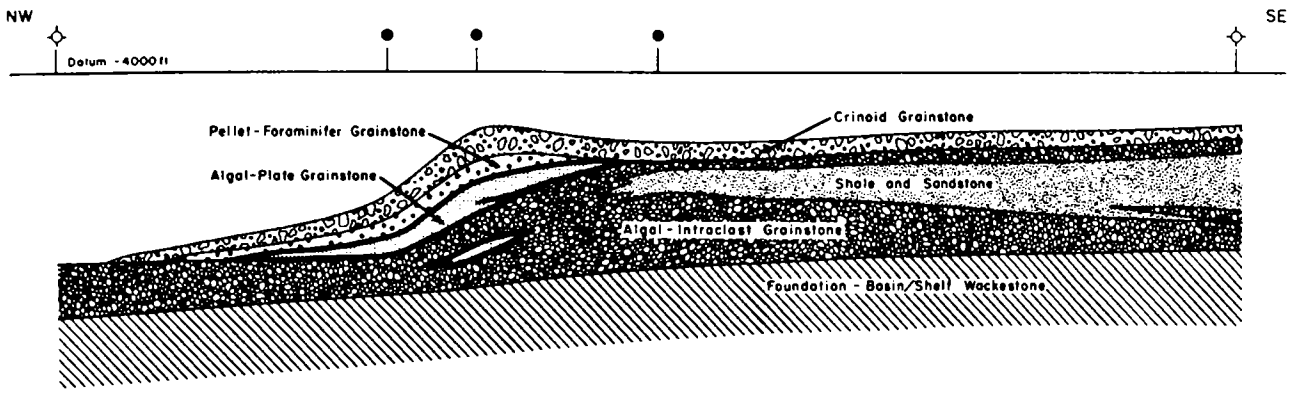
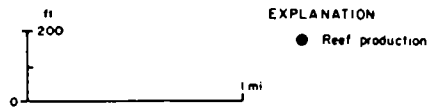


Figure 26. Lithologic cross section of facies in middle Strawn reef of Nena Lucia field, Nolan County. Production is obtained from the algal-plate grainstone facies. Modified from Toomey and Winland (1973).



can be correlated beyond the shelf edge into the basin. Specific regional carbonate markers—such as the Odom, Santo, Goen, Capps/Village Bend, Dog Bend, Palo Pinto, Winchell, Ranger, and Home Creek Limestones—should be identified on the shelf segment of each cross section. The bottoms (or tops) of successive transgressive carbonate markers define the boundaries for isopach- and isolith-mapping intervals. The positions of the shelf-interior facies assemblage and the shelf-margin carbonate-bank system are also well demarcated by regional cross sections. This is especially true if carbonate lithologic continuity (as indicated by a brick pattern) rather than well-log curves is shown on some of the cross sections (Fig. 15). Wherever possible, seismic evidence that documents the same or nearly the same line of section as the lithologic cross sections should be included with the study.

The second step in Bloomer's (1990) suggested protocol for reef prospecting involves construction of whole-interval isopach and net-lithology isolith maps. All the map types should be prepared for single genetic units (Galloway sequences or format units) that are most likely to contain reefal buildups at the shelf edge. Within a single interval, the shelf-interior, shelf-margin, slope, and basinal deposits each show a characteristic thickness pattern that is easily identified on an isopach map. Net-sandstone isolith mapping of the same interval delineates the facies belts of interior-shelf fluvial–deltaic siliciclastics and the exceedingly thick slope submarine-fan complex beyond the shelf edge. Of course, for the Strawn Group, there is no slope system beyond the carbonate ramp; the starved-basin black shale of the basin system does not exceed 40 ft per genetic interval. Net-carbonate isolith maps indicate a maximum thickness of limestone at the shelf edge, a dramatic thinning of carbonate on the slope, and a much more gradual thinning toward the shelf interior. The exact position and trend of the shelf margin are the most important features illustrated on this map. Regional limestone isolith maps can also pinpoint large pinnacle reefs on the slope as well as interior carbonate buildups on the shelf. More detailed, larger scale maps covering specific areas of interest can then be constructed that determine the geographic extent and total interval of section contained within prospective shelf-edge reefal buildups.

Once individual buildups have been delineated along a shelf margin, additional maps should be prepared to locate specific prospects. A structural-contour map showing the top of the reefal buildup for a given genetic interval will demonstrate its elevation above the surrounding non-reef facies and delimit the area of most likely hydrocarbon entrapment. Transgressive black shales within the accretionary upper Strawn–Canyon shelf-margin reef for each of the principal genetic sequences help prevent migration of hydrocarbons out of the individual components of the total stacked reefal edifice. Thus, one need not restrict exploration efforts only to the highest parts of the complete upper Strawn–Canyon reef complex. A structural-contour map showing the top of the Odom Limestone, the effective base for post-Caddo reefing, might also be meaningful. This map would help identify basement structural highs on which later reefing took place.

For the Cisco shelf margins, it would also be desirable to prepare structural-contour maps of carbonate markers that overlie the buildups. Because Cisco lowstand deltas of the superjacent cycle prograde out on top of and beyond the older shelf edge, these supra-reef contour maps will delineate closure caused by differential compaction. Similarly, complete-sequence isopach maps between two marker beds above shelf-edge reef zones act to quantify the amount of thinning that takes place there. This is another indicator of possible differential compaction. Production will be obtained from fluvial–deltaic facies draped over the shelf-edge reef.

The final step of the initial exploration effort is achieved by drilling a well into the reef buildup as high on the structure as possible. A three-dimensional seismic survey, if carried out preceding the drilling of this well, can be used to pinpoint the site for this well and supply a better visualization of the overall reef geometry. On the other hand, the explorationist may wait until after drilling the first well to conduct the seismic survey. Under this circumstance, he will seek confirmation of reservoir porosity and the presence of hydrocarbons from a detailed analysis of well cuttings, porosity logs, and mud logs. With subsequent development wells, cores should be taken from all the identified reservoir-quality reefal-porosity zones.