FOCUS EXPLORATION—USE ALL YOUR GEOCHEMICAL DATA!
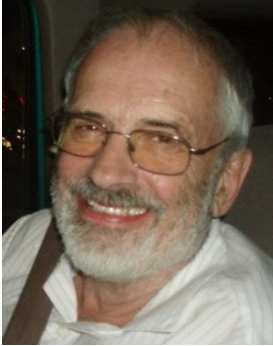
RvDfS—*R*ELATIVE *V*ALUE & *D*ISCRIMINATION *F*ACTOR *S*YSTEMATICS

A PRACTICAL & NEW METHOD FOR DEFINING MULTI-ELEMENT ANOMALIES IN GEOCHEMICAL DATA USING PROBABILITY DERIVED RELATIVE VALUES (R), AND GEOLOGICAL DISCRIMINATION FACTORS (D)
Presented by

Colin I. Godwin, PhD, PEng, PGeo,

October 22, 2013

RvDfS—*R*elative *V*alue & *D*iscrimination *F*actor *S*ystematics—enhances discovery opportunities in geochemical analysis. The technique uses: (i) all available geochemical analyses, (ii) statistical identification of anomalous populations, (iii) simple renumbering of anomalous and background populations to obtain relative values [**R**-values] that are additive, (iv) the addition of **R**-values to form geologically meaningful discrimination factors [**D**-factors], (v) direct application of **D**-factors to the interpretation of extensive, multi-element data sets, and (vi) geologically related multi-element **D**-factors, built from **R**-values, to identify underlying rock types and mineral deposit types.

Relative factors (**R**) are determined visually from log-probability plots and stem-leaf plots. **R**-values are assigned as follows: **1** = Low Background Population equal to or below the third quartile, **3** = High Background Population that is above the third quartile and up to the Mixed Population, **5** = Mixed Population of mixed High Background and Clearly Anomalous Populations, **7** = Clearly Anomalous Population immediately above the Mixed Population, **9** = Highly Anomalous Population, and **11** = Outliers of Highly Anomalous Population with exceptional concentrations. Because geochemical elements are changed to numbers with genetic and population significance, those that occur in disparate amounts can be combined without the overshadowing of one element by another. For example, lead with an anomalous concentration of 100 ppm (say, **R** = 9) can be combined with zinc with an anomalous concentration of 2,500 ppm (say, **R** = 7) giving an **R**-value average of 8. Given chemically related elements, the average **R**-value is likely to be more robust than the **R** for a single element. For example, K and Rb correlate closely and the combination of the two using averaged **R**-values is stronger than either element by itself.

Discrimination factors (**D**-factors) are the sum of the **R**-factors divided by the number of **R**-factors summed. Examples are **D**-factors for mafic rocks (**DMafic**) and precious metal deposits (**DPrec**), where: **DMafic** = (**R**Mg + **R**Sc + **R**Ti+ **R**V+ **R**Cr + **R**Fe + **R**Co + **R**Ni)/8, and **DPrec** = (**R**Ba + **R**Cu + **R**Ag + **R**Au + **R**Hg + **R**Tl + **R**P + **R**As + **R**Sb + **R**Bi + **R**S + **R**Se + **R**Te)/13. In both these cases, the associated **R**-values are for elements that provide a geological-association-description of mafic rocks or precious metal deposits. Generally, a **D**-factor of 4 or above represents values that are almost certainly statistically anomalous.

This new methodology, a "geologists' factor analysis", allows geological interpretation of data in a way that has genetic significance. And more specifically, where anomalous values exist for two or more elements, **D**-values from addition of **R**-values enhance the anomaly—and therein lies their great practical advantage.

This approach, which defines factors using probability statistics, and geological knowledge and experience, complements traditional approaches. **RvDfS** will aid in discovery of mineral deposits from regional geochemical data sets, and detailed geochemical soil grids. It also provides zoning vectors in geochemical data from drill holes.

Colin I. Godwin, (PhD, PEng, PGeo) is Professor Emeritus of UBC, where he taught economic geology for about 22 years with a specialty in galena lead isotopes and its application to ore-search. During his time at the university he published more than 100 professional papers and was awarded the Duncan Derry Medal, the highest award to mineral deposit geologists bestowed by the Geological Association of Canada.
*Exploration with mining companies has involved him mainly in the Yukon, Mexico, Argentina and Chile. Until recently he was President of Rome Resources Ltd. Currently he practises as **Godwin Consultants Ltd.** 2706 - 660 Nootka Way, Port Moody, BC, (T 604-939-6507, cigodwin@yahoo.com) and consults to IMPACT Silver Corp.*
Passions include: (i) capture of field geochemical, field geological, and drill-hole geological and alteration data in computer compatible ways that follow his early work as a founder of International Geosystems Ltd., which developed the GEOLOG System, and (ii) interpretation of geochemical data using a statistical-probability scheme that is geologically driven and which he calls the Relative value - Discrimination factor - System, or RvDfS.