SNOWDEN

Final

Highland Gold Mining Limited: Taseevskoye Resource Estimate Update

Project No. **V381**

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Tables

Figures

1 FINDINGS

- Snowden has restored and reviewed the Taseevskoye databases, and confirms that the block models therein reproduce the resource estimates prepared for the 1997 Feasibility Study. Modifications to the historic classification have been implemented to ensure the resource reporting is prepared in accordance with the JORC Code (2004) and consistent with current standards of data verification.
- Meetings were held with Russian specialists to determine whether any additional data was available for updating the resource estimates. From Snowden's brief site investigations there appears to be no additional data that could be readily included in the short term and that would materially affect the block model estimates. TPRG, on behalf of Armada Gold Corporation, had drilled some shallow core holes in the Taseevskoye Pit 1, and Au assays from this drilling has been included in the updated resource block model reported herein.
- **Conclusions** from Snowden's data compilation work in 1997 are repeated here for consideration in Highland Gold's project planning:
  - Data compilation, resource modelling and later definition drilling within the defined domains of the resource model by TPRG provided independent validation of the resource model vein envelope. Validation of the halo mineralization was more difficult to achieve. The TPRG 1996 drilling reported a grade of 0.35-0.4 g/t Au for this zone, somewhat lower than the Russian resource statement suggested.
  - Mineralization within the halo is quite distinct from that within the bounds of the vein envelope. Russian data suggests that splay veins and stockwork zones have a reverse attitude to the main fissure structures. This, together with the wide spaced nature of drilling in this environment, suggests that the drilling results are probably not representative of the halo domain.
  - Restricted access to the data pertaining to the lower levels curtailed definition of the resource below the large pit design. Although grades declined through this zone, significant potential for higher grade mineralization exists at the basement contact. The operators were aware of this target towards the end of the period of underground production.
  - In relation to the residual volumes of mineralization remaining within the envelope environment and stope pillars, there is some concern regarding the precision of sectional information used for the stope solid models. Without a detailed (and time consuming) appraisal of stope passports it will not be possible to further quantify potential volumetric variances. There is insufficient drilling information throughout the upper stope environment to assess the precision of the modelling.
- **Recommendations** from Snowden's data compilation work in 1997 are repeated here for consideration in Highland Gold's project planning:
  - Additional resources may be defined at Taseevskoye provided access to the lower levels 316 – 416 can be achieved. In the short term, information from the 316 level could improve the precision of the lower portion of the resource model. There are numerous additional pillars indicated on the long section, and conversations with Russian specialists in 1996 suggest

that very high grade mineralization was selectively mined through this level.

- Compilation data at Baleyzoloto and the Baley – Taseevskoye model at the Baley Geological Expedition should be critically reviewed in order to clearly understand the relationships with the other zones, in particular zones 4 and 5. These areas may have a significant impact on developing halo mineralization adjacent to the proposed Taseevskoye pit.
- A review of all stope passport information is required to further validate the extent of stoping within zones 1 and 3. This work will also identify the extent of remnant pillar mineralization. The completion of this work could potentially have a significant impact on the volumes of mineralization which can be defined within the higher grade vein envelopes.
- There is significant scope for the discovery of high grade mineralization within the environs of the Baley conglomerate – basement granite contact zone. Limited exploration was undertaken by Baleyzoloto which clearly demonstrated that mineralization had developed laterally in this environment. This target must be considered a lower priority, given that underground decline development would be required, together with significant diamond drilling from the base of the new pit.
- More detailed evaluation of the halo environment could be achieved by additional surface drilling aligned perpendicular to the stockwork and splay vein orientations. Consideration should be given to utilizing a large diameter RC system to reduce drilling costs, greatly improve sample size and also avoid hydration of hydrothermal clays. Given the instability of the surface cover units, consideration would need to be given to running a casing advancer, and permanent casing installation.

- Snowden has adjusted the classification for the updated resource estimates from the previous reports to ensure the reporting has been prepared in accordance with the JORC Code (2004 edition). Blocks that lie below Armada's stage 4 pit have been excluded from the resource report in order to reflect the low potential for economic extraction by open pit methods. Another modification to the classification scheme has been implemented to reflect the uncertainty in the stope models and the grades assigned to the stope fill. It is not possible to verify the historic underground sample data due to lack of access, and the author recommends downgrading the Measured component of the resource to the Indicated category.
- A thorough analysis of mining and processing costs is required to determine an appropriate cut-off grade for resource reporting. In the interim, a cut-off grade of 1 g/t Au is a reasonable basis for resource reporting at this stage of the project. At this cut-off grade the Taseevskoye deposit (within reasonable open pit limits) consists of 25.2 Mt of resource at a grade of 3.35 g/t Au in the Indicated category and 4.7 Mt at a grade of 4.2 g/t Au in the Inferred category.
- Snowden recommends that HGM engages a licenced surveyor to re-establish the survey controls and to check the validity of the DTM for use in medium to short term mine planning.

2 INTRODUCTION

At the request of Highland Gold Mining Limited (HGM), Snowden Mining Industry Consultants (Snowden) has reviewed and updated the Mineral Resource estimates for the Taseevskoye Au deposits, located at Baley in the Trans-Baikal region of the Russian Federation.

HGM announced that on 30 November 2004 that it had been awarded the license for the Taseevskoye goldfield by the Russian Ministry of Natural Resources. This award followed a public auction held on 23 September 2004, where HGM acquired the rights for 100% of the Taseevskoye deposits. Snowden understands that the license provides HGM with the rights to develop and mine the deposit for an initial term of 20 years.

3 BACKGROUND

3.1 Licence history

Information regarding the license history of Taseevskoye goldfield was described by the Russian authorities to Snowden, as follows:

The Taseevskoye goldfield was developed by underground methods from 1946 till 1992. During this period, the annual ore production rate reached 300 thousand tons. A total of 195 tons of gold was produced with the average gold content of 13.6 g/t of ore.

The U.S.S.R. State Committee for Mineral Reserves approved the reserves in the upper horizons of the First and Third ore zones for re-development by open pit method down to the 166 level (Protocols No. 8992 dated 28 April, 1982 and No. 10190 dated 27 May, 1987).

Open pit development of the First ore zone commenced in 1983. A total of 1.88 Mt of ore, averaging 1.8 g/t, was produced from 1983 till 1992. At present, the pit is at a depth of 86 m from the surface. So far, the Third ore zone has not been re-developed.

Private Corporation Joint Venture ZAO SP Balgold Limited held the license for re-development of the First and Third ore zones from September 5, 1995 until April 18, 2002. In 1996 – 1997, this company performed exploratory drilling to verify the resource and processing characteristics of the ore. No exploration report was submitted to the Regional Information Databank.

Due to the company's failure to comply with the effective regulations on subsurface management, the license was revoked by the decree of the Ministry of Natural Resources of the Russian Federation (Decree No.87-P dated 18 June, 2002) and the decree of Chita Regional Administration (Decree No.142 dated 23 April, 2002).

