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Geospatial Analysis Delineates Lode Gold Prospectivity in Alaska

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Alaska produces more than 50,000 ounces of gold annually from placer deposits across the state. Many of the placer districts lack known lode sources of proportional size, suggesting potential for undiscovered lode gold. Comprehensive data-driven analyses were conducted in a geographic information system (GIS) framework to assess prospectivity for lode gold in Alaska. The analyses used available geospatial lithologic and geochemical data sets, known mineral sites, and geophysical data to build models for recognizing different types of gold systems. The models are applied to physiographic units defined by stream drainage basins that are approximately 100 km^2 in area. The GIS-based analyses successfully delineate areas known to contain gold systems and predict prospectivity in areas of Alaska where no gold deposits are known. Broad-based analyses for undivided lode gold systems have application for land-use decisions. GIS-based analyses can also be tailored to individual types of gold systems and may help exploration campaigns in areas where high sample densities for diverse data types are available.

Analyses were designed to assess the potential for lode gold systems in Alaska in general, as well as to distinguish the distribution of different types of gold systems, including orogenic, reduced-intrusion-related, epithermal, and gold-bearing porphyry. Multiple parameters that discriminate these types of gold mineralization were applied; geochemistry of rocks and stream sediments is the most heavily weighted parameter. Trace elements and pathfinder elements reflect fluid compositions in different systems and are diagnostic for distinguishing favorable geologic environments. Substantial overlap in geologic environments leads to overlap in parameters and difficulty in distinguishing types of gold mineralization. Owing to the limitations of reconnaissance scale geologic mapping and the uneven distribution of geochemical data available for Alaska, the four types of gold mineralization listed above are difficult to distinguish. To mitigate overlap, we combined gold systems that form in similar geologic environments; one ore-system model is reduced intrusion-related and orogenic systems, and a second model is oxidized epithermal and porphyry systems. This approach achieved better discrimination of gold systems and increased the precision of the distribution of types of gold mineralization.

Prospectivity analysis for lode gold potential in Alaska highlights areas where exposure is good as well as areas under surficial cover. Our results confirm high prospectivity for known gold occurrences and nearby areas, indicating potential for expansion of areas that contain gold deposits. Exploration in these areas may improve the balance between the volume of placer gold produced in a mining district and the relatively low volume of identified lode resources that contributed to the placer deposits, if the lode sources are preserved. Our analyses also indicate high gold prospectivity in a few areas in the state that are not known to contain lode gold deposits. These areas warrant further evaluation, new geologic mapping, systematic geochemical sampling, and application of modern technology for various types of sample analysis. Our results can help focus future investigations in areas where data are lacking, bedrock geology is incompletely understood, and prospectivity can be better defined and constrained with additional data.