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Minerals geophysics

Terry Harvey
Associate Editor for Minerals geophysics
terry.v.harvey@glencore.com.au

When is enough, enough?

When investigating blind targets (e.g. under younger cover) or larger areas of interest (e.g. a magnetic complex) one of the harder decisions in mineral exploration geophysics is deciding when to stop collecting data and start drilling. We're all familiar with exploration case histories where perseverance finally triumphed. Equally, there are lots of examples where the exploration effort far exceeded what the target warranted. Do you drill sooner to save money and risk missing the real target, or do you continue to add detail where an early drill-hole could have told you not to bother?

Site your drill-holes on insufficient data and you run the risk of testing the wrong part of the target, or missing it altogether. Discouragement from poorly sited drill-holes could result in exploration being prematurely abandoned – a potential discovery jeopardised.

Collect too much data and you've wasted time and resources that could have been better directed to investigating other targets. Results from drilling earlier in the program may have shown the geological environment to be unpromising or the mineralisation to be uneconomic. All exploration effort after that could have been better expended on other more worthy targets.

Here are a couple of Australian examples where extra exploration resulted in a better understanding of the targeted mineralisation.

Systematic IP-resistivity on 500 m spaced lines passed either side of a small zone of mineralisation that previous drilling had shown to be of inadequate size and grade. The IP patterns on the two lines were quite similar, inviting extrapolation across the 500 m gap. However, linear extrapolation gave an IP anomaly trend which by-passed the known mineralisation (see Figure 1). Were these IP anomalies highlighting a new untested zone of mineralisation, or was the trend arcuate, passing through the area of previous drilling? Additional information was needed. A gradient array IP-resistivity survey was commissioned to map the area between the two lines. This showed that the original IP anomalies were not part of the same linear trend, but were from two separate sources, possibly arranged in an *en echelon* pattern (see Figure 2). Previous drilling had already tested one of the features. The second feature could be considered as yet untested, but was probably similar. Subsequent drill-testing confirmed this, obviating the need for additional drilling.

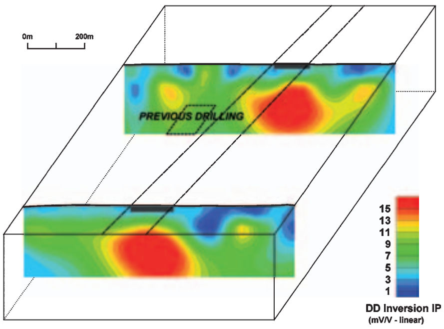

Figure 1. *Linear extrapolation between 500 m spaced IP data giving an IP anomaly trend which by-passes known mineralisation.*

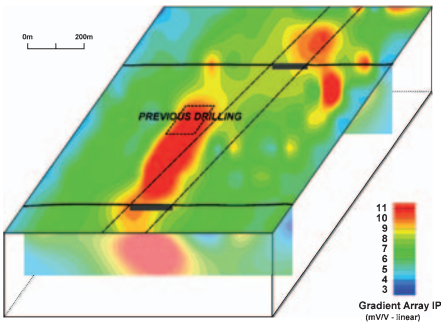

Figure 2. *A gradient array IP-resistivity survey mapping the area between the two lines shown in Figure 1 and demonstrating that the original IP anomalies were not part of the same linear trend, but were from two separate sources.*

In the second example results from a semi-regional scale aeromagnetic survey over an area of surficial cover showed that drill-hole DH1 appeared to have tested the source of a discrete magnetic anomaly (see Figure 3). DH1 drill-hole results, however, were disappointing and the magnetite concentrations intersected were inadequate to account for the magnetic anomaly. Had mineralisation been missed? A later much more detailed aeromagnetic survey revealed that the original discrete magnetic anomaly actually comprised two separate features, with drill-hole DH1 passing between the two sources (see Figure 4). Subsequent drill-testing (DH2) encountered significant magnetite, adequately explaining the source material for these magnetic features, adding to the understanding of the geology in the target area.

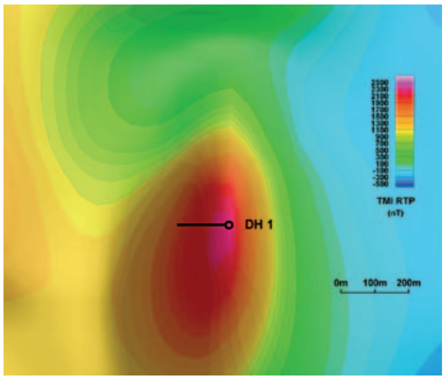

Figure 3. *A semi-regional scale aeromagnetic survey over an area of surficial cover showing that drill-hole DH1 appears to have tested the source of a discrete magnetic anomaly.*

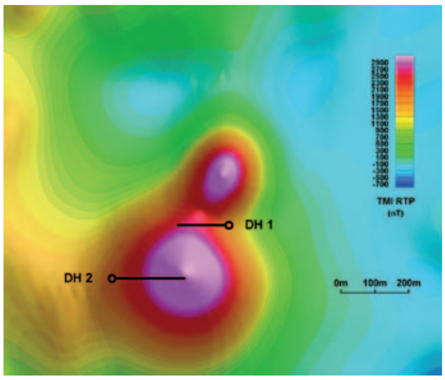

Figure 4. *A more detailed aeromagnetic survey of the area shown in Figure 3 revealing that the original discrete magnetic anomaly actually comprised two separate features, with drill-hole DH1 passing between the two sources.*

Collecting too much data thus wasting time and resources is typically realised only in hindsight. An early see-what's-down-there hole drilled purely to find out whether the geological environment and/or mineralisation style is worth persevering with may have merit. In this case, management would have to know that the drill-hole wasn't the definitive test of the target, merely one step in the exploration process.

How you decide when enough is enough is hard to quantify and I really don't know the answer. I suspect it won't be formulaic, and will be on a case by case basis, reacting to new information as it comes in. This re-affirms the need for interpretation, experience, and imagination – all qualities that go to make a good explorationist. What do you think?

Editor's note: If Terry's column has caught your attention, you might also be interested in the talk being given by Andy Green on Wednesday in the Exploration Strategy session at the AEGC Conference. The presentation is entitled 'Budget allocation and the stopping problem in mineral exploration' and the abstract appears in the Conference Handbook section of this issue of *Preview*.

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www.vortexgeophysics.com.au