From 29 October, 2002 until 6 September, 2003 the right for short-term use of the subsurface resources was granted to Public Corporation Imitzoloto (Polymetall). During this period, a process sample of ore was taken to assess the possibility of extracting gold by heap leaching. There were no positive assessment results. A report entitled "Report on additional assessment of the properties of residual reserves in the first-stage pit of Ore Zone I at Taseevskoye goldfield to determine feasibility of leach heap ore processing" was submitted to the Regional Information Databank. The executive in charge of the report was Y.M. Shmelev. The license was cancelled due to expiration of the license term.

3.2 Balgold – Armada – Tprg resource estimates

A resource estimate was completed by Snowden in 1997 at the request of the Balgold venture and was prepared in accordance with The JORC Code (1996 edition[1]). Although no reports appear to have been submitted to the Russian authorities, documentation of the estimate is included in a mining feasibility study that was filed for public viewing by Armada Gold Corporation (Armada) on 29 July 1998 (electronic document reference "kvavol01" prepared by Kvaerner Metals). In the author's opinion that study is an accurate record of the estimation work performed during the period 1995 to 1997 by Snowden on behalf of the Balgold venture.

[1] The JORC Code is the Australasian Code for Reporting of Mineral Resources and Ore Reserves, prepared by the Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia (JORC).

The 1997 estimate was based upon sample data collected and recorded during the operation of the underground mine (1948 – 1992) and from surface DH data subsequently acquired by TPRG-Armada and Kvaerner Metals for the feasibility study during the period 1996 – 1997. Open pit mining around the upper levels of the underground mine was carried out during the period 1983 – 1992, however the grade control sample data from the open pit was not used in Snowden's historic estimate as it was considered unreliable for resource estimation purposes at the time.

The reader is referred to "kvavol01" for details of location, history, description of mine workings, sample data sources, and comprehensive details of the resource estimation method and validation of the models.

At the request of HGM the following sections are included as background information.

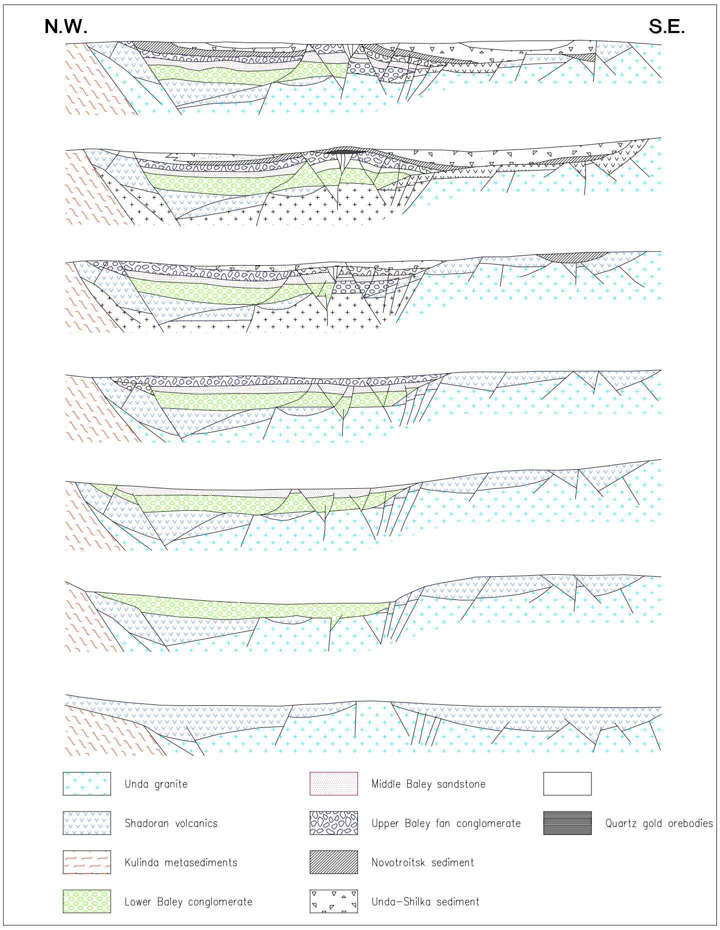
3.3 Geological setting

3.3.1 Regional geology

The geology of the Baley region is dominated by a Mesozoic to Recent ENE-WSW trending rift-like basin structure known as the Unda Rift Basin. Some 30km wide, its strike continuity of 100km is defined by the Borshovochny fault system, an extensional graben style structure (see Plan 1 for a 1:100,000 map of the region). This fault system abuts Proterozoic basement granitoid and gneiss with the complex Mesozoic stratigraphic sequence of intermediate intrusives, volcanics, and volcaniclastics, which have a total thickness exceeding 1000m.

The Unda Rift Basin hosts a series of five rhombic shaped basins regularly spaced over the 100km strike length of the basin. These fault basin structures were tectonically active from late Jurassic to late Cretaceous periods. They contain voluminous high-energy breccia, conglomerate and sandstone deposits. Extensive sequences of ignimbrite and tuff occur within these structures which have a total thickness exceeding 300m. A generalised evolutionary structural model of the graben is displayed in Figure 3.1.

