Prospectivity Mapping of Orogenic Lode Gold Deposits Using Fuzzy Models: A Case Study of Saqqez Area, Northwestern Iran

Authors : Fanous Mohammadi, Majid H. Tangestani, Mohammad H. Tayebi

Abstract : This research aims to evaluate and compare Geographical Information Systems (GIS)-based fuzzy models for producing orogenic gold prospectivity maps in the Saqqez area, NW of Iran. Gold occurrences are hosted in sericite schist and mafic to felsic meta-volcanic rocks in this area and are associated with hydrothermal alterations that extend over ductile to brittle shear zones. The predictor maps, which represent the Pre-(Source/Trigger/Pathway), syn-(deposition/physical/chemical traps) and post-mineralization (preservation/distribution of indicator minerals) subsystems for gold mineralization, were generated using empirical understandings of the specifications of known orogenic gold deposits and gold mineral systems and were then pre-processed and integrated to produce mineral prospectivity maps. Five fuzzy logic operators, including AND, OR, Fuzzy Algebraic Product (FAP), Fuzzy Algebraic Sum (FAS), and GAMMA, were applied to the predictor maps in order to find the most efficient prediction model. Prediction-Area (P-A) plots and field observations were used to assess and evaluate the accuracy of prediction models. Mineral prospectivity maps generated by AND, OR, FAP, and FAS operators were inaccurate and, therefore, unable to pinpoint the exact location of discovered gold occurrences. The GAMMA operator, on the other hand, produced acceptable results and identified potentially economic target sites. The P-A plot revealed that 68 percent of known orogenic gold deposits are found in high and very high potential regions. The GAMMA operator was shown to be useful in predicting and defining cost-effective target sites for orogenic gold deposits, as well as optimizing mineral deposit exploitation.

Keywords : mineral prospectivity mapping, fuzzy logic, GIS, orogenic gold deposit, Saqqez, Iran

Conference Title : ICFLAGS 2022 : International Conference on Fuzzy Logic Applications in Geological Sciences

Conference Location : Zurich, Switzerland

Conference Dates : September 15-16, 2022