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Exploration 07, the fifth decennial conference on mineral exploration technology was held in Toronto, Canada, on 9–12 September 2007. For 40 years, these meetings have provided a once-a-decade review of the major developments in the fields of geophysics, geochemistry, remote sensing and data management and processing as they relate to minerals exploration. At Exploration 07, the core program consisted of 54 invited papers, 66 poster and 19 3D theater presentations. In addition there were seven workshops on topics related to the overall conference themes prior to and after the conference. There were over 1200 registered delegates from 60 countries. A short summary of the geophysical component of the program is provided below.

Acquisition systems. In the past decade, a number of new geophysical acquisition systems have been either developed or been refined from earlier technology.

Airborne geophysics. Airborne gravity and gravity gradiometry—the world’s first operational gravity gradiometer was being developed during the last conference and began commercial surveys in 1999. While the first system was a proprietary development, since then several other groups have begun providing contract gravity gradiometer services, and a number of groups have announced their plans to develop second generation systems with improved operational specifications. Some of the other major developments in airborne geophysics are summarized below (Figure 1).

- Heli-Time Domain EM—Efforts to develop technically and commercially viable helicopter time domain (heli-TD) EM technology have spanned the last 25 years. Only in the last decade, however, have these developments reached fruition. Seen as providing the “best of both worlds” in traditional airborne EM systems (power and precision), there has been an explosion in the varieties and numbers of heli-TD systems such that whereas there were no systems in 1997, there are now eight different heli-TD systems flying commercially and likely >30 systems available worldwide for survey work (Figure 3).
- SQUIDs—Although a high temperature SQUID was tested as an airborne EM sensor almost ten years ago, the idea is now being revisited, this time using low temperature SQUIDs which could function as both a sensitive magnetometer as well as EM sensor.
- Drones—Drawing upon developments supported by the military and advances in software and navigation technology, commercial unmanned survey aircraft began commercial in the last several years. Limited currently to acquiring magnetic data, the success of this type of geophysical platform will most likely be determined over the next decade.
Ground and borehole geophysics. SQUIDs—the use of both high and low temperature SQUIDs has grown considerably in the last decade and both types of technology are seeing routine application in survey work (Figures 2 and 4).

- Array systems—Using seismic acquisition as a model, a number of groups pursued the development of array-style acquisition systems to record IP-resistivity, active source EM and MT data. The benefits of this approach are now becoming apparent in terms of improved depth of investigation and the generally superior “processability” of data.
- Borehole geophysics—the last decade has seen the arrival of a practical gravity survey system as well as in-hole neutron activation tool that provides accurate real-time measurement of a number of elements.

Data processing analysis and integration. Enormous strides have been made in the modeling and display of all types of data. Advanced processing of basically all forms of geophysical data is now common as is the integration of the processed geophysical outcomes with other geoscience information.

3D theater presentations. A 3D theater facility was provided at the conference that featured both scientific and commercial presentations which highlighted the benefits of geoscience data integration in a 3D presentation. At the exploration stage (prior to discovery), 3D displays help in the following ways:

- Allow better communication to stakeholders as to the outcome of geophysical surveys, especially after the data have been converted into 3D distributions of physical properties
- When drilling of geophysical and geologic models is taking place, 3D displays enable a much better understanding of how well that the targets have been tested.

At the resource definition stage (when you know something is there but you are not sure where or how much), the 3D environment allows the stakeholders to collectively understand what the progress is in defining the resource and how best to optimize the use of assets to achieve the best economic outcome in the shortest time possible.

Case studies and applications. A number of speakers pointed out that the cost per discovery of resources has risen dramatically in the past 20 years. Figure 5 shows the overall expenditure versus discovery rate over the last 57 years for base metals (one of the major but not only areas of focus for mining).

The trend of spending more but finding less is becoming worse in the last 15 years; this year over US$10B will be spent but this has not had a significant impact in the number or quality of discoveries.

The major reason for this is that the easy deposits have been found and the industry has not (it seems) adapted to find the more difficult deposits. With this serious overhanging issue in mind, the conference provided a number of papers on case studies and the application of technology to search for ore deposits. Included in this was a full day of presentations where a number of major ore deposits were reviewed, first from a geological model perspective and followed then with a discussion of the best exploration tool kit to apply to each deposit style.

Exploration wisdom. Through the means of two panel discussions and the theme of the technical lunch presentation, the issue of exploration effectiveness and role of technology was examined (Figure 6).

Only highlights of the geophysical program are reviewed here but copies of the full proceedings and related materials are available through the conference Web site; please go to www.exploration07.com for details. TLE

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