Figure 3.1 Evolutionary structural model of the Baley Graben

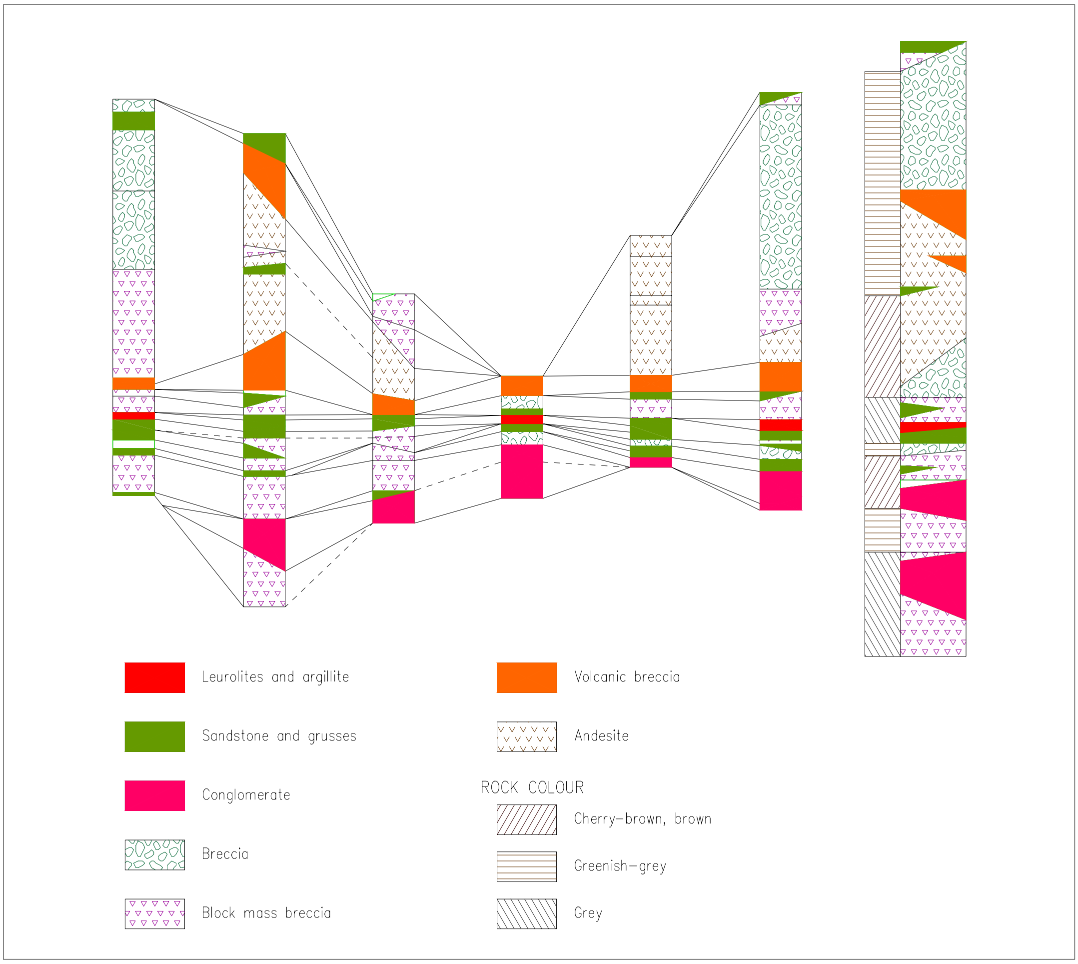


3.3.2 Local geology

The Baley and Taseevskoye epithermal deposits lie within the Baley graben located at the intersection of two depressions, the Undino-Dainsky and Undino-Ononsky depressions. The extensive Undinsk intrusive complex, an upper Paleozoic intrusive complex of predominantly acid to intermediate rocks, encloses these structures. Three phases have been identified, 1) diorite, gabbro-diorite, gabbro; 2) diorite, granodiorite, rarer granite; 3) granite, granodiorite.

A thick sequence comprising conglomerates, tuffs and sediments grouped within the Unda-Shilka, Novotroisk and Shadoron series occupies the Baley graben. Generalised stratigraphic columns of the Baley series across the graben are presented in Figure 3.2.

Figure 3.2 Stratigraphic columns of the Baley series



Exploration drilling by Russian expeditions through the central portion of this structure has demonstrated a depth to basement ranging from 300m to 500m. The entire sequence is cut by a complex series of NE and NW trending faults. Secondary fault structures have developed locally within these depressions and reflect an almost mosaic fracture pattern.

High angle NE and NW striking fault sets significantly displace the granitic basement. Late secondary fault structures displace the basement, overlying sediments and epithermal vein structures. Displacement of the epithermal mineralisation is reportedly less than the surrounding sediments, suggesting at least some post mineralisation movement. Vertical and lateral displacement of these structures has resulted in localised thickening of ore bearing structures.

Alluvium and loess cover

These units occur throughout the Baley basin and surrounding areas, forming cover to most of the earlier stratigraphy. Typically these deposits are unconsolidated and erode easily when covering vegetation is removed, resulting in deep rills.

Undifferentiated tuff and sandstone horizons

The upper horizons of the Baley series comprise dominantly tuff, sandstone, quartz-feldspathic arkose-greywackes, and siltstone horizons. These units were modelled as a single lithology given that epithermal fluids have responded in a comparatively uniform manner to the controls of this horizon. Typically these horizons have lenticular distributions and display well developed graded bedding. Exposures within the Taseevskoye pit reveal numerous carbonaceous horizons, which need to be considered in the context of the design of the metallurgical processing flowchart.

Fissure vein and stockwork vein structures become highly evolved through these units, with enhanced metal grades. Permeability controls within host rocks have been a significant control on the vertical positioning of mineralisation. Fine silt though to mudstone horizons would have developed localised aquicludes resulting in highly variable grade distributions on a local scale.

The variation in grade distribution between zones Taseevskoye I and III may relate to intraformational controls rather than highly evolved epithermal fluid conditions. These microstructures were not included in the modelling nor identified as domains for the resource modelling.

Summarised grade distributions for Taseevskoye Zones I, III and the central zone are displayed in Figure 3.3 to Figure 3.5, which were copied as unreferenced diagrams from the 1976 Russian ore reserve reports. The localisation of high grade mineralisation and control by host lithology is apparent in these diagrams.

