

New Soil-Gas Chemistry Technique Effective Under Transport Cover



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Soil Desorption Pyrolysis “SDP” is an emerging penetrative geochemical technique which is achieving successes in challenging environments such as young alluvium, deeply weathered regolith, till, glaciolacustrine clays and black soil floodplains.

SDP is applicable to multiple commodities, including gold, base metals, diamonds and petroleum. As far as gold is concerned, the method has been tested on FeOx copper-gold targets, Carlin-Style and Porphyry systems, with limited work on Archaean shear-zone gold.

SDP differs from other methods in a number of key aspects. First, a shallow soil sample is taken, distributed over about a square meter. After sieving in the field, a minus two micron clay fraction is separated in the lab. This clay size material is exploited as a natural adsorptive substrate in the soil. Using the clays allows the gas flux to be averaged over time and space, resulting in much lower variability than that achieved with “sniffer probe” techniques. Also, the clay separation greatly reduces the noise in the measurement, which largely derives from coarser fragments of organic material.

The second step in SDP analysis is to heat the clay separate to 450 °C, which drives off all the adsorbed gas. A single mass spectrum is rapidly determined for each sample, from which more than forty compounds are measured. The compounds used in SDP are a mixture of inorganics, hydrocarbons, sulphur gases and halogenated hydrocarbons. No metals are measured, only volatile compounds.

The final step is calibration. An orientation survey is used to find a “fingerprint” template which discriminates between ore and background. The template is essentially composed of many stacked compound ratios, and is derived using a proprietary, empirical, process. Once a satisfactory calibration has been developed, it can be applied to exploration samples.

Orientation and Calibration

Because SDP is an indirect measurement, a calibration is needed to interpret the survey results. The ideal case is to run a small orientation survey before exploring in a particular district, using a known mineralization example of the same style as the exploration target. Where this is not practicable, it may be possible to use a “generic” calibration, aimed at a

particular deposit style. For example, a single calibration can be defined which will distinguish most of the Australian massive sulphide deposits so far examined; likewise, a single calibration responds to two Chilean porphyry copper systems, a manto-style copper deposit, and the Osborne iron oxide Cu-Au deposit in North Queensland (fig 2). In this case, the deposits and their settings are sufficiently diverse that it is likely that the gas response relates to a simple common process such as bacterial oxidation of sulphides.

