out most of the study area. The Fort Chadbourne fault system is a linear zone of deformation trending from Sutton County northward into northeastern Nolan County. This structural zone contains uplifted and faulted Wilberns Formation. En echelon faults and folds as the predominant structures along the Fort Chadbourne fault system suggest wrench faulting. The orientation of these faults (north-south) and folds (northeast-southwest) suggests that the wrench system had left-lateral movement that was produced from compressive forces active during the Ouachita orogeny.

Based on thin-section analyses of core samples, the general paragenetic sequence for the upper sandstone units of the Wilberns Formation consists of at least 4 diagenetic stages: (1) reduction of primary porosity and development of quartz overgrowths resulting from burial and compaction; (2) precipitation of dolomite cement into remaining pore space; (3) dissolution of calcareous material and development of secondary porosity in response to uplift and exposure; and (4) precipitation of hematite, pyrite, and clays as pore lining and pore fill after reburial (hydrocarbon migration probably occurred during this stage).

This sequence of diagenetic events is responsible for the excellent reservoir quality of the sandstone units within the Wilberns Formation found along the Fort Chadbourne fault system.

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Petrographic and Trace Element Analysis of Nonreef Silurian Carbonates, Northern Lower Michigan

Carbonate sediments of the northern reef trend in Michigan have been the subject of serious scientific scrutiny since the discovery of significant hydrocarbon reservoirs in pinnacle reefs in the late 1960s and early 1970s. The reef trend is a complex of reef and nonreef carbonate facies capped by an evaporite/carbonate sequence. The reef and the evaporite/carbonate sequence have been extensively described and discussed over the last decade. However, the nonreef (interreef) facies has received little more than brief descriptions throughout this time. As these nonreef carbonates are virtually barren of hydrocarbons, their analysis has been neglected.

Most exploration for pinnacle reefs centers around geophysical techniques; however, it should be considered that patterns of textural or geochemical gradients may occur between the reef masses and surrounding nonreef deposits. This study examines, in detail, the petrographic and geochemical character of these nonreef (interreef) sediments. These characteristics can provide additional data and a potential exploration tool for determining the spatial facies relationship between pinnacle reefs and interreef carbonates in the Michigan northern reef trend.

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Reservoir Volume and Production Decline Programs for the IBM-PC

Two programs useful for geologists and engineers in calculating reservoir volumes, setting up well and field production schedules, and projecting production decline have been written for the IBM-PC. Both programs are "user friendly" with simple full-screen data entry, and output to screen, printer, or diskette file for use by other programs. The programs are written in BASIC. Minimum system requirements are 128K RAM, one disk drive, monochrome monitor, and MS-DOS 1.1.

PXVOLUME calculates reservoir volume using input data consisting of contour values, measured areas within the contours, and reservoir isochore information. Output includes net reservoir volume above each contour. The program will interpolate or extrapolate areas and volumes for contour levels for which areas have not been measured, such as gas-oil and hydrocarbon-water contacts. Gas-cap and oil-reservoir volumes will be calculated and output separately if the gas column is provided.

PXDECLIN is designed primarily for use in estimating production profiles for prospects or individual wells, but may also be used for projections based on actual production data. The user is given a choice of production parameters to input, and remaining parameters are calculated. Hyperbolic, exponential, or harmonic decline may be specified, and decline rates may be either entered or calculated. Specifically, the "b" exponent for hyperbolic decline will be determined without any requirement for estimation or curve matching. Output consists of production profiles by month, quarter, or year, and both input and calculated production parameters, such as daily rates, cumulative production, production life, and the "b" exponent and "a" factor.

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Neogene Paleogeography of Western Snake River Plain, Idaho and Oregon

Analysis of Miocene through Pleistocene siliciclastic and volcaniclastic sequences in the western Snake River Plain of Idaho and Oregon allows detailed paleogeographic reconstruction of sedimentation associated with the development of a rapidly subsiding continental basin. Extensional tectonism was accompanied by voluminous outpourings of basaltic and silicic volcanic material. These in turn were reworked basinward by marginal alluvial fan–braided stream networks into basin-center fluviolacustrine systems. Episodic influxes of both felsic and basaltic tephra are recorded in fossiliferous lacustrine silt and claystones of the Poison Creek and Chalk Hills Formations, radiometrically bracketed between 12.5 to 5 m.y.B.P. Basinward-fining facies indicate deposition in a large lacustrine complex fed by at least 2 major fluvial systems. Complex interfingering of coarse-grained strandline deposits with offshore fine-grained sediments suggests repeated expansion and contraction of the lake system and record the dynamic interplay between basin tectonism and sedimentation. A major unconformity and presence of extensive interbasinal basaltic volcanism (Banbury Basalt) reflects draining of this lacustrine system and renewed extensional tectonism in the basin approximately 4 m.y.B.P. Reestablishment of a major fluviolacustrine complex is represented by deposits of the Pliocene-Pleistocene Glenns Ferry Formation (4-1.8 m.y.B.P.). The fossiliferous mudstone, sandstone, and conglomerate represent alluvial fan, meandering stream, flood-basin, and lake margin systems. Interbedded with these are a series of basaltic tuffs and flows reflecting continuing volcanism along the basin margin and basin center. Continued structural adjustments along high-angle normal faults that bound the basin are indicated by stratigraphic relationships as well as the style of fluvial sedimentation. Periods of rapid basin subsidence are recorded by thin, discontinuous channel sandstone encased by thick overbank siltstone and claystone. More stable periods allowed development of sheet-like channel sandstone with subordinate amounts of overbank fines. Basin-wide structural adjustments have continued to the present, as indicated by the incisement of these Neogene deposits by the modern Snake River.

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Depositional Control on Red Clinton Sandstone Production, Holmes County, Ohio

The Clinton sandstone (Silurian:Albion) is a major producing horizon throughout eastern Ohio. It accounts for 75% of total drilling activity in the state in recent years. The middle member of the Clinton, the Red, has caused problems for drillers in Holmes County, Ohio; rapid changes in thickness and porosity create wide differentials in production between closely spaced adjacent wells. A detailed analysis of Red Clinton variation in this area would be helpful for better direction of exploration and development programs.

On the basis of more than 1,100 drillers' and geophysical logs, structural, isopach, and porosity interpretations were assembled for the Red Clinton in Holmes County. Data analysis indicates that the Red Clinton is arranged in a number of multiple bar systems trending east-west to northeast-southwest throughout the county. Production statistics show that thickness and porosity of the Red Clinton is relatively good in the cleaner bar sands, whereas thinner, finer grained, more argillaceous interbar sands yield poorer producers or dry holes. Use of this depositional model clarifies the nature of controls on directional variation in thickness and porosity in the Clinton and facilitates prediction of production trends.