

DEFINITION OF A BURIED PRECAMBRIAN BASINAL DEPOSITIONAL SETTING BY GRAVITY AND MAGNETIC ANALYSIS: ILLINOIS BASIN, USA

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The Precambrian (late Proterozoic) rock sequence that regionally underlies the central portion of Illinois, southern Indiana, and western Ohio is interpreted to have been deposited in a series of linked sub-basins that formed immediately proximal to the Grenville orogen. Gravity and magnetic analysis, utilizing relationships of signal intensity to sediment thickness, yields a complex pattern of small localized accumulations of thick sediment interpreted to be depocenters controlled predominantly by preexisting and syndepositional basement faulting and localized subsidence. Distribution patterns were primarily derived from the observed linear relationship between gravity and magnetic intensity and thickness established in a series of existing structural cross sections that depict sediment thickness as constrained by seismic data. The correlation coefficient in the observed relationship approached 0.7. Sequence thicknesses were calculated to exceed 5,000 meters in some localities while rapidly decreasing to near zero over structurally high portions of the underlying basement complex. The sequence of rocks can be divided into two parts, each representing a different depositional setting. The overall regional pattern in both thickness and areal extent is supportive of a complex basin history that may have initiated as a dominantly tensional system of linked grabens and half-grabens, and evolved to become a fragmented foreland basin system where individual sediment accumulations were controlled by transtensional or oblique slip faults possibly associated with the closing phases of the Grenville compressional tectonism. Alternatively, this sequence could have been regionally deposited and then selectively preserved in a series of down-dropped blocks.