Figure 3.3 Projected long section, grade distribution, zone 1

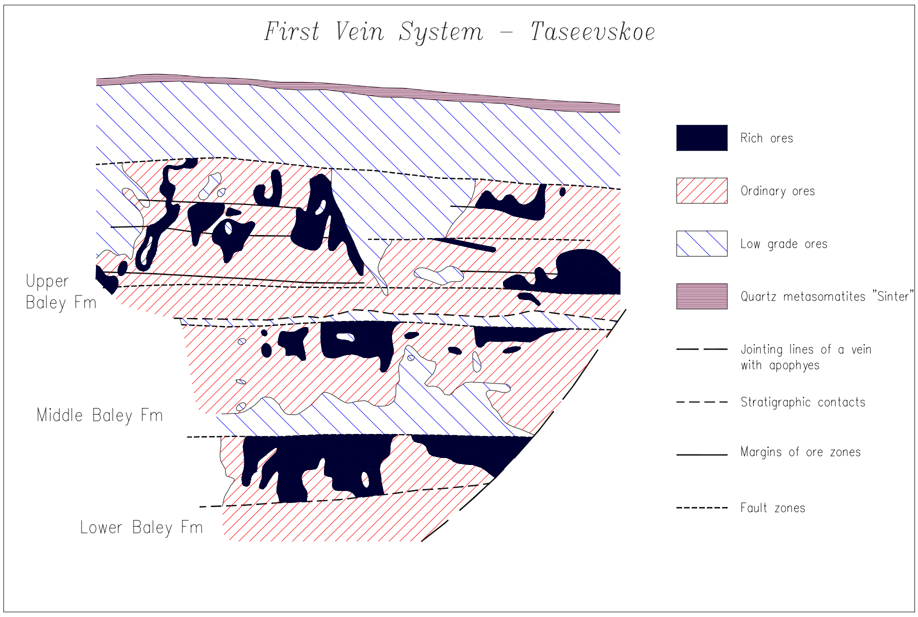


Figure 3.4 Projected long section, grade distribution, central zone

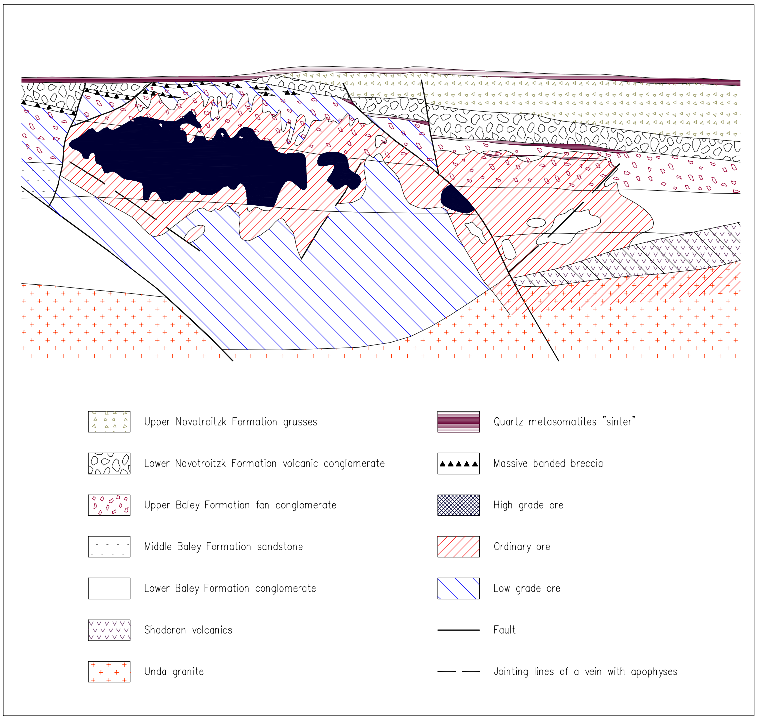
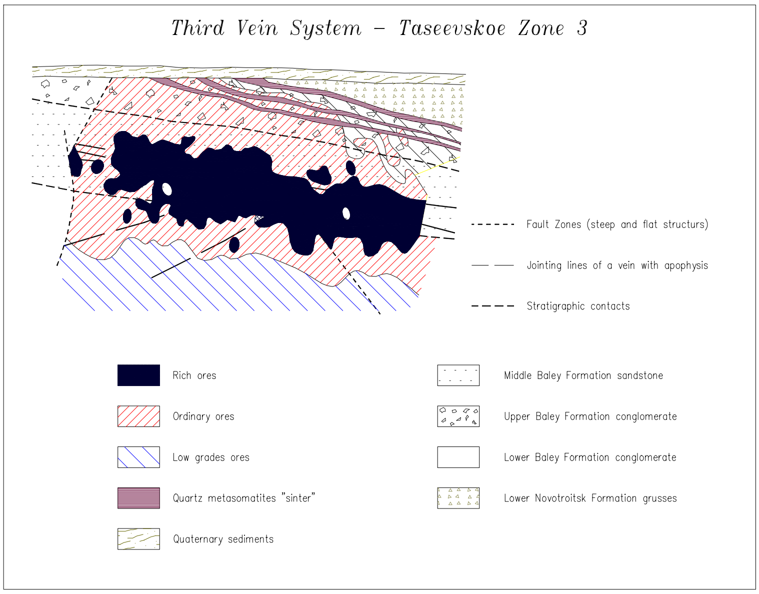


Figure 3.5 Projected long section, grade distribution, zone 3



Conglomerates

The Lower Baley Series is dominated by medium to coarse grained conglomerates. Underground exposure revealed variable alteration within these units together with strong mottling. Boulders are either well rounded clasts or matrix supported by a sandy polymictic fill. Discrete horizons are variably cemented.

The conglomerate horizons display weak vertical compositional zoning. The lowest levels of the sequence are dominated by granitic boulders, while the upper horizons contain a higher proportion of volcanic and sedimentary lithologies. Compositional changes probably reflect a dynamic tectonic environment eroding a diverse terrain.

Hydrothermal Breccia Units

Exposed within the Taseevskoye pit floor is a linear series of hydrothermal breccia deposits. Although texturally similar to the medium grained conglomerates, these deposits contain milled clasts of hydrothermal vein and sinter fragments. The occurrence of eruption breccia in this environment has not been clearly documented, nor has the significance of such structures in relation to ore forming processes. It would appear that late hydrothermal brecciation of the system has occurred, penetrating through the paleosurface of the system. Recent resource drilling through this zone by TPRG has demonstrated the continuity of high grade mineralisation.

Given the economic significance of these structures, detailed geological mapping of the Taseevskoye pit is warranted to provide better definition of probable high grade mineralisation boundaries. This work, together with clear mapping of the primary fissure vein structures, is required in order to characterise the distribution of gold.

Sinter Deposits

Laterally extensive deposits of sinter are exposed through the Taseevskoye pit and collapse areas of Taseevskoye III. These deposits exceed 5 metres in thickness on the western wall of the Taseevskoye pit, indicating sustained fluid discharge over tens of thousands of years. Sinter deposition appears to have been syn-mineralisation, with high angle vein structures observed dissecting sinter material in a number of exposures. Locally the sinter horizons are highly sulphidic (>10% pyrite), attesting to significant interaction with deeper seated fluids.

A high proportion of relic plant fragments through some areas of the sinter attest to the environment of sinter deposition being in close proximity to vegetation. This is a common feature at a number of currently active sinter deposition environments elsewhere.

Wall Rock Alteration

Argillisation is the most common alteration style observed throughout the Baley – Taseevskoye field. The lower section of the Baley Series, the conglomerates and underlying granites are extensively altered. This reflects high primary permeability of conglomerates, and locally intense basement fracturing. The upper, finer grained lithologies display highly variable alteration haloes reflecting tighter permeability and early silicification. From field observations and published literature, it is concluded that early regional alteration of the host rocks (Baley Series, including the underlying granite basement) was critical in defining fluid flow paths for later emplacement of epithermal fluids.

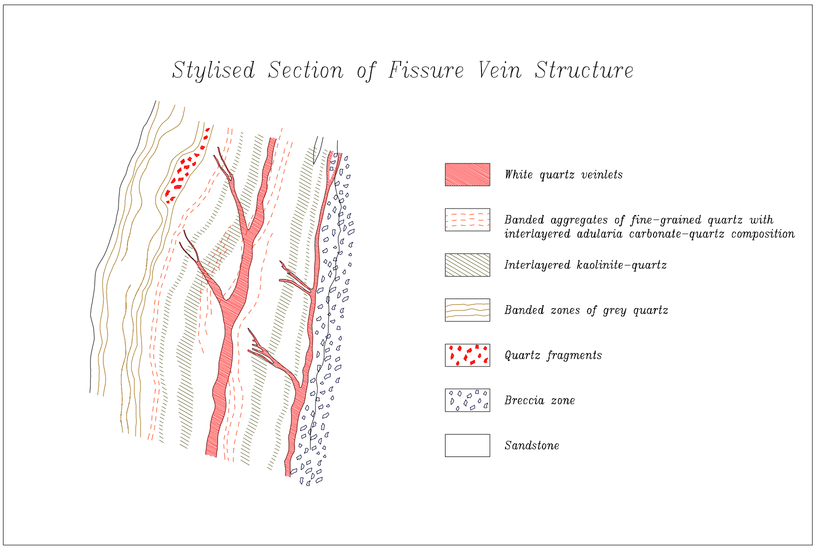
The Taseevskoye field reflects a strong structural focus. Fluid movement has been relatively restricted away from the highly fractured zones with lithological controls having a strong bearing on the lateral movement of fluid. Steep sub-vertical structures high in the system would have been a key control on the positioning of later ore bearing fluids.

