposures have been used by the petroleum industry to design hydrocarbon exploration and development strategies, it is significant as to whether or not these rocks were deposited in a reef or non-reef setting.

Several important reasons for these interpretive differences stand out. The first is the combined effect of the extent of the Capitan outcrop and the temporal variability it displays. Much of the outcrop is in rugged areas that are difficult to sample. Results of some areally limited studies have been extrapolated to encompass the entire Capitan outcrop. Secondly, individual studies have all had specific focus and approach, such as the examination of sedimentological, paleontological, paleoecological, or diagenetic questions. Some of these studies that have generated depositional models may have overlooked information best obtained from the fossils themselves in favor of other lines of evidence about the nature of the depositional surface. Lastly, studies based on statistically valid random sampling methods are rare in the Capitan literature, making it difficult to address issues of community composition and structure.

Our efforts were designed to address this final point. Upper Capitan Massive Limestone outcrops were examined in nearly every canyon and draw between Dark and Rattlesnake canyons. Three localities, Dark Canyon, Bat Cave Draw, and an unnamed draw (Carlsbad Caverns National Park) were chosen for study. Outcrops were gridded and censused using random sampling techniques. Census plots were acid etched and paleontological and lithological data were traced onto acetate sheets. Nearly 6,000 fossil data points were recorded from ten taxonomic groups, six of which contained 98.7% of the total sample. Analysis using pairwise comparisons and the *f*-value statistic indicated less paleontological heterogeneity within and between canyons than previously thought to exist. The only significant difference detected was in the abundance of bryozoans between Dark Canyon and Bat Cave Draw. A better understanding of the Upper Capitan Limestone should serve to facilitate carbonate hydrocarbon exploration and development involving reef lithofacies.