tion, and decline curves each characterized by fitting to a sum of up to three exponential decay curves (adjusting for those wells in which a later cleanup occurred), are also interpolated onto the grid.

We are then using contingency tables to study the degree of correlation between different geologic and flow parameters. For example, final open flows show a much higher correlation with structure or with its curvature along the major fracture trend than they do with the slope of the structure normal to the fracture trend.

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Petrology and Depositional Environments of Boyle Dolomite (Middle Devonian) in East-Central Kentucky

The Middle Devonian Boyle Dolomite is a sequence of dolomite, dolomitic limestone, limestone, chert, and shale which has been deposited on a regional unconformity that truncates successively older units toward the axis of the Cincinnati arch. The Boyle varies in thickness (0 to 11 m) and crops out in a 40-km-wide, northeast-trending, arcuate belt on the eastern margin of the Blue Grass region.

The Boyle Dolomite is divided into the following four lithofacies: Kiddville, Winston (Boyle limestone), Casey, and Duffin. The basal Kiddville is a quartzose dolomicstone with abundant fish remains and represents the slow accumulation of a lag deposit in a platform environment. The Winston (Boyle limestone) is a crinoidal grainstone-packstone and indicates a full marine transgression with high-energy winnowing action on the shelf. The Casey is a cherty dolomicstone with a sparse fauna and represents continued transgression of carbonate mud environments. The Duffin is an interbedded dolomicstone and shale with an abundant and diverse trace-fossil assemblage and marks the transition between carbonate and clastic deposition in Middle to Late Devonian time.

An upward decrease in fossil abundance, diversity, and detrital clastics corresponds to an increase in the percentage of dolomite. Iron substitution in the dolomite crystal lattice increases upward and suggests an influence of reducing diagenetic environments. Trace-fossil analysis reveals a shelf to slope assemblage in the Boyle.

The Boyle Dolomite represents the marine transgression in the western margin of the basin during Middle Devonian time. The transition between open-marine carbonate and anoxic black shale is a shelf to slope carbonate mud with a predominant infaunal assemblage.

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Hydrothermal and Uplift Histories of Northern Appalachian Basin

Geochemical and structural analysis techniques were integrated in an investigation of epigenetic mineralization on fault zones to develop an evolutionary model for the post-Paleozoic history of the northern Appalachian basin. Analysis of faults in outcrop, excavations, and oriented drill cores revealed the occurrence of strike-slip and dip-slip faults which are representative of a fabric which is persistent in style, orientation, and magnitude across New York State. The elements of this fabric do not decrease in frequency with distance from the Allegheny structural front nor do they fan around the centers of deformation as do the Allegheny structures. Indeed the west-northwest trends of the normal faults and the acute bisectrix of the conjugate strike-slip faults are parallel with the short axis of the Appalachian basin. Their formation is attributed to the stresses produced during the asymmetric uplift of the basin in post-Paleozoic time.

Mississippi Valley-type epigenetic mineralization was deposited along these fault zones where they served as the dominant channels for circulating fluids within the well-cemented sandstones. Homogenization of fluid inclusions in vein minerals revealed an intermittent range of depositional temperatures from that typical of the peak of diagenesis in deep sediments, 170°C, to as low as 70°C. The higher temperatures may reflect waning of an elevated heat-flow regime produced by dehydration during diagenesis. The temperatures between 112 and 70°C are attributed to cooling during uplift.

Strike-slip faulting was initiated at temperatures near 170°C as indicated by syntectonic deposition of high-temperature calcite. Normal faulting did not occur until the hydrothermal brines had cooled to 112°C. Minor deformation and entrapment of secondary fluid inclusions continued to 70°C. The timing of tectonic events can be estimated by several techniques which generally indicate a late Paleozoic to early Mesozoic age for strike-slip faulting and a late Mesozoic to Cenozoic age for normal faulting.

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Patterns of Species Diversity in Helderberg Group of West Virginia and Virginia

Twenty-five outcrops of the Lower Devonian Helderberg Group in West Virginia and Virginia were analyzed for stratigraphic, petrographic, and paleontologic variations to interpret depositional environments. Fossil counts, by species, were made along 260 line-transects of standard sampling lengths in 14 of the 25 outcrops.

The stratigraphic study suggests that Helderberg sediments were deposited in the Virginias during an overall Early Devonian transgressive phase of deposition, and that formations comprising the Helderberg Group in the study area are rock-stratigraphic rather than time-stratigraphic units.

Thirty-three interspecific fossil associations involving 10 of 34 species of New Scotland invertebrate macrofossils were identified using a chi-square test for independence. Species showing significant associations were grouped into a primary recurrent group and a related secondary recurrent group by the Fager method. There is a direct relation between the number of interspecifically associated strophomenids in a sample and the percentage of fine-grained sediment.

An index of species diversity was calculated for each outcrop using the Fisher, Corbert, and Williams loga-