Fissure Vein Structures

Mineralisation within the Taseevskoye deposit occurs mainly within high angle epithermal fissure vein structures. These large-scale structures have strike extents exceeding 4km and vertical continuity in excess of 800m. The system is highly telescoped with gold mineralisation extending through to the paleosurface.

Fissure vein structures display a highly complex vein paragenesis, comprising chalcedonic and crustiform banded silica, carbonate replacement textures, milled hydraulic breccia zones, together with complex mineral assemblages. A stylised section through a typical fissure structure is presented in Figure 3.6.

Figure 3.6 Stylised fissure vein cross section



Underground mining at Taseevskoye exploited these structures and proximal splay veins where grade and structure widths permitted. Peripheral stockworks were mined via the Taseevskoye I pit.

3.4 Mining background

3.4.1 Brief history

The Taseevskoye mineralised zones are located two kilometres to the south-east of the Baley epithermal gold-silver deposit, which was the site of modern underground mining from the 1920's. Open pit mining of the Baley deposit commenced during the Second World War and continued into the 1970's.

Discovered in the 1940's by geophysical and grid drilling across alluvial terraces, the Taseevskoye mine commenced production from underground in 1949. Ore was initially processed through Baley's ZIF-1 mill, with underground production averaging about 46 g/t Au and annual average grades ranging from 28 to 68 g/t Au. A larger mill, ZIF-2, was commissioned in the late 1950's and mill head grades were reduced to approximately 15 g/t Au.

The later phase of production from Taseevskoye was from open pit and this ceased production in early 1994 due to issues associated with the privatisation of state-owned enterprises - a lack of technology and insufficient capital to mine and process the remaining lower grade ore.

3.4.2 Nomenclature of ore systems

The Taseevskoye deposits are part of the large Baley epithermal system and are located south of the Unda River. Russian reports described five main Ore Zones in this area which were itemised from North to South as follows:

1. Fourth Ore Zone: this is located at the southern part of the Baley deposit, and as such was not part of the current study.
2. Second Ore Zone: this is located in the hangingwall of the First Ore Zone.

3. First Ore Zone: this is the main ore zone, partially mined by open pit as well as underground,
4. Intermediate or Central Zone.
5. Third Ore Zone: this is the second major ore zone.

In the Snowden study, Taseevskoye I refers to items 2 and 3 and Taseevskoye III refers to items 4 and 5.

3.4.3 Project grid rotation

The strike of the Taseevskoye deposit is around 50o east of grid north, with respect to the local grid system. In order to improve the volumetric representation of the deposit for resource modelling, the grid coordinate system was rotated 50o to the east to align the model northing parallel to the strike of the deposit. The grid rotation details are outlined in Table 3.1:

Data in the local grid is rotated 50o clockwise about a reference point that was based on the north-western edge of Russian Ore Reserve Section 1.

Table 3.1 Project grid rotation details

Original co-ordinates	Rotated co-ordinates
14088.441mN	15000.000mN
-24740.130mE	5000.000mE
-100mRL	-100mRL

3.4.4 Underground mining

Development took place on seven main levels as listed in Table 3.2 with access provided by shafts, raises, ramps and levels. The location of seven shafts is provided in Table 3.3.

Table 3.2 List of mining development levels

Named level	Elevation mRL
46	560
66	540
86	520
126	480
166	440
216	390
266	340
316	290

Table 3.3 Locations of identified shafts

Shaft name	Profile dimensions	Easting co-ordinate	Northing co-ordinate
Shaft 3	4.0m x 2.5m	5376.76	14344.59
Shaft 5	5.5m x 3.0m	5358.77	14540.46
Shaft 7	4.0m x 3.0m	5159.57	14346.90
Shaft 8	4.0m x 2.5m	5812.88	14521.15
Shaft 11	4.5m x 3.5m	5695.18	13976.68
Shaft 12	6.5m diameter	5334.15	13936.19
Shaft 13	4.0m x 2.5m	5695.18	13976.68

As reported by Geoval (1995), the main features of the development were:

- Stopes: these followed the main vein systems, depleting them except for pillar supports.
- Development galleries: these enabled access to stopes from several levels. Sampling and mapping of veins was done regularly by mine staff.
- Exploration cross-cuts: these enabled sampling and mapping of veins, and positioning of underground exploration drill holes.

Details of four mining methods employed for the First Ore Zone were briefly described by Geoval (1995). These were: horizontal slicing method with waste backfill; sub-level caving with ore shrinkage and further waste filling; open extraction chambers with mining from preparatory workings with further waste filling; sub-level chamber method with artificial concrete pillars.

3.4.5 Open pit mining

According to Russian reports, a feasibility study was prepared in 1975 for an open pit mine on Taseevskoye I down to Level 46 (560mRL). Pit parameters from the feasibility are summarised in Geoval (1995). It is understood that the reserve study did not gain Russian approval status (pers.comm.M.Fox 1997).

The current dormant pit over Taseevskoye I is excavated to a depth of 100m (approximately 500mRL) and is located between 4880mE-5450mE and 14845mN-15770mN.

4 Review work undertaken by Snowden in 2004

HGM requested that Snowden review its prior work to confirm or adjust the resource estimate as required. In particular the following areas were identified for reassessment:

- the extent of surface mining;
- the extent of underground mining;
- the metal content that can be attributed to any low grade haloes surrounding previously mined stopes, and
- the incompleteness of the sample database.

Snowden was asked to re-assess these aspects to assure compliance with current requirements of data verification and reasonableness of the classification scheme employed in respect of the JORC Code (2004 edition).

At a meeting on 17 December 2005, Snowden was asked to describe general mining practices in an open pit scenario around prior underground workings.

4.1 Site visit

Snowden's senior consultants Mr. Richard Goodwin (P.Eng) and Mr. Andy Ross (CP) travelled to Chita and Baley during the period 14 – 15 December 2004 and met with Russian specialists with first-hand knowledge of both the mining operations and the technical data contained in government archives. The purpose of the visit was to confirm that no new material work had been undertaken since Armada's study and to secure any additional data for use in the estimates. The project site and Armada's drill core were inspected during the brief visit.

At Chita and Baley, discussions were held with the following specialists in the company of HGM's translator, Mr Anton Yershov:

- Mr. Hapis Souleymanovich Bakramov (Head of Territorial Agency for use of Natural Resources);
- Mr. Vladimir Petrovich Dolbak (Chief of Geological Service of the Agency);
- Mr. Nicholai Shoukstrov (Chief of Mines Inspectorate);
- Ms. Laubov Prokopievna Novikova (Director of the Baley Geological Expedition); and
- The Chief Geologist of the Baley Geological Expedition.

