

## Abstract

*The application of geochemical prospecting methods for mineral exploration in the Goldfields effectively commenced in the early 1960s. A broad range of sampling media, including stream and lake sediment, soil, lag, laterite, fresh and weathered bedrock, vegetation, groundwater and soil gas were tested in orientation surveys and/or applied in exploration projects before the end of the 1970s. Most of these are still in routine use.*

*The major advances over the last 40 years have been in analytical and computer technology. In the 1960s, the commonly used colorimetric analytical methods placed severe limitations on both productivity and detection limits. In gold exploration, this led to reliance on pathfinder elements, particularly the arsenic-gold association. Atomic absorption spectrophotometry, developed by CSIRO during the 1960s, was of great significance in geochemical exploration. It proved particularly applicable in the nickel exploration boom that followed the discovery of Kambalda in 1966 and in the search for VHMS base metal deposits, which peaked in the 1970s. The development of methods capable of analysing gold to 1 ppb (background) levels, firstly by AAS and more recently ICP\_MS, has revolutionised Goldfields exploration since the mid-1980s and marked the emergence of geochemistry as the primary exploration method for gold. Geochemists are still learning how to extract knowledge from the high quality, multi-element data now available from ICP\_MS in media such as rock, soil, lag and groundwater. Computer technology is an indispensable aid to the interpretation and communication of the voluminous geochemical data now being generated. Interpretation methods have progressed from the basic concepts of background, threshold and anomaly to pattern recognition, and multi-variate statistical techniques to incorporate multi-element data into signatures indicative of target ore associations. The diversity of geochemical sampling and analytical methods applied over the past 40 years has resulted in large and complex databases. The application of robust statistical methods and computer visualisation techniques are crucial to the extraction of useful knowledge from such historic data, as well as new multi-media surveys. The availability of GPS instrumentation, improved understanding of regolith complexity and selective sampling of pedogenic carbonate for gold, have also enhanced geochemical exploration methods in recent years.*

*Special techniques such as BLEG and MagLag have had lesser impact, and partial digest methods have yet to achieve general acceptance.*

*Developments over the next decade are likely to see the emergence of hydrogeochemistry as an important technique in concealed and leached terrains. The documentation and interpretation of 3-dimensional multi-element primary dispersion patterns is also likely to be used increasingly to target blind mineralisation, particularly in established mining camps. The powerful combination of GPS-controlled low density multi-media geochemical sampling with sensitive multi-element analysis has been convincingly demonstrated and will become a mainstream tool in regional exploration and geological mapping.*

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an unincorporated  
joint venture between  
eight Core Parties:**

Australian National University,  
Curtin University of Technology,  
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CSIRO Exploration & Mining  
and Land & Water,  
Geoscience Australia,  
Minerals Council of Australia,  
NSW Department of Primary Industries, and  
Primary Industry and Resources South Australia,

**established and supported under  
the Australian Government's Cooperative Research Centres Program**



## "50 YEARS OF GEOCHEMICAL EXPLORATION IN THE GOLDFIELDS"

*A commemorative address by*

**DR RICHARD MAZZUCHELLI**

*inaugural winner of  
the CSIRO/CRC LEME  
Butt Smith Medal*

***"for outstanding and sustained  
contribution linking regolith science  
to exploration in Australia"***

**6.00 pm Thursday 28 April 2005**

**SMEDG meeting  
Rugby Club, Rugby Place**

**near Goldfields House  
Circular Quay, Sydney**



### ***Dr Richard Mazzucchelli***

*has been at the leading edge of geochemical exploration in Australia since beginning his doctorate in 1962. His frontier research into geochemical methods and application of regolith geochemistry has directly contributed to successful exploration programs for nickel, gold and copper.*

*Richard introduced geochemical methods into the exploration programs of Western Mining Corporation (now WMC Resources) including sampling and analysis for gold, nickel, copper-lead-zinc and uranium.*

*His work in developing geochemical exploration techniques has been important to the success and growth of exploration companies both through discoveries and cost effective testing and rejecting of unmineralised areas.*

*Richard describes himself as a bullet maker, not a bullet firer. "People have applied the exploration methods I have developed, and come up with something"*

*Great grandfather Mazzucchelli emigrated from Switzerland and joined the Victorian gold-rush. The whole family moved to the WA Goldfields in the 1890s after the Coolgardie discovery. His grandfather started the jewellery business in Kalgoorlie which moved to Perth in the 1920s. Richard was born in Nedlands, but moved back to Kalgoorlie on graduation from UWA.*

*"My father, four children and two grandchildren were all born in Kalgoorlie-Boulder and now, with five of my six descendants living there, you could say we have reverted to our Goldfields roots!"*

*Richard's career with WMC spanned almost 25 years and included appointments as Chief Geochemist and Regional Exploration Manager. In 1987, he established the geochemical consultancy, Searchtech Pty Ltd. He has extensive experience in all facets of geochemical exploration for a wide range of commodities in Australia, North and South America, Africa, Asia and the Pacific.*

*Richard has made a substantial contribution as a lecturer and in scientific literature, covering regolith materials. Publications he has written or co-authored document the use of laterite as a sampling medium and the arsenic-gold association in rocks, soils, streams and lake sediments.*

*In 1999, the West Australian Division of the Geological Society of Australia awarded Richard the Gibb Maitland Medal for his contribution to geoscience in Western Australia.*



### **The Medal**

By way of the **Butt Smith Medal**, CSIRO Exploration and Mining and the Cooperative Research Centre for Landscape Environments and Mineral Exploration (CRC LEME) are proud to honour two great Australians.

**Dr Charles Butt and Dr Ray Smith** have played a significant role in the development of the Australian mineral industry in the past three decades. Charles and Ray have won international respect as outstanding scientists tackling the enormous topic of the Australian regolith and providing exploration solutions. Thanks to them we now understand simple but vital messages based on complex concepts - metals can be dispersed in the regolith, some materials are more important than others to sample and different landform settings require different exploration strategies.