CHINESE CHIM – THE AUSTRALIAN EXPEDITION

Adrian Fabris[1], Xianrong Lou[2], Nanshi Zeng[2], Baohong Hou[1], Roger Fidler[3], John Keeling[1] & Keith Scott[4]

[1]CRC LEME, PIRSA, PO Box 1671, Adelaide, SA, 5001
[2]Guilin Institute of Technology, Giulin, P.R. China, 5410004
[3]PIRSA, PO Box 1671, Adelaide, SA, 5001
[4]CRC LEME, Department of Earth and Marine Sciences, Australian National University, Canberra, ACT, 0200

INTRODUCTION

Electrogeochemical "CHIM" techniques developed by Chinese researchers are undergoing trials in South Australia to assist in the search for buried mineral deposits. These surveys are the first time that the Chinese CHIM technique has been tested under arid conditions in the Australian outback.

The Chinese method is a variation of the original CHIM (CHastichnoe Izvlechennye Metallov) technique developed by Russian scientists in the early 1970s (Ryss *et al.* 1977). In the 1980s this method spread to China and India where it was widely applied. In the early 1990s, with an increased knowledge of weathering halos around ore bodies and the increased necessity to detect deeply buried ore deposit, interest spread to western countries such as the USA and Canada.

BACKGROUND

Early theory suggested that the extracted ions migrated under the influence of an electric current from a buried orebody through up to hundreds of metres of cover (Levitski *et al.* 1996). To achieve this, very strong currents were applied for up to hundreds of hours. Russian researches eventually conceded that this was not likely due to the electrical and physical properties of the regolith profile and determined that the technique was aimed at the geochemical halo that exists much closer to the surface. The original Russian CHIM was not only time consuming and required cumbersome and expensive equipment, but preference was given to the collection of positively charged elements while negatively charged complexes were not reported. Research has since described element movement by complexes as being vital in the formation of anomalies in the surficial soil. A method called the 'Dipole CHIM' was developed which was able to collect both anionic and cationic species (Levitski *et al.* 1996). The United States Geological Survey developed a similar but slightly more advanced version they termed the 'NEOCHIM' (Leinz *et al.* 1998). Both CHIM methods consisted of a charge being applied to both a positive electrode (anode) and negative electrode (cathode), which are within a vessel filled with electrolytic solution (typically HNO_3). Ions migrate from the soil by action of the applied current into the collection electrolyte through a thin semi-permeable membrane (Leinz *et al.* 1998). The electrolyte is then analysed. Numerous case studies have been reported throughout Russia, USA, Canada and China (Leinz *et al.* 1998, Leinz *et al.* 1998b, Antropova *et al.* 1992, Levitski *et al.* 1996, Alekseev *et al*. 1996, Fei 1984, Xu 1989).

CHINESE-DEVELOPED CHIM

In the last 20 years CHIM technology has been developed in China (Fei 1984, Xu 1989). Ongoing research and modification by Professor Luo Xianrong of Guilin University of Technology has resulted in a simplified, highly mobile system that can be rapidly deployed in a variety of terrains. This method uses an electric current to draw mobile ions from the surrounding soil and sub-surface to be captured on specially coated carbon electrodes placed in the soil. The electrodes are exhumed and the coating removed and analysed to determine the concentration of metal ions. The method relies on the leakage of ions from an ore body to the surface where the applied current has potential to collect the ions from a much larger volume than would be feasible with traditional soil sampling methods. The technique is effectively an *in situ* partial extraction.

Studies have been conducted over ore bodies of varying depths and ore deposit styles. These include high to low temperature hydrothermal, sedimentary, metamorphic-related, volcanogenic and skarn-style ore deposits for ores associated with Cu, Pb, Zn, Au, Ag, Sn, As and Sb, and at depths of cover of well over 100 m. This is of particular interest to explorers in South Australia where much of the highly prospective crystalline basement rocks are deeply weathered and covered by windblown sand and sediment.

SOUTH AUSTRALIAN TRIALS

Field surveys were recently conducted at Dominion Mining Ltd's Challenger Au Mine in the far north of South Australia, at Havilah Resources NL's Cu-Au-Mo prospect at Kalkaroo, northwest of Cockburn on the SA-NSW border and at Southern Cross Resources Inc's Gould's Dam U prospect, south of Lake Frome in

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the east of South Australia. Survey lines were designed to test the techniques ability to delineate different styles of mineralisation over a range of cover types and thicknesses. These include: thin transported cover but with mineralisation at 100-400 m in bedrock at the Challenger Au Mine; 50 m of transported cover including a 40 m thick unit of Tertiary lacustrine clay, with mineralisation at approximately 110 m depth at the Kalkaroo Cu-Au-Mo prospect; and, mineralisation sitting at the base of 110 m of transported Tertiary sediments at the Gould's Dam U prospect. Trials were part of a collaborative research project in South Australia, supported by Primary Industries and Resources, South Australia (PIRSA) and is integrated with current activities of the Co-operative Research Centre for Landscape Environments and Mineral Exploration (CRC LEME) in which PIRSA is a core participant.

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