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The Amulsar "Drive-By" Discovery, Armenia; We Had to Be There for a Reason?

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The Amulsar gold deposit in Armenia is a low-grade, high-tonnage deposit with a current total combined resource of just over 5 million ounces. The deposit lies within silicified host rocks along the crest of a conspicuous 2,800-m-high mountain ridge. Gold, hematite, and silica occur within fractures, narrow oxide-filled breccia zones, and a few larger hydrothermal breccia zones. The alteration history at Amulsar is complex, reflecting a complex structural history. Alteration patterns suggest an early high- to medium-sulfidation system and a later, overprinting, silica-hematite-gold system which shows Au-Fe-Cu correlations suggestive of an IOCG signature. The Amulsar deposit was discovered in 2005, simply by observing the effects of an extensive hydrothermal alteration system on volcanic host rocks from the roadside. The phrase "drive-by discovery" was coined to describe the Amulsar discovery. However, such a description conceals the contribution that real exploration science made to that discovery and, while the absolute contribution of its part may remain arguable, the "drive-by" was not entirely fortuitous. The notion that led to targeting Armenia for high-level gold deposits had its origin in tectonic and structural studies and consequent search strategies developed from work in the Argentine, Chilean, and Peruvian Andes and, to an extent, in neighboring Turkey. In the Andes, orogenesis is dominated mostly by orthogonal trenchward motion of the South American continent and by resistance to this motion due to coupling and "collision" at the trench axis with the Nazca slab and sub-slab mantle. The resulting contractional deformation at the continent's leading edge is both episodic and diachronous, both along and across the orogen, as is Andean arc magmatism, which is most focused and voluminous when rates of contraction are episodically low. Tertiary age porphyry- and epithermal-style gold and copper mineralization is also episodic and diachronous along and across the orogen and appears to be best associated in time and in space with basement-driven contraction events just following an event of arc magmatism. Regional mapping and the interpretation of remotely sensed and geophysical data define a major conjugate network of fault/lineament zones that are oriented oblique to and transect the Andean orogen, and have had significant impact on the time and space development of the Andes and on the emplacement of porphyry and epithermal mineralization. Corner flow and indentation tectonics that occur at the leading edges, where these orogen oblique fault zones link, produce anomalous vertical and horizontal stretches that lead to structural and topographic anomalies ("bow-wave" structure). Tension fractures and accommodation fault arrays commonly develop a fan-like pattern around the corner complex. These bow-wave structures may develop at orogenic scales where convergence is broadly orthogonal, such that desktop-based time-space analyses can lead to the definition of certain geologic terranes for certain mineralization styles of various ages. Armenia was highlighted as hosting potential for Tertiary age porphyry- and epithermal-style gold and copper mineralization because of the large, orogenic-scale, bow-wave style structure and by way of time-space analyses conducted initially in Turkey and then extended eastward across Armenia.