

# Geosensing Techniques for Mineral Exploration and Mine Planning

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## Abstract

Geophysical techniques have been applied to petroleum exploration since early in the 20th Century. More recently geophysical methods have been applied in detail to mineral and coal exploration. As a generalisation, geophysical techniques have not been applied in the areas of mine planning, development and production.

A variety of geophysical methods have been improved or adapted within BHP to provide accurate, cost effective services to the mine manager on time scales that are realistic for day to day planning and production. Considerable success has been achieved with in-seam seismic, cross-hole seismic and surface seismic techniques. Electrical and magnetic methods have also been beneficial for specific applications.

The identification and evaluation of mineral deposits increasingly uses a range of advanced geophysical techniques. Geophysical techniques are now also emerging as key factors in mine planning and production. The purpose of this paper is to show how BHP is developing a variety of geophysical techniques to improve the efficiency of exploration, mine planning and production both for minerals and coal. Emphasis is placed on the benefits of these advanced geophysical techniques on day-to-day mine operations. This, of course is only one company's perspective viewpoint, but since BHP has such a wide diversity of operations, this viewpoint may have general applicability.

BHP has had a long history of using geo-expertise in a wide range of operations over the past 40 years. This expertise developed in the minerals and coal industries but has subsequently developed into the petroleum industry. In regard to the coal industry alone, several notable geophysics firsts can be attributed to the coal geology groups within BHP. These firsts include:

- The application of surface seismics to coal exploration;
- Geophysical logging — BHP were instrumental in bringing BPB Instruments Ltd to Australia;
- Radar — early experiments were undertaken at Cook Colliery;
- Development and application of high resolution surface seismics in Queensland and New South Wales;
- Development and routine application of in-seam seismics;

- Cross-hole seismic/in-seam seismic tomography — application of a production oriented package to coal and metalliferous mines.

In the development of these techniques for the mining industry, a number of common factors are present which have resulted in them being commercially successful. BHP's background as a large resources company has obviously provided the initial impetus to develop smarter geophysical techniques, but this is only one factor which has made them successful. The old adage of a new product or technique being 1% inspiration and 99% perspiration also applies to the development of these techniques.

Probably the most important single factor to consider for the successful development of innovative geophysical techniques is that they require a multi-stage team effort over at least two years, (typically 4-5 years for the more complex developments) and that failures can be expected throughout this period. Also the expectations of production personnel are often too great during this developmental stage, which leads to a perception that the technique in question is not useful even after all the 'bugs' in the system have been removed. The onus is on researchers to clearly outline both the potential benefits and possible failures of a new technique during its developmental stage, so that it will subsequently be more readily accepted in the mining production environment.