The results of the site visit were discussed at a meeting on 17 December with the following representatives of HGM:

- Mr. Alexandr Titkov (Head of Production);
- Mr. Fyodor Shaidulin (Chief Geologist);
- Mr. Alexandr Peretyatko (Geological Engineer);
- Mr. Dmitri Chernakov (Taseevskoye Project Manager);
- Mr. Sergei Egeou (Analyst); and
- Mr. Michail Cheine (Head of Financial Department).

Findings from the site visit are discussed below.

4.2 Surface workings

In 1995 the Russian agencies provided Snowden's geological consultants with 1:10,000 scale published topographic sheets and Baleyzoloto mine survey sheets. A preliminary digital terrain model (DTM) for the Taseevskoye zone was derived from manual digitization of these plans. Contours for the Taseevskoye number 1 pit were digitized from 1:1,000 pit map sheets. Newer pit survey data was incorporated as 3D points and a new DTM with better control in the critical pit area was constructed by Armada's surveyor. Davy International later supplied the survey pickup for the tailings areas. All data was transferred to the Baley mine grid system.

The DTM used in Snowden's 1996 estimate was retrieved from archive and checked for reasonableness at site. The major features such as the large pits and sinkholes around former underground excavations appear to agree with the DTM, however it was not possible to undertake a more detailed comparison due to snow cover. Snowden believes that the 1996 DTM is still valid for the purposes of long term mine planning as there is no evidence that open pit mining has occurred since 1994.

Snowden recommends that HGM engages a licensed surveyor to re-establish the survey controls and to check the validity of the DTM for use in medium to short term mine planning. The Armada study stated that there was some settling in the northeast corner at the base of the main Zone 3 pit during early 1996. One unfilled open stope on Vein 26 was reportedly still exposed at the 520 m elevation on the northwest corner of the Taseevskoye Zone 1 pit.

4.3 Underground workings

A meeting was held with Nicholai Shoukstrov, the Chief of the Mining and Technical Department of the Federal Service (the "mines inspector") at Chita on 14 December 2004. Mr. Shoukstrov was formerly a mine captain at the Taseevskoye Mine and was in charge of shaft operations. The purpose of the meeting was to obtain detail regarding the status and condition of the underground mine at time of closure, as described below.

The operation began in the 1940s as an underground shaft-accessed mine with trolley lateral haulage on sublevels and vertical conveyance in the shafts. The primary mining method was shrinkage stoping with timber supports.

A cut-off criterion of grade x thickness was used. Both factors varied considerably from stope to stope. Production in some years was reported to average 50 g/t Au as a head grade. Some stope grades were reported to be "up to 30 g/t". The diluted mill feed ran between 12 and 15 g/t on average over the life of the operation. The ultimate depth and horizontal extent of the orebody was never fully explored.

As the average grade dropped during the 1970s the mining method was switched to sublevel open stoping, with hydraulic sand used as the backfill.

The tailings were classified; the coarse portion was used as fill and the fine fraction was cycloned off and disposed of as tails. Cement was added to the classified sand to give strength to the fill. As with virtually all hydraulic sand fill systems, the mine found it difficult to produce enough fill to keep pace with mining. Occasionally un-cemented development rock was used as fill and in the later stages of operations of the mine's life many of the stopes were unfilled or incompletely filled due to lack of sand.

Flooding began in 1995 and reflected the filling status of the stopes: at first the rise rate was slow due to the numerous poorly filled stopes, and then accelerated when the water reached the older and more completely filled horizons. The existing cave to surface is also a reflection of the lack of fill in the underground stopes. The mine was not deliberately flooded; it was allowed to flood.

The mining method left permanent pillars in the stopes to protect the raises. As these would be rigidly placed according to spans and scraping distances, it would be expected that these pillars would run at average grade, rather than be located in low grade ore.

The mine employed very rigid control of surveying and kept very current mine layouts. As such, the current plans are expected to be very accurate and up-to-date.

Mining levels were located every 50 m vertically, with a sublevel at the middle of the stope, providing 25 m between stope horizons. Stopes in general were divided laterally into 50 m strike segments. Sometimes additional raises were used to divide the 50 m by 50 m stopes in half.

The ground was, in general, of medium stability, not strong. The upper levels were assigned rock quality numbers of 8 to 12 (20 was considered very stable). The lower levels had improved rock quality numbers of around 16. According to Nicholai, "everything depended on ground conditions", which often required creative operations. The ore was a harder rock than the waste and much of the early development was placed in the ore. It was later located outside of the ore zones in the weaker waste rock. There were some problems associated with caving inside the larger open stopes.

Many different support mechanisms were employed including timber in the drifts, metal arches, and shotcreting.

The stoping dilution was lower in the old timber framed open stopes than in the shrinkage stopes. Dilution increased with the adoption of sublevel open stoping to the 25 to 30% range. Dilution grade was in general between 2 and 3 g/t Au.

Mucking was done with overhand mucking machines with 1.6 m3 cars.

The mine did not experience a lot of stress – most failures were gravitationally driven.

The operation was shut down very abruptly – "like a switch was thrown on surface" and in fact the power was immediately cut to most functions. As such, the underground working has stopes and headings at all stages of production – some being developed, some ready to blast, some partially blasted, some being filled, and some awaiting fill. Presumably all broken muckpiles were hauled and hoisted.

At its peak, the mine produced 500,000 t/a and employed 3500 workers. The last years of the mine's life saw production rates of 80,000 t/a with 300 workers. On closure, approximately 30,000 tonnes were prepared for mining.

The existing pit was designed and dug by Balgold, and the authorities do not have a complete set of data. The final pit was designed to be 260 m from surface for both #1 and #2 orebodies. No Russian Feasibility Study was produced for the big pit option. The current test pit is 86 m deep. Only pre-strip waste has been mined so far – the ore of the first levels was just contacted but not mined.

In all there were 20 operating shafts and four ventilation shafts over the life of the mine. At mine closure there were four operating shafts.

4.3.1 Data

In 1995 the Russian agencies provided Snowden with access to the data listed in Table 3.1:

Table 4.1 Data Sources - Taseevskoye Project

Data Type	Source
Topographic DTM Model	Published 1:10,000 Russian topographic mapping and Baley Gold survey data
Underground Development data	1:1,000 Baley Gold production level plans
Geological & Structural Models 17 Series Sections	1990 Reserve statement 1:500 vertical cross sections
Drillhole Database	Baley Geological Expedition Drill Passport Reports and Summaries
Underground Sampling Database	Capture of channel sampling information from 1:500 scale production level plans

Development information was digitized by Snowden in 1995 from paper plans either as outlines or centre lines. These were then offset to a back height of 2.5m and a solid excavation created. In the case of the centre lines, these were extruded as a solid excavation using a 2.5m x 2.5m development profile with the floor of the profile equal to the elevation of the level plan. As no survey points displaying RL's were recorded on the plans available, the development was created horizontally with a constant elevation for the entire level. Sub level information was not captured.

