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Mapping Large-Scale Faults in the Michigan Basin Using Tops Data

A set of Northwest-Southeast trending lineations has been mapped using formation tops data over the entire Michigan Basin. The lineations were mapped using 25,000+ top picks for the Dundee Formation (U. Devonian) compiled in digital form and plotted as a surface relief map on a closely spaced grid using standard PC software. Subsequent mapping using other formation tops data confirmed the Dundee results. The lineations have been interpreted as basement-controlled fractures and faults that formed in the Late Paleozoic, since they occur in all formations up to the Saginaw Formation (L. Penn) where they cannot be recognized. If the lineaments are reactivated basement faults, the orientation will depend on the orientation of the original basement structures as well as the geologic provenance at depth. Several of the lineations are coincident with previously mapped faults, such as the Howell and Lucus-Monrow Anticlines in Livingston County. However the majority of the lineations here appear to be new although they are parallel to previously reported structural and geologic trends in the Michigan Basin. These lineations appear to be major controls on productive structures and may have provided conduits for passage of fluids, including dolomitizing brines and hydrocarbons.
A large number of productive oil fields are located in low-amplitude anticlines that parallel the trend of the lineations. Zones of repalcement dolomite mapped in oil fields are generally adjacent or near these lineations. In some cases the lineations are clearly faults, with vertical displacements approaching 500-800 feet. In other cases, the evidence for displacement is lacking, although it seems likely that the lineations are the locus for fracturing and minor displacements.