THE CENTURY ZINC DEPOSIT – GEOLOGICAL UPDATE

Ian Kelso[1], Terry Briggs[1] and Paul Basford[2]
[1]Pasminco Century Mine Limited
[2]Pasminco Exploration, Melbourne

INTRODUCTION

The Century zinc-lead-silver deposit is located 250km northwest of Mount Isa in the Gulf of Carpentaria region of Queensland. Initial discoveries of lead and silver in the region by prospectors in 1887 led to sporadic small-scale mining and exploration activities up to the 1970's. In 1987 (hence the name Century), CRA Exploration (CRAE) commenced a regional exploration program in the area resulting in the discovery drill hole intersecting the Century deposit on the 4th April 1990. Resource definition drilling and feasibility studies from 1990 to 1996 by CRAE and Century Zinc Limited (CZL) resulted in the estimation of an in-situ mineral resource of 167Mt grading 8.2% zinc, 1.2% lead and 33 g/t silver. In 1997, Pasminco acquired the deposit from RTZ-CRA Limited and commenced project development culminating with the first ore mined and treated in the Pasminco Century Mine concentrator on the 6th November 1999.

The Century open pit will occupy an area approximately 300ha and extend to a final depth of 340 m. The mining rate is scheduled at 5Mtpa of ore by selective mining and around 80Mtpa bulk waste mining by truck and rope shovel fleet. The ore will be processed on site and then pumped as zinc and lead concentrates along a slurry pipeline 300km to the port facility at Karumba in the Gulf of Carpentaria. The Pasminco Century Mine will be the world's largest zinc mine producing 780,000 tpa of zinc concentrate over a 20-year mine life.

GEOLOGY

The deposit is hosted within the Lawn Hill Formation, a Proterozoic sequence of shale, siltstone and sandstone overlain by younger Cambrian limestone (Thorntonia Limestone). The Cambrian limestone crops out as a discrete 15km diameter ring structure and lies unconformably over the Proterozoic sediments. The Century deposit lies below the southwest edge of the limestone ring, and in the vicinity of the mine the limestone is known to be over 400 m thick within fault blocks. Structurally, the deposit is located within the Page Creek syncline and is terminated to the east by Cambrian limestone and faults associated with the Termite Range Fault, a regional northwest trending fault system. Listric normal faults, Magazine Hill and Nikkis Faults define the southern and northern boundaries respectively. The western boundary is truncated by Cambrian limestone and by the present day surface at the Discovery Hill gossan. The mineralisation is divided into Northern and Southern blocks by the north dipping normal Pandoras Fault, a similar structure parallel to the Magazine Hill Fault. Broadbent and Waltho (1998) present a detailed description of the exploration history and deposit geology.

The stratiform zinc-lead-silver mineralisation is contained in a 50m thick carbonaceous shale and siltstone package within the Lawn Hill Formation. Economic mineralisation consists of laterally continuous beds of carbonaceous shale containing sphalerite, galena and minor pyrite as millimetre scale laminations. The ore and gangue mineralogy is relatively simple, consisting dominantly of sphalerite, galena, pyrite, quartz, siderite, illite and pyrobitumen. The sphalerite is typically high purity (+62%Zn) and contains most of the silver in solid solution (Waltho and Andrews, 1993). The mineralised carbonaceous shale beds range in thickness from 0.2 to 5 m, separated by 0.3 to 4m thick siderite-altered siliceous siltstone beds. A detailed stratigraphy through the mineralisation was established during the evaluation drilling to correlate individual units across the deposit for resource modelling.

MINE GEOLOGY AND GRADE CONTROL

Geological work undertaken by Pasminco geologists during the pre-strip mining phase focused on establishing systems and procedures required for ore production including, grade control, structural analysis based on open pit mapping, geotechnical studies and pit dewatering. Resource definition and grade control systems were identified to have the most direct economic impact for the success of the operation. To achieve plan mill feed grade and production schedules a significant amount of geological work is required to accurately define ore boundaries within a strongly faulted sedimentary sequence for short-term mine planning.