Earlier work undertaken by Geoval in 1993 was initially included in Snowden's modelling, but problems associated with the location of these files in 3D space and merged levels dictated the ultimate re-digitising of this data. This was achieved by digitising a single centre line from plotted plans of the Geoval data.

All development was referenced from shaft centres and grid coordinates where these were located. Grid information on all plan and sectional data had typically been removed, making referencing of information difficult. Sections from the 1990 reserve statement were indexed from the level plans and end points of the sections were derived from AutoCAD digitized control plans reported in the Baley Mine Grid system. This work was completed during December 1995 on site prior to the commencement of any compilation work.

Shaft positions were identified during December 1995 from level plan information and were digitized into AutoCAD. Solid excavation outlines were created from a vertically projected centre line down to a nominal elevation below the lowest level of development. A cross sectional profile was attached to the centre line and a solid extruded from the profile. The dimensions for each of the identified shafts were directly calculated within AutoCAD. A total of seven shafts were identified, their locations and approximate cross sectional profiles being presented in Table 4.2.

Table 4.2 Shaft Profiles and Locations

Shaft Name	Profile	Easting (Baley Grid)	Easting (Baley Grid)
Shaft 3	4.0m X 2.5m	-23995.8858	13955.7670
Shaft 5	5.5m X 3.0m	-24157.4906	14067.8922
Shaft 7	4.0m X 3.0m	-24137.2609	13790.8712
Shaft 8	4.0m X 2.5m	-24172.1891	14020.3217
Shaft 11	4.5m X 3.5m	-23509.3681	13963.2066
Shaft 12	6.5m	-23710.4146	13660.6120
Shaft 13	4.0m X 2.5m	-24044.8876	13563.2879

An enormous amount of data related to stoping exists both within the daily production passports and the three series of vertical sections (17b and 62 section (1986) series, and 17 section series (1990)) available, but only the 17 series extends through both of the vein systems. Compilation of the stope outlines has been hindered by the lack of coordinate control with respect to the passport data, while the vertical section information, with the exception of the 1:500 1990 series of 17 sections, only extends down to the 440RL. The 1990 sections provide detailed data extending through to the 290RL which, although more generalized, does provide coverage to within 80 m of the projected pit bottom.

4.3.2 Deficiencies in the underground data

Stopes

Stope outlines were digitized by Snowden in 1995 from the 1990 series sections, with each outline being coded with the vein number being stoped. This allowed correlation of discrete vein structures across major fault boundaries. These sections represent the most recent compilation of the underground operation, but definitely lack the precision available on the 1:200 scale 62 section series or the production passports.

In an attempt to quantify volumetric errors in the stoping models, stope outlines from the 62 series sections were digitized and a wire frame created for the upper portion of vein number 1. This solid was then located in the correct Cartesian position in 3D space within AutoCAD, and exported to Gemcom mining software. A comparison of the two stope volumes revealed a significant percentage error between the models. This reflects two major deficiencies with the current stope modelling; these are as follows:

- Firstly, the current stope models are based on vertical sections with a nominal spacing of 40-45 m, and this spacing is variable throughout the deposit. The 62 series sections are more closely spaced at 10-20 m centres. When tied for wire framing, the closer spaced sections produce more uniform geometric shapes, while the wider spacing results in very angular structures, with portions of the solid reporting beyond the real limits of the actual boundaries between sections.
- Secondly, the stope outlines on the 62 series sections are quite different from the 17 series outlines. Snowden assumes that stope outlines have been smoothed on the 17 series, and that detailed information was only recorded on the 62 series (1:200 scale) sections. Alternatively, updating of the various working drawings may not have been undertaken at the time of mining.

Lower mine levels

A conclusion from the Armada feasibility study was that considerable data still remained unreleased by Russian authorities, particularly information from the lower mine levels (316, 366, and 416) and fringe areas of the deposit. Much of this was believed to be retained in a restricted government archive and was not available for copying in 1995. In the current site visit by Snowden it was stated that the unreleased data does not reside in the Baley Geological Expedition, and HGM should therefore continue to request the data from other government sources. It is entirely possible that the data does not exist as Snowden was told that a lot of information was destroyed by fire, although much of it was pieced together from other sources.

4.4 Sample Database

In the current visit it was confirmed that no original Russian diamond drill core is available or has been retained from their past work. This was also the finding in 1995. Core was split for assay and one-half retained for reference, but was subsequently thrown away. No sample pulps or reject material from any of the historical sampling campaigns could be located for verification work in 1995. Three underground levels were available (216, 266, 316) and were visited at the start of the Armada study by Snowden and Kvaerner. The drifts had unfortunately collapsed close to the shaft sites and safe access was not possible to any crosscuts, stopes or pillar areas for any controlled type of confirmatory sampling program or metallurgical bulk sampling.

The core drilled by Armada for resource confirmation, geotechnical and metallurgical purposes was found to be in good condition and is securely stored and indexed. The existing Snowden database was checked, and only the geotechnical DH data appears to be missing.

In January 1997, a 23 short hole (20 m) program totalling 440.1 m was completed on the Taseevskoye pit floor at the 510 m elevation. The close spaced (5 m) holes crossed a pillar area and the adjacent halo zone. This program recommended by Snowden was drilled as a validation test of the kriged block model, and to aid in the definition of resource categories, however, this data was not available for use in the 1996 resource estimate. Snowden has now incorporated this data (212 composites) into the updated resource estimates.

There is anecdotal evidence that Troy Resources or Polymetall undertook minor sampling activities in the open pits after Armada's departure, however none of this data was provided to the Russian agencies nor is it available for Snowden's use in updating the resource estimate.

5 Resource model update, including the low grade halo

The historic block models were developed in outdated versions of Gemcom and Datamine mining software, yet are accompanied by sufficient documentation to permit their restoration in current software. Datamine block model estimates were imported into the latest Gemcom version (GEMS 5.4) for scrutiny and compare well with the Armada-era geological wireframe interpretations and development models that were created in 1995. The reports of tonnages and grades were found to reconcile within acceptable limits to the reports generated in the 1997 feasibility study.

Grade blocks in the vicinity of the Armada pit drilling were updated by indicator kriging in 2004 using restored parameter files.

The updated resources are reported with respect to The JORC Code (2004 edition) which is different in some respects to the 1996 edition. The latest Code requires that ***portions of a deposit that do not have reasonable prospects for eventual economic extraction must not be included in a Mineral Resource***. Accordingly the author judges that the deeper levels of the mine that were uneconomic in the Armada feasibility study for open pit mining should be excluded from the HGM Mineral Resource report. Only those blocks identified within the final stage 4 pit (Armada) are reported here, however it should be noted that additional resources could be defined at Taseevskoye provided access to the lower levels 316 – 366 can be achieved and the mineral resource at those levels can support economic extraction by underground methods. Detailed information from the 316 level could improve the confidence of the lower portion of the resource model, provided the data can be located. There are numerous additional pillars indicated on the long section, and conversations with Russian specialists suggest that very high grade mineralization was selectively mined through this level. Such mineralization is only likely to be extractable by underground mining methods.