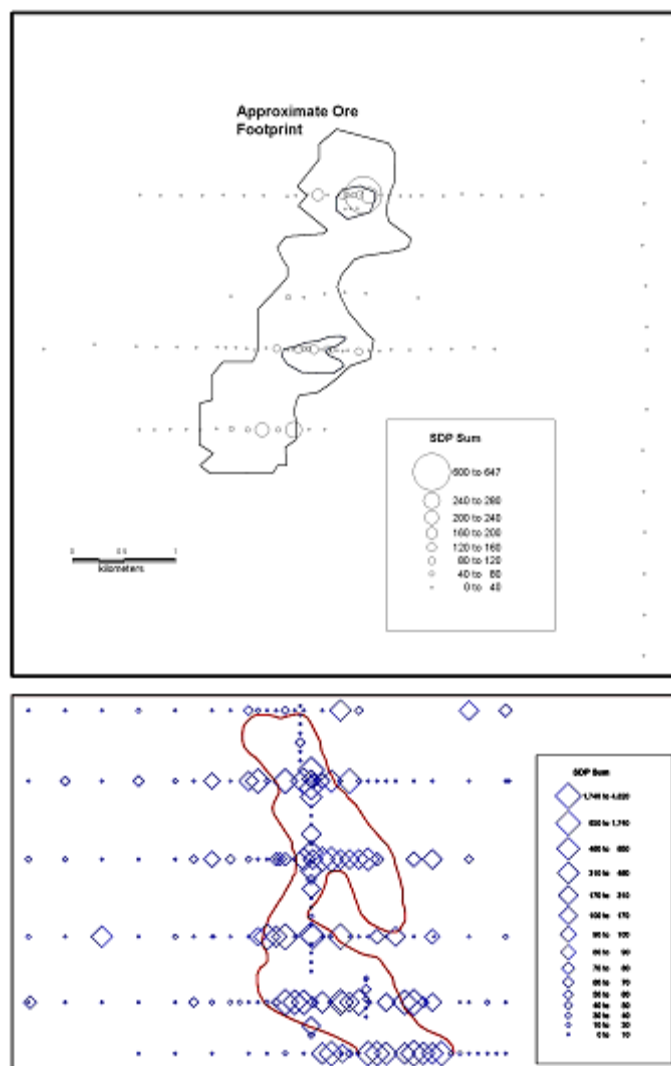


Figure 2: SDP response of a Chilean porphyry copper (top) and the Osborne iron oxide copper-gold deposit in NW Queensland. The same calibration is used in both surveys. Cover thickness is 100m of gravels in Chile, and at Osborne cover is 250m of Proterozoic volcanics plus 60m of Tertiary sediment. The surface projected ore footprint is shown in both cases. Clearly, the Osborne deposit would have been identified in an exploration survey using the Chilean calibration.

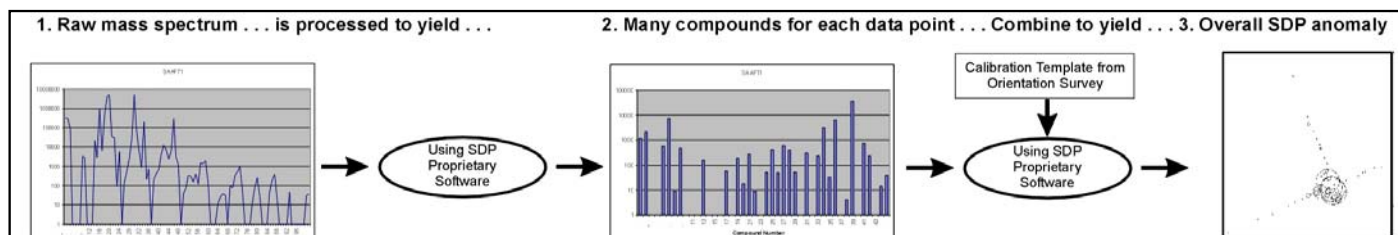


Figure 1: SDP Process overview

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Carlin Style Gold

The pediments in the Basin and Range province of Nevada are a challenging geochemical environment. Debris shedding off the range fronts is often weakly mineralised, potentially obscuring signals from deeply buried mineralisation beneath the alluvium. Gas geochemistry is well suited to the area: the gravels are highly permeable, and the relatively rapid kinetics of gas transport and adsorption mean that even the young alluvium has had time to acquire a distinct soilgas signature above the deposit. The multivariate fingerprinting approach used by SDP is able to distinguish mineralisation from noise.

An orientation survey was made on a blind deposit in the middle of a pediment (unpublished data – details are confidential). The deposit is situated on a horst block of uplifted basement, resulting in a coverage of about 100m of alluvium over the deposit and much greater thicknesses in the background areas. A line of control samples was

collected across the range front fault to assess the effect of barren structure.

A collection of gas ratios has been defined which effectively discriminates between subcropping mineralisation and barren pediment. An extensive soil geochemical dataset in the same area was ineffective, with all the different strength leaches essentially responding to the provenance of the alluvium.

Application of SDP to other commodities

Recently, SDP has been applied to diamonds exploration with significant success. Work on distinguishing buried kimberlites from other barren geophysical targets was recently presented at the 23rd IGES in Dublin. Using a combination of SDP and partial leaches, BHPB has achieved 85% success rate in identifying kimberlite targets in blind tests, in terrain ranging from till in Canada to Kalahari sands in Botswana.

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