The mineral resource model developed by CZL geologists is based on diamond drilling on a nominal 50 x 80 m grid extending over the deposit. This model is considered to be a robust model for project evaluation and long term planning. During the evaluation phase, faulting was recognised as issue that would influence the reliability the resource model for detailed short-term mine planning and grade control. To improve the resolution for ore boundaries additional data collected during mining is used to generate a short-term resource model. Rather than embark on high cost infill diamond or reverse circulation percussion drilling to provide additional data a system based on geophysical blast hole logging and detailed geological mapping is being developed. These two data sets have the potential to define the mineralisation on a 5 x 6m grid for computer modelling. Regular rock chip sampling across ore faces provides additional assay data for grade estimation in the short-term resource model.

Three blast hole logging systems have been investigated to design a system capable of providing the required data to update the short-term model with the minimum turnaround. The systems assessed are borehole gamma, density and magnetic susceptibility logging, measure while drill (MWD) Aquila Mining System Ltd and the SIROLOG spectrometric logging system. The Aquila and geophysical logging have been recently trialed on site during ore mining operations.

The CSIRO-developed SIROLOG has been trialed at Century by CRAE / CZL geoscientists. The probe utilises a low intensity radioactive source and readily differentiates sideritic siltstone and mineralised carbonaceous shale. The system also has the potential to provide semi-quantitative down-hole zinc and lead assays.

The Aquila MWD DM-2 system uses a vibration sensor and pattern recognition software to automatically process drill variables (pull-down pressure, penetration rate, rotation torque etc). The Aquila system aims to provide information on hard / soft ground, fractures and locations of ore and waste boundaries in real time. Interpreted geology determined by the Aquila system is based on calibrating the signature with known geology, a diamond drill hole adjacent to the blast hole.

Borehole physical property logging (natural gamma, magnetic susceptibility and density) in the same holes drilled in the Aquila trials enabled direct comparison between the two techniques as well as further correlation of the Aquila system. The combination of natural gamma and magnetic susceptibility provides the desired lithological and stratigraphic data without requiring blast holes to be logged with a radioactive source. The identification of mineralised shale beds, plus the stratigraphic position assists in identifying faulting within the blast pattern. To date, comparing interpreted blast hole geology and actual geology is approximately 80% reliable, with further improvements under investigation. Automated geophysical interpretation of the blast hole data (natural gamma and magnetic susceptibility) using LogTrans software significantly reduces the time to generate geological logs. Further refinements in field logging procedures and automated interpretation is expected to produce data for the blast pattern in a single 12-hour shift.

Mapping 3m high flitch faces using a remote laser system routinely collects further geological data. The laser, operating from a known survey station literally digitises geology cross sections along the face. Sections are laser surveyed at approximately 10m intervals through a blast pattern. This system provides further spatial data to model the stratigraphic units and faults. Conventional geological face mapping to generate bench geology plans provides the information for structural interpretation. Combining the original diamond drilling with the new geophysical blast hole logging and laser mapping points results in a high-resolution data set to re-model the mineralisation and construct a short-term block model. Ore blasts are scheduled at 2-3 day intervals and work to date has shown that it is possible to complete the whole process prior to mining the next blast block. The short-term model is used to generate new ore outlines for mine planning and to direct selective mining activities.

This innovative process has the potential to generate a high-resolution model suitable for short-term mine planning and directing grade control / selective mining activities. All blast hole logging systems trialed at Century have demonstrated potential benefits. However, the combination of natural gamma and magnetic susceptibility provides the desired data. Significant cost savings in terms of reducing the reliance on infill resource definition diamond drilling have been identified. The application of geophysics for resource evaluation by previous CRAE / CZL geoscientists is recognised, and heralded as a major contribution. Their effort has meant it is possible to utilise these methods in ore production without the extended lead-time required developing in-house systems. These systems are still in development phase, but with continued persistence by the Pasminco geology team are expected to be operational within the first half of year 2000 and contribute to the success of the new Pasminco Century Mine.

REFERENCES

Broadbent, G.C. and Waltho, A. E., 1998. Century zinc-lead-silver deposit. In: *Geology of Australia and Papua New Guinean Mineral Deposits*, Eds: D A Berkman and D H Mackenzie. Australasian Institute of Mining and Metallurgy, Melbourne:729-736.

Waltho, A.E. and Andrews, S.J., 1993. The Century zinc-lead deposit, in northwest Queensland. In: *Proceedings AusIMM Centenary Conference.* Australasian Institute of Mining and Metallurgy:41-61.

Received: March 2000
Published: Jan 2001