PT. Nusa Halmahera Minerals

The Gosowong Goldfield;
5 Moz Au and still growing!

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Objectives of Presentation

- Apa Gosowong???
- Geology and deposits in goldfield
- Terry’s contribution in 1998
- Overview of Kencana system
- K1, K2 Bonanza Zones
- Current developments
Gosowong... apa????

- **What?** Au / Ag epithermal and Cu porphyry district
- **Where?** East Indonesia on Nusa Halmahera
- **Who?** 82.5% Newcrest Mining  
  17.5% PT Aneka Tambang
- **When?** Production since 1999;  
  Gosowong, Toguraci, Kencana
- **Why?** Cumulative Au production over 2Moz  
  Au Resources +3Moz  
  Average Head Grade; ~1 Au oz/tonne  
  400k oz pa production plan (next 4 years)  
  Strong cash generation (ccost ~USD235/oz)
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Figure 1

GOSOWONG OPERATIONS

PT Nusa Halmahera Minerals CoW Boundary

Halmahera

Ternate

Maluku Sea

Bacan Island

Equator

100km
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Gosowong geology

Toguraci; 0.55Moz
Gosowong; 0.85Moz
Kencana; 3.65Moz
Terry’s contribution

- Visited site for 4 days in May 1998 to review prospects and data for Newcrest.
- Focus on two Po Cu-Au projects (Matat and Bora) and reviewed data in Gosowong epithermal deposit recently discovered. The Toguraci epithermal sits above the Bora Po deposit.

Gosowong
- Observations of potential fluid pathways being more horizontal than vertical.
- Arsenic anomalism in soil above southern end of Gosowong
Overview of Kencana System

• ‘Narrow vein’ style – low sulphidation epithermal.
• Four stages of mineralisation
• Intersecting network of structures; K1, K2, K Link…
• Bonanza Zones, Main Zones and Stockworks
• Generally low orebody dip ~45° K1 to ~35° K2
• Poor to Very Poor ground conditions – altered andesites, clays and mudstones! Undercut and fill mining method – high cost.
• Irregular plan geometry and lateral offsets occur - complex in detail.
Mineralisation stages

- **Crystalline Veins**: precursor epithermal event, distinct silver bias, massive to banded quartz ± chalcedonic banding ± adularia, and includes vughy, dog toothed quartz. Mineralisation is as electrum with some base metal sulphides. Gold grades are generally <5 g/t. ‘Stockwork’ mineralisation.

- **Quartz-Adularia event**: layered quartz and quartz adularia episode, veins are crustiform to colloform banded with fine interlayers of dark chlorite. Grades range from 5 - 50 g/t Au, mostly as electrum, with visible gold regularly reported in the dark bands. ‘Main Zone’ mineralisation.

- **Quartz-Chlorite event**: This is a vein and breccia overprint with a common texture being Quartz Adularia veins as clasts encrusted by Quartz Chlorite veining. Volumetrically less significant than the Quartz Adularia event, the high gold grades 50 - 200++ g/t with a Au bias) This mineralisation event is commonly referred to as ‘Bonanza Zone’ mineralisation.

- **Silica-Sulphide event**: Late stage, dark grey /black molybdenate/pyrite veins crosscutting structure trends, with a chemical signature of Mo, As, Tl, Sb, Ag, Au. Suggests a closer affiliation with a magmatic fluid source.
KENCANA MAIN ZONE QUARTZ VEIN TEXTURE

- Quartz crystalline stockwork
- Quartz crystalline breccia
- Black sulfide with fracture fill texture on quartz crystalline vein
- Black sulfide breccia
- Dambco chalcedony
- Colloform-crushiform of black sulfide bands
- Colloform of chalcedony bands
- Colloform-crushiform of adularia bands
- Muscovite-crushiform quartz-adularia
- Moss texture of quartz-adularia
- Cockade breccia

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Kencana Geometry - LS
Kencana Geometry - Plan
Kencana Geometry - Iso
Too Many Ks ??

- K-1 N: 1.84M oz
- K-1 HW
- K-1 S
- K-2 N: 1.52M oz
- K-3
- K-L2
- K-L3
- K-L4: 0.18M oz
- Gos Sth
- K-Link
- 9400mE
- 9600mE
- 9800mE
- 10000mE
- 12000mE
- 19400mN
- 19600mN
- 19800mN
- 20000mN
Sirovision
Bonanza Zone

- Present in K1 and K2, lacking in K Link.
- “10% of Volume contains 40% of Metal”
- Irregular yet predictable
- Internally very low CV (~0.9); valid domain
- Proving to be more widespread in K1
- Estimation of Bonanza Zone has major impacts on Resource.
K1 Longsection with decline and mined areas.
Current mining locations as orange dots, reserve outline in green, bonanza zone in red.
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Cross-Section 19750 N

- ‘Bonanza’ Zone (BZ)
- Main Zone (MZ)
- Stockwork

K1 BZ Wireframe
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SUB LEVEL 2

Interpretation

- ‘Bonanza’ Zone (BZ)
- Main Zone (MZ)
- Stockwork

Reality
Interpretation

- ‘Bonanza’ Zone (BZ)
- Main Zone (MZ)
- Stockwork

Reality
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SUB LEVEL 4

Interpretation

- ‘Bonanza’ Zone (BZ)
- Main Zone (MZ)
- Stockwork

Reality
**SUB LEVEL 5**

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**Interpretation**

- ‘Bonanza’ Zone (BZ)
- Main Zone (MZ)
- Stockwork

**Reality**
Interpretation

Reality

‘Bonanza’ Zone (BZ)
Main Zone (MZ)
K2 Plane of Vein Longsection (inclined @45 degrees)
reserve outline green, bonanza zone red with internal hole
filled by non-bonanza ore
Current Developments

• K1 North
  – Additional shoot north of K1 but along the same structural trend

• K1 Deeps
  – Remake of the main K1 shoot at depth below previously ‘closed off’ mineralisation
K1 North

- Initial Intercept KXD001;
  13mdh @ 170g/t Au

- Follow-up intercept in KXD003R;
  18mdh @ 34 g/t Au
  (including 1.1m at 165g/t)

- KXD003R located 80m updip of KXD001.

- Further drilling has shown the extension to be tightly constrained.
Conclusions

• Kencana has made a step-change to Gosowong. Upside remains on the structures with additional resources becoming evident.
• Bonanza Zone material has a big impact on the resource in both K1 and K2.
• BZ is both variable and consistent.
• Expectations are high for further discovery in the district.
Terima Kasih!