Current standards of data verification have also been taken into account by the author in determining resource categories for reporting of the updated estimates. In the author's opinion the term "Measured" should not apply to the Taseevskoye deposits because much of the sample data has not been verified, although historic records show that sampling practices were of high quality. For example, in Snowden 1997 it was stated that the underground sampling dataset could not be validated as there is no access to any of the stoping areas nor face exposure of mineralization within the drives.

During September 1995 a trip to three underground levels prior to the mine flooding revealed no surface exposure because of the extensive ground support measures. Walls and the backs of drives have either been timber clad or shotcreted. In the lowest levels through the conglomerates, ground conditions were so poor that steel sets were added to the shotcrete surfaces. Even with underground access established, re-sampling of specific channel samples would be very difficult without significant support from mining crews and identification of original sample sites would be impossible.

A second area of concern is the stoping and amount of backfill. For example, in Snowden 1997 it was stated there is some concern regarding the precision of sectional information used for the stope solid models. This affects the determination of residual volumes of mineralisation remaining within the envelope environment and stope pillars. Without a detailed appraisal of stope passports it will not be possible to further quantify potential volumetric variances. There is insufficient drilling information throughout the upper stope environment to access the precision of the modelling.

Accordingly the author recommends downgrading the Measured blocks to Indicated status, and applying the Inferred status to the pillars and stope-fill. On this basis the identified Mineral Resource within the limit of the stage 4 pit is presented in Table 5.1, as a grade tonnage report.

Table 5.1 Grade tonnage report of the Identified Resources within reasonable open pit limits

Classification	Cutoff grade	Volume M**3	Density T per M**3	Tonnage T x 1000	Au g/t Grade	Au kgm Product
INFERRED	2.5	1212	2.1	2517	6.6	16560
	2.0	1430	2.1	2958	5.9	17558
	1.75	1579	2.1	3264	5.6	18131
	1.5	1709	2.1	3531	5.3	18562
	1.25	1903	2.1	3945	4.8	19123
	1.0	2275	2.1	4774	4.2	20061
	0.9	2445	2.1	5157	4.0	20423
	0.8	2723	2.1	5788	3.6	20958
	0.7	2946	2.1	6294	3.4	21337
	0.6	3232	2.1	6947	3.1	21760
	0.5	3528	2.2	7626	2.9	22130
	0.3	4060	2.2	8844	2.6	22611
	0.001	5021	2.2	11073	2.1	23047
	Total	5021	2.2	11073	2.1	23047
INDICATED	2.5	4621	2.3	10669	5.9	62444
	2.0	5765	2.3	13316	5.1	68371
	1.75	6430	2.3	14854	4.8	71241
	1.5	7327	2.3	16930	4.4	74585
	1.25	8642	2.3	19978	3.9	78734
	1.0	10899	2.3	25211	3.4	84537
	0.9	12042	2.3	27860	3.1	87048
	0.8	13762	2.3	31850	2.8	90435
	0.7	15383	2.3	35608	2.6	93248
	0.6	17618	2.3	40793	2.4	96613
	0.5	19707	2.3	45639	2.2	99253
	0.3	24523	2.3	56810	1.8	103562
	0.001	27672	2.3	64115	1.6	105237
	Total	27672	2.3	64115	1.6	105237

6 Mining over previous underground workings

The following procedures are used at a large open pit gold mining operation in Australia:

A dedicated person (the Voids Officer) is employed to be responsible for defining underground workings on a day to day basis and to maintain a safe working environment. This person is also appointed in writing to conform with mines regulations and to define clearly what the responsibilities of this position are. The Voids Officer has final authority on access to working mine areas. This position also includes responsibility for near mine areas and for the maintenance of exclusion zone mark ups.

Every possible effort was made to collect previous plans of underground workings. These are used as a guide to highlight potential danger zones. Hard copies are kept of all these plans and they are also digitized and kept as electronic files.

As mining progresses through the orebody (and previous underground workings) additional probe drilling is done to delineate the current extents of the underground voids. The procedure involves drilling 76 – 89 mm angled holes. The drill rig starts at a suitable distance from the expected void to allow the 60 degree angled holes to intersect the void at a vertical distance of about 20 m vertically below the current working bench. The drill rig will then step 2 m closer to the void area and drill another hole. This means the drill rig is working from a position of safety and defines the extents of the void. This process is repeated every 10 m along the potential underground void. The drill operator records whether he has intersected solid ground, backfill material or void and at what depth. This requires experience on the part of the drill operator.

The Voids Officer will then use this information to define different exclusion zones. Exclusion zones are marked on the working benches with plastic bollards and danger tape. The different exclusion zones are defined as follows:

A black and white exclusion zone is marked around a void that is identified as being filled – either through previous backfilling or as a result of open pit mining. These areas are identified on the working benches with white bollards and black and white danger tape. Earth moving equipment that is fitted with roll over protection is allowed to cross over these areas. Nobody is allowed in these areas on foot.

A red and white exclusion zone is marked around a void that is identified as being open. These areas are identified on the working benches with red bollards and red and white danger tape. Nobody is allowed inside these areas unless they are attached to a safety harness and only with the permission of the Voids Officer.

Additional procedures are defined for blasting:

Following a blast nobody is allowed on the blasted rock for an hour. This is to allow any void that might have been opened up to cave.

Before the ore mark up is done the exclusion zones have to be marked up by the surveyors.

Small coloured flags on steel shafts are used to identify different ore zones. These can be thrown into exclusions zones without actually entering into the exclusion zone. This is used in additional to coloured tape on the boundaries of ore zones. GPS technology is now also used to identify ore mark ups.

Where no other option is available a steel bridge is used to cross over a void area. The bridge is mounted on skids and is dragged into place by a dozer.

Large voids are backfilled with low grade ore where access is possible. Backfilling must never be assumed to be successful. Probe holes should be drilled after backfilling on every working bench.

Additional procedures for large open voids include:

Drilling probe holes when the large void is within 50 m vertically below the current working bench (use a 1:1 ratio as a guide eg a 50 m wide void should be probed when 50 m below the current working bench).

Procedures must allow for the potential that large voids might have caved and increased in extent.

Large voids are also mapped by lowering a laser instrument into the probe hole. This requires a bigger probe hole than the 89 mm size. The results from the mapping are then used to update electronic files of three dimensional void models.

Where high open pit walls cut through stopes or other workings the walls are covered with steel diamond mesh to protect against loose material getting dislodged. This is done by installing rolls of steel diamond mesh on berms and then rolling the mesh down once mining has progressed further down.

All exploration drill holes are logged for additional information.

Microgravity was used with limited success to identify voids that were not on any previous plans.

GPS technology is also used. This is fitted to diggers and dozers and includes exclusion zone mark ups.