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Title: GEOLOGIC AND GEOCHEMICAL EVIDENCE FOR A MESOZOIC MARGINAL BASIN IN WESTERN MEXICO: IMPLICATIONS FOR REGIONAL ORE GENESIS

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Abstract: Jurassic outcrops of marine sediments and submarine volcanic rocks, along with a spatially coincident tourmaline anomaly, help define a Mesozoic marine marginal basin in Sonora, Chihuahua and Durango, Mexico. Regional mapping indicates that the Cananea Trend, a well known alignment of porphyry copper districts in northern Mexico is actually a major fault separating the North American Craton from this basin. Field data is consistent with a rifted cratonic margin model. Jurassic volcanism and clastic sediments fill the northern portion of the marginal basin and transition to dominantly marine shale, mudstone, turbidites and submarine volcanic rocks (Jurassic where dated) from central Sonora south to Durango. These units commonly form the oldest outcrops with the exception of two ridges of Precambrian cratonic rock, consistent with extended crust, enclosed within the Jurassic basin sediments at Moris, Chihuahua and Opodepe, Sonora. Tourmaline rich outcrops are common from southwestern Arizona to south of Batopilas, Chihuahua, coincident with this geologically defined marginal basin. An abundance of tourmaline in hydrothermal systems also supports the presence of a large shale-rich basin, as the primary reserve of boron in the Earth's crust is shale (an estimated 10 to 30 times greater than overall crustal abundance). Evolving magmas under the right chemical conditions incorporate boron from the shale wall rock and produce tourmaline breccias, veins and replacement during crystallization and evolution of hydrothermal systems. The Jurassic marginal basin appears at least in part correlative with the Guerrero sediment and volcanic terrane of southwestern Mexico. This correlation would redefine the related portion of the Guerrero as mostly an in-place volcano-sedimentary province along a rifted margin rather than an accreted terrane.

A significant number of Mo and Au deposits and occurrences are coincident with this marine shale belt. Porphyry copper deposits along the Cananea Rift Margin contain more tourmaline and Mo (>0.02wt %) than is typically found in the rest of the southwestern North America porphyry province (<0.01wt %) to the east. Porphyry mineral systems within the shale-turbidite-volcanic province are more typically Mo deposits instead of Cu deposits. Tourmaline occurs as a common alteration mineral in these systems. Gold deposits and occurrences along the trend of this belt represent a major portion of

Mexico's total Au resource. The association of tourmaline with many of the Cu, Mo and Au systems in the region and the anomalous concentration of these metals in the Jurassic marine sediment belt suggests a genetic tie. The sediments or oceanic crust under the sediments may be anomalous in these metals or fluid chemistry resulting from the interaction between magma and these sediments may be favorable for the transport and concentration of these metals.