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RECENT ARTICLES PUBLISHED IN *EXPLORE*

The following abstract is for an article that appeared in issue 194 (March 2022) of the *EXPLORE* newsletter.

"Lithium Analysis of Brines and Minerals for Exploration and Resource Definition"

Hugh de Souza[1], Alexander Seyfarth[2], Nicholas Turner[1], John Woods[1], and SGS Natural Resources[3]

As the world transitions from fossil fuels to renewable energy sources lithium ion batteries have become the leading technology for battery storage of electricity from renewables. Global demand for lithium has doubled over the last three years and is expected to double again over the next three years because of increasing electric vehicle production. Prices for battery grade lithium carbonate have increased five-fold since mid-2020 triggering a large increase in funding for lithium exploration and development projects. The two major sources of lithium are from brines, almost all from the Lithium Triangle where the borders of Argentina, Bolivia and Chile meet, and lithium pegmatite mines, most of which are in Western Australia.

Lithium is an easily ionizable metal that can be analysed by a range of spectroscopic methods available in commercial geochemical laboratories. Current X-ray instruments cannot detect lithium as it only emits a very weak X-ray. Most lithium bearing minerals are easily dissolved by four-acid digests. However, spodumene which is the most important ore mineral in lithium pegmatites is refractory and resistant to acid digestion. The more aggressive sodium peroxide fusion is necessary to ensure complete spodumene decomposition. The lithium ion is highly mobile and as lithium minerals are altered will readily diffuse out from its pegmatitic host to form geochemical anomalies in surficial sediments.

The developing portable technologies for analysing lithium in the field include Laser Induced Breakdown Spectroscopy and Fourier Transform Infrared Spectroscopy. The latter instrument identifies key lithium minerals such as spodumene and petalite and can provide a chemometric measurement of lithium content.

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The following abstract is for an article that appeared in issue 195 (June 2022) of the *EXPLORE* newsletter.

"Whole-rock geochemistry for intrusion-hosted magmatic Ni-Cu-Co exploration: identifying prospective host rocks"

Steve Barnes[1]

Magmatic sulfide ore deposits are a major source of the world's Ni, Cu, Co, and platinum group elements (PGEs), and are the target of a major global exploration effort owing to projected demand for the electric vehicle market. These deposits are formed by the mechanical accumulation of immiscible sulfide liquid from basaltic magmas. These are challenging targets for explorers owing to the lack of "distal footprints" such as alteration haloes. This contribution addresses the question of how to extract the maximum value from the large quantities of lithogeochemical data routinely collected by explorers and geological surveys. Such data sets can be used in several ways to identify prospective host rocks and to expand the detectable footprint of deposits. The method presented here concerns the identification of cumulate rocks, i.e., rocks formed by separation accumulation of silicate crystals from magmas. Presence of cumulates indicates depositional environments, potentially suitable for accumulation of sulfide liquid. They can be detected geochemically using various combinations of major elements, particularly Mg, Fe, Al, Ti and Si. We explain the diversity of cumulate rocks, show how a variety of different mineral assemblages can be generated from small variations in the composition of the parent magma, and illustrate a number of useful geochemical discriminant plots using natural data sets from Australia and Tanzania.

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The following abstract is for an article that appeared in issue 197 (December 2022) of the *EXPLORE* newsletter.

"New Era of Geochemical Survey in the Kingdom of Saudi Arabia"

Mazen B. Balkheyour[1], Ibrahim Osman Abdella[2], and Christopher C. Johnson[3]

Saudi Arabia is moving to accelerate the exploration for and exploitation of its mineral reserves in accordance with Vision 2030. The Regional Geological Program (RGP), which includes a geochemical survey, airborne geophysical survey and geological mapping, seeks to achieve this vision by establishing a unique geoscientific database that will attract companies operating in the mining sector.

The High-Resolution Geochemical Survey of the Arabian Shield (GSAS Project), which covers the entire Arabian Shield (c.600,000 km²), involves the collection of stream sediments at an average density of one sample per 6.25 km². Multi-element analysis for 76 elements using various methods will be conducted on the -10 to +60 mesh (<2 mm to >0.25 mm) fraction of the sediments.

The main objective of the survey is the acquisition, analysis and storage of quality geochemical data with the intention of stimulating a dynamic exploration sector through the open publication of pre-competitive geoscience data, thereby forming an important accelerator to understanding the Kingdom's mineral potential for the mining sector. The up-to-date geoscience data acquired under the scope of the GSAS project will be used to produce various styles of geochemical maps at a variety of scales in order to identify targets for mineral exploration.

The GSAS Project is implemented by the China Geological Survey (CGS) and is directed by the Saudi Geological survey (SGS) aided by Technical Partners - experienced geochemists from IGS (International Geoscience Services) Ltd. and the Geological Survey of Finland (GTK).

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The full articles of the above can be viewed at www.appliedgeochemists.org/index.php/publications/explore-newsletter.