



A Gravity and Magnetic Study of the Chiwaukum Basin, Central Washington, United States

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The Chiwaukum Basin (CB), located on the eastern slope of the central Cascades in Washington State, is bounded on the northeast and southwest by the Entiat and Leavenworth faults, respectively. Until recently, the CB was considered to be a graben structure resulting from Eocene extension or transtension. Recent geological mapping and structural analysis suggest a transpressional setting due to episodic crustal shortening and propose the feature be considered a structural low. In order to aid in determining which one of the above structural models is correct (or if another model is more applicable), a gravity and magnetic study was performed that will aid in understanding the complex tectonic evolution of the CB and the surrounding region. The central objective of the analysis is to constrain the thickness of the Chumstick Formation (CFM) and to locate faults to estimate the geometry of the CB. The CFM is a middle-late Eocene, non-marine sedimentary deposit within the CB, the thickness of which remains uncertain. Earlier hypotheses for the thickness of the CFM vary from <2km to >9km which is based mainly on stratigraphic mapping. Gravity and magnetic data collection within the CB, along with density measurements on units within, will better serve to estimate the sediment thickness and subsequent interpretations of basin geometry. The present gravity and magnetic analysis utilizes existing data supplemented with new gravity data to produce a series of residual anomaly maps. A residual gravity anomaly map shows that the basin is associated with a gravity minimum while the magnetic map is more complicated with a large wavelength maximum with superimposed minima. A preliminary 2.5-dimensional gravity model constructed along the southern rim of the basin with a density contrast of -0.17 implies CFM thickness varying from 0.5-1.5 km. The preliminary model also illustrates the geometry of the southern edge of the CB and is indicative of possible faults and structures which would be more consistent with crustal shortening rather than extension. An extended series of two dimensional gravity and magnetic models are currently under construction along four additional profiles throughout the extent of the CB. These models will utilize calculated hand sample densities, water well log data, and previous stratigraphic data for lithologic and structural constraint.