Association of Applied Geochemists

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NEWS FROM AAG REGIONAL COUNCILLORS

Africa

The total output in applied geochemistry for the Africa region, in terms of research, publications and industrial utilisation, continues to be limited and far out of proportion to the huge benefits that would potentially accrue if applied geochemistry were used in mineral exploration programmes, the investigation of environmental chemical phenomena, agriculture, health and land-use planning. The dearth of activities in this important branch of geoscience is manifested in many ways, a situation that has not changed significantly during the last few years, despite the growth of commercial laboratories such as Actlabs and SGS, which offer diverse, high-quality analytical facilities across the continent.

For instance, South Africa, considered the world's top mining country (Wealth Wire 2011; www.wealthwire.com/news/global/2372), lags far behind Russia, Chile, the United States, Canada, Australia and the United Kingdom in total output from applied geochemistry programmes (Fig. 1). These statistics are surprising, given that it was in Africa (Zambia and Sierra Leone), Eire and the UK that Webb first observed several important correlations between geochemical patterns, mineralisation, soil type and the incidence of agricultural disorders (Webb 1966, cited in Howarth 2010; http://geea.lyellcollection.org/content/10/3/213.abstract).

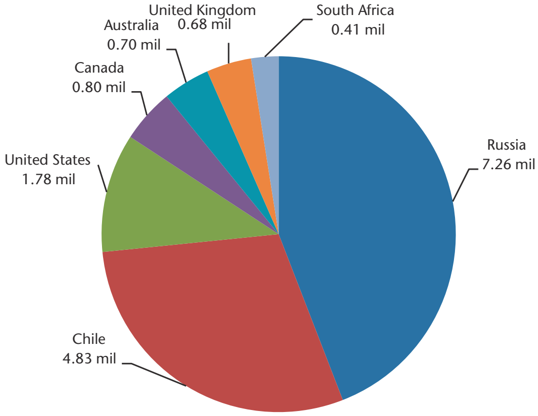

Figure 1 Number of entries (mil = million) recorded for 3 keywords "XX", "applied" and "geochemistry" for seven of the world's top mining countries (XX) using the Google search engine (18 March 2013)

Encouraging developments during the last two to three years include an invitation by the Government of Sierra Leone to consultants to undertake geochemical sampling of the country for mineral exploration purposes under the Mining Technical Assistance Project (MTAP), funded by the World Bank. The Nigerian geochemical mapping programme under the MTAP, started in 2008, covered stream sediment sampling in two pilot areas ('cells') in the west-central part of the country (Johnson 2012; http://nora.nerc.ac.uk/18820). It is reported that the South African regional geochemical mapping programme by the Council for Geoscience of South Africa, which has been ongoing for about 30 years and has seen major improvements over time (Smith et al. 2012; www.globalgeochemicalbaselines.eu), continues during the 2012–2013 financial year.

Since 2011, UNESCO and the Swedish International Development Agency have been promoting a flagship International Geosciences Programme (IGCP) of investigation into the health impacts on agro-ecosystems due to the release of potentially harmful elements from abandoned mines in Sub-Saharan Africa. This is done under a collaborative mandate involving two IGCP sister projects, IGCP-594 and IGCP-606.

Figure 2 Acid mine drainage, Witwatersrand goldfields, South Africa. Photo: www.clevergreen.co.za/2011/02/25/government-response-on-acid-mine-drainage/ (20 March, 2013)

A number of other research groups within Africa and elsewhere are engaged in tackling the problem of acid mine drainage (Fig. 2), which is also a subject of intense debate in political circles, especially in South Africa.

Addressing the issue of the shortfall in intensity of applied geochemistry campaigns in Africa would require a concerted effort by governments and pertinent geoscientific institutions to train an adequate number of highly skilled applied geochemists, and concomitant massive investment in analytical geochemical infrastructure. In the short term, however, more use should be made of the high-quality geochemical facilities offered by commercial laboratories now readily available in most parts of the continent.

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RECENT ARTICLE PUBLISHED IN *EXPLORE*

Matthew I. Leybourne and Sarah Rice (2013) Determination of Gold in Soils and Sediments by Fire Assay or Aqua Regia Digestion: Choosing the Optimal Method. *EXPLORE* 158 (March 2013)

Although there are a number of analytical techniques used to measure the Au content of soils, sediments and rocks, there is confusion regarding the optimal method. Advances in analytical techniques, instrumental sensitivities and demands of the exploration and industrial processing industries have meant that Au detection limits are continuously being lowered, and are particularly important for geochemical exploration in deeply covered terrain. In this study, we analyzed more than 2000 soil samples by Pb fire assay (Pb-FA) and aqua regia (AR) digestion to provide insights into how to determine the optimal method to use based on the type of exploration or analytical program. Pb-FA is a fusion technique that results in full sample decomposition, followed by a separation step to preconcentrate the Au. In AR digestion, the sample is leached by concentrated HCl and HNO_3 acids. For the ~2000 samples, Au values by Pb-FA ranged from the detection limit of 0.001 ppm to 0.18 ppm, whereas AR Au values ranged from 0.0001 to 0.145 ppm. The two datasets are statistically significantly different at the 99% confidence interval, although they are approximately log-normally distributed with similar log-probability distributions. The two methods are strongly correlated ($r^2 = 0.768$), with AuAR = 0.63AuPbFA + 0.00024 ppm. However, the strong correlation indicates that despite some scatter in the data, both datasets would show similar geochemical anomalies. For soil, till and stream sediment geochemical surveys, AR is an excellent method of choice, owing to relative ease of analysis and ability to achieve lower detection limits; the low detection limits offset the fact that typically <100% of the Au is recovered. As shown by our case study, for many deposit types (and depending on Au transport mechanism), the AR digest will not be total for Au. This is not always critical, as many geochemical surveys target the labile Au. By contrast, for drill core and rock samples, Pb-FA is the preferred method.

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