INTRODUCTION

South Africa has a mineral endowment that is unequalled in value and diversity by any similar region in the world. The geological setting of these mineral deposits, and the associated mining methods, are often unique; as are the exploration and drilling methods used to prospect existing and potential orebodies. These deposits placed South Africa among the top ten producers in 23 out of 26 mineral commodities in 1987. (Figure 1).

For many years the mining industry has been South Africa's largest earner of foreign exchange. Gold sales between 1980 and 1990 have averaged some R4570 of total annual export earnings. Average gold grades have steadily decreased from 14g/tonne in 1970 to 5g/tonne in 1988. Gold accounted for 33%, or US$7,750 million, of foreign exchange earnings in 1988.

Gold mining commenced close to Johannesburg in 1886 when surface outcrops of the pebbly, oxidized "banket" reef were first mined. The surface mining was limited to very shallow depths and adits and vertical shafts were then sunk to intersect the reef underground. When the surface and shallow deposits were exhausted, deeper shafts were developed giving rise to the largest and deepest gold mining industry in the world. In 1977 a shaft complex at the Western Deep Levels Mine was completed to a depth of 3777m.

The establishment of a deep level mine costs an average of US$4 billion, involves a high degree of risk and considerable leadtimes between investment and initial dividends. Exploratory boreholes to define the geological structure and grade distribution reduce the risk and allow confidence levels to be placed upon investment decisions.

GEOLOGY OF THE GOLDFIELDS

South Africa's gold is contained within tabular conglomerate beds between 0.1 and 10m thick. The metal is incorporated with the molecular lattice of iron pyrite (FeS2); it is extremely uncommon for gold to be found as a native element. The conglomerates are separated by sequences of quartzite, many hundreds of metres thick, and have a wide lateral extent with strike lengths covering tens and even hundreds of kilometres. The reefs were formed some 3500 million years ago when sediments containing gold
Figure 1. Role of South Africa in World Mineral Supply: Production 1987.