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INTERPRETATION OF GRAVITY AND MAGNETIC DATA FROM THE NORTHERN APPALACHIAN BASIN

by

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ABSTRACT

Gravity and magnetic data covering a 12,000 square kilometer area of New York, Vermont and Massachusetts are interpreted for structure and depth to Precambrian basement The geology of this part of the Appalachian orogen includes a deformed continental margin, and a sedimentary basin with multiple levels of thrust wedges involving both Paleozoic sediments and Precambrian basement. Depths are calculated along seven profiles using an inverse method based on the gravity effect of an infinite rectangular prism, and one based on the autocorrelation of the effect of an infinitely-bottomed magnetic dike. Data thought to have common source were jointly inverted for depth. Resolution problems stem from the multiple levels of basement, the lack of rock property information and the quality of the magnetic data. Depths to basement west of the overthrust reveal a faulted dipping surface of low relief. Beneath the overthrust, basement relief increases and abrupt large depth changes occur. These depth changes suggest basement underthrusts which developed in response to plate collision and subduction during the Taconic orogeny.

The analytic signal method is applied to on the gravity data to produce a trend map representing faults in the basin. This map shows persistent northeast trends which imply surface faults are inherited from basement rooted fault zones. A high-pass filter was applied to separate the intrasedimentary gravity anomalies from the basement anomalies.

These residual anomalies outline several of the Taconic thrust slices and the surrounding formations. Both techniques indicate that northwest trends of basement structures probably control zones of fracture-enhanced porosity and the distribution of intrasedimentary structural traps.

Sediment-basement density determinations indicate the basement is 0.26 to 0.30 tonnes/m^3 more dense than the sediments. This density contrast is poorly constrained so that the maximum sedimentary thicknesses of 3.5 and 4.0 km, which occur along the axis of the gravity low, may increase.

Seismic, gravity, magnetic and geologic information is best explained by a deeply eroded Grenvillian collision suture associated with one of the northeast trends on the analytic signal map. Two igneous bodies protrude above

basement along the suture. Solution confidence is gained from the remarkable similarity between magnetic basement and seismic basement along the COCORP seismic line. The joint inversion of gravity and magnetic data complemented the more ambiguous single inversions.

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