through the analysis of well data. Sedimentation rates, sediment lithologies and densities, and structural imprinting have all influenced the geometry of the Williston basin. With this background information, a subsidence model for the basin has been proposed. Mechanisms controlling the subsidence history appear to be a combination of a thermal mode and a mechanical mode. The thermal aspect of basin subsidence is related to factors associated with subsurface heating and cooling of the lithosphere through time. A noted property of thermal-induced subsidence is the relation of square root of age to depth of sediments. The mechanical aspect of basin subsidence is related to tectonic rifting and normal faulting.

An important component of the thermal history of the Williston basin is the relation between thermal heating and hydrocarbon maturation of the sediments within the basin. The organic-rich sediments accumulating within the subsiding basin will be subjected to increasing depth of burial through time, and concurrently experience increased heating induced by the geothermal gradient. Application of the "liquid-window" concept to hydrocarbon generation in the Williston basin gives an indication of the potential for hydrocarbon accumulation. Petroleum production data have confirmed this hypothesis.

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Geology of Albion Group of Tuscarawas County, Ohio

The Albion Group is the Lower Silurian sequence that was deposited along the northwestern edge of the Appalachian basin. The Albion Group is composed of the Brassfield Limestone and the Clinton Sandstone Formations. The Clinton Sandstone is the major petroleum producing formation in Ohio.

Cross sections and isopachous and lithofacies maps indicate that the Clinton Formation occurs as a "blanket" deposit or a series of overlapping sandstone bodies which intertongue with the Cabothead Shale to the west. Deposition is commonly interpreted to have occurred in a marine-deltaic environment. The sand bodies represent delta channel sands and offshore bars. Hydrocarbon accumulations are stratigraphically controlled by sand-bed facies changes or porosity pinch-outs. The key to petroleum exploration in the Clinton Sandstone is determining the orientation and extent of the sandstone bodies through subsurface mapping.

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Constructional Framework in Buttress Zone: Role of *Acropora cervicornis* and *Agaricia,* Discovery Bay, Jamaica

The fore-reef buttress zone is composed of broad, terrace-like outgrowths at depths between 12 and 28 m. Coral-dominated buttresses—20 m wide, 50 m long, and less than 10 m vertical relief—are transected by regularly dispersed carbonate-sand channels cut subperpendicular to the strike of the reef slope. The width of the channels ranges from 12 to 20 m.

The construction buttresses are the result of vigorous outgrowth and lateral accretion, and can be divided into two major zones based on the contribution of the corals to the reef framework. In zone 1, water depths range from 12 to 17 m. *Acropora cervicornis* is dominant, and intergrown colonies exhibit polyp fusion creating a thicket that is an effective stabilizer. An abundance of broken, dead *A. cervicornis* rubble infills voids between primary hermatypic corals such as *Agaricia.* Species of *A. agaricites* are found commonly filling voids in the *Acropora cervicornis* meshwork. *Agaricites* colonies range in size from 4 to 30 cm, growing in close nonrandom distribution. This growth pattern reflects a defense mechanism for more aggressive corals, substrate preference (commonly dead *Acropora cervicornis*), and preference for a shaded environment. Along the steepsided flanks of the buttress *A. cervicornis* is of limited abundance and *Agaricia agaricites* is dominant. Interspecific aggression was not observed and it appears that growth of many *Agaricites* colonies is subsequent to the meshwork of *Acropora cervicornis.* Water depths in zone 2 range from 18 to 28 m. The predominance of *A. cervicornis* diminishes with depth and *A. cervicornis* occurs as loosely aggregated rubble piles and smaller living meshworks adjacent to the buttress. *Agaricia lamarki* replaces *A. agaricites* as a dominant primary hermatype. Rapid growth and fusion generally occur on vertical overhangs of the buttress and the change in species reflects diminishing illumination. The ability of broken *Acropora cervicornis* to regenerate, and its high growth rate, contribute to lateral outgrowth. Subsequent growth of *Agaricia* sp. in newly created preferential niches strengthens the buttress.

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Dynamic Analysis of Deformation Lamellae Occurring in Vein Calcite

Detailed stress analysis is of great importance to the structural geologist in the interpretation of various structural features. Of the many methods which have been devised to aide in dynamic analysis, the more promising has been in the use of calcite twin lamellae for the derivation of principal stress orientations.

Most work to date has centered on the analysis of detrital calcite grains in experimentally and naturally deformed limestones.

This paper summarizes research on the dynamic analysis of calcite twin lamellae occurring in calcite-filled fractures.

Four hand samples containing calcite-filled fractures were removed from the Lincolnshire Formation, an Ordovician limestone of the central Appalachians near Strasberg, Virginia. Before removal of the samples, the fracture type, relative age, and orientation were recorded. The standard techniques of dynamic analysis developed for such studies were applied to data from thin sections prepared from each sample.

It is presumed that the development of fractures and the subsequent filling with calcite occur in progressive stages throughout the phase of deformation. It is expected that the dynamic analysis of each calcite-filled fracture will yield information concerning the stress orientations present at the time of the associated stage of fracture development.

By sampling calcite-filled fractures of differing ages it is possible to follow the principal stress orientations throughout the progressive stages of deformation. Thus, by this method it is possible to derive the incremental stress orientations for each stage of fracture development. Present methods of dynamic analysis using detrital calcite provide only the principal stress orientations of the finite deformation.

By being able to derive the incremental stress orientations of a progressive deformation, a more detailed deformational history is obtained.

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