PROPOSED BACTERIAL HEAP LEACHING OF ORE SORTER PRODUCTS AT <u>ANAX METALS</u> INNOVATIVE <u>WHIM CREEK PROJECT</u>

¹Tony Parry , ²Geoff Laing

¹ Nexus Bonum, Australia ²Anax Metals Ltd, Australia

PRESENTATION BY ANAX AND NEXUS

- □ INTRODUCTION ANAX METALS AND NEXUS BONUM
- □ ANAX METALS' WHIM CREEK PROJECT
- **BIO LEACHING RESULTS LAB TEST WORK**
- DEVELOP GLOBAL JV EMERGING PROCESSING HUB OPPORTUNITY
- □ CHALCOPYRITE LEACHING CHALLENGES AND OPPORTUNITIES
- CONCLUSIONS

WHO WE ARE

ANAX METALS:

- Aquired 80% interest in the Whim Creek Project, from Develop Global Limited (ASX:DVP) in 2020.
- Strategy to fast-track the re-start of copper and base metal production at the site, utilising smart technology to realise processing efficiencies and reduce capex.
- Completed a DFS, secured final regulatory approvals to commence mining operations.
- Implementing Pilbara Consolidation Strategy: development of a processing hub at Whim Creek capable of treating more than 20ktpa copper (eq) from our own deposits and other regional assets.



NEXUS BONUM:

- Established in 2014, as a specialist consultancy focused on ore sorting and associated pre-concentration technologies.
- Combined metallurgical and engineering expertise.
- Design and manage comprehensive test work programs, technical and economic evaluations, Scoping Studies, PFS and Definitive Feasibility Studies.

ANAX METALS' WHIM CREEK PROJECT



WHIM CREEK HISTORY

- Copper mining commenced in the late 1800's with DSO ore shipped from the port at Balla Balla
- Processing facilities followed in the early 1900's
- Straits Resources Oxide Heap Leach Operations between 2004 and 2009
- Blackrock/Venturex turned the upper lift over in 2018/19
- Anax acquired Whim Creek June 2020 focus on existing infrastructure and establishing primary mineralisation resources



Whim Creek Copper Mine 1900



PRIMARY MINERALISATION IDENTIFIED BY ANAX (DFS Published

Resources):

COPPER	000 Tonnes	Cu %	Zn %	Pb %	Ag ppm	Au ppm	ZINC	000 Tonnes	Cu %	Zn %	Pb %	Ag ppm	Au ppm
Measured	990	1.62	1.42	0.61	38	0.28	Measured	70	0.16	4.56	1.79	53	0.23
Indicated	6,390	1.22	0.71	0.17	13	0.14	Indicated	1,230	0.40	7.55	2.20	58	0.27
Inferred	1,820	0.86	0.32	0.07	5	0.04	Inferred	430	0.34	5.07	1.75	27	0.10
TOTAL Copper Resources	9,200	1.19	0.71	0.20	14	0.13	TOTAL Zinc Resources	1,750	0.37	6.75	2.05	50	0.22



THE ANAX FLOWSHEET – USING TECHNOLOGY TO TRANSITION TO SULPHIDE ORE TREATMENT

Two Parallel Process Streams – Concentrator and Heap Leach

- Whim Creek fully permitted site
- Low Capex development option by <u>using</u>
 <u>concentrator and heap</u>
- Ore Sorters and Jigs are 'gatekeepers' to determine concentrator/heap feed split



WHIM CREEK – A PROCESSING HUB WITH SORTING, CONCENTRATOR AND HEAP LEACH FACILITIES ¹



THE ANAX FLOWSHEET – USING TECHNOLOGY TO DELIVER A ROBUST PROJECT

High Grade Ore Feed – Massive/semi massive

sulphides

Higher Grade Feeds – Most feed goes to milling/flotation



THE ANAX FLOWSHEET – USING TECHNOLOGY TO DELIVER A ROBUST PROJECT Low Grade Copper Ore Feed – Stringer Zones

Lower Grade Feeds – Increase focus on secondary sorter and heap leach



WHIM CREEK HEAP LEACH TEST WORK



ANAX ORE PRE-CONCENTRATION AND FLOTATION TEST WORK

Extensive test work program completed

- ✓ Domain-specific ore sorting bulk tests.
 - Whim Creek Ore Bodies: Massive sulphide and stringer zones
 - Satellite Ore Bodies: Salt Creek, Evelyn
- Fines (<8mm) gravity upgrade (Gekko jig).

Flotation test work on bulk ore sorter pre-concentrates

✓ Domain-specific flotation strategies developed.

Heap Leach Test Work on ore sorter 'middlings'





ANAX BIOLEACHING TEST WORK

Staged test work program has progressed to 1.0m columns



Early 2021: Bioleach amenability tests – BioHeap cultures



2021/2022: Bioleach amenability tests followed by small column (0.5m) leach tests – BV cultures

CSIRO

2023-present: Small column tests (0.5m) progressed to larger column (1.0m) tests – CSIRO and Whim Creek cultures tested





BUREAU VERITAS SMALL COLUMNS (0.5M) BIO LEACH TESTS



BV Cultures : ~60-70% Cu Recovery and ~80% Zinc Recovery



- Temp 50C
- Head 0.92% Cu and 0.15% Zn
- Agglomeration
- P₁₀₀ 3.35mm
- pH 1.8 2.0
- Control of Fe levels and ORP

CSIRO SMALL COLUMN (0.5M) BIO LEACH TESTS

Promising Results using Ore Sorter Middlings Products



- Temp 45 60C
- Head 0.94% Cu and 0.21% Zn
- Agglomeration
- P₁₀₀ 3.35mm
- pH 1.8 2.0
- Control of Fe levels and ORP

CSIRO and Anax Whim Creek Cultures :

~80% Cu Recovery and ~90% Zinc Recovery



CSIRO LARGE COLUMN TESTS

- Tests on-going
- ~10kg per column
- Assessing feed size (3.35mm, 6.4mm)
- Agglomeration/no agglomeration
- Assess higher bed temp (60C) to enhance kinetics



FURTHER INNOVATIVE WHIM CREEK BIO LEACH INITIATIVES – focus on acid consumption



ANAX HEAP LEACH SCOPING STUDY (Sept 2023)



Heap Leach Feed Type	Kt
Secondary Sort Rejects	788
IPJ Rejects	300
ROM Ore (transitional ore + new sulphide ore + redirected ore)	751
Tailings	354
Total Heap Leach Feed	2,193

ANAX DFS FINANCIALS

Includes Heap Leach Scoping Study

Metric	Concentrator (DFS)	Heap Leach Contribution**	Combined Project ²
Pre-Production Capex	\$ 71M	(\$10 M)	\$ 71 M
Operating Costs (mining, processing, freight and admin)	\$ 628 M	\$ 46 M	\$ 674 M
Operational Cashflow	\$ 451 M	\$ 85 M	\$ 536 M
Free Cashflow (before financing and tax)	\$ 340 M	\$ 71 M	\$ 411 M
IRR	54.3%	n/a	55.3%
Payback	20 months	n/a	23 months
NPV (7%)	\$ 224 M	n/a	\$ 270 M

*Reported on a 100% Project Basis. Anax has an 80% interest in the project and will contribute 80% of costs and receive 80% of financial outcomes. **Heap Leach Capex to be committed in Y2 of operations and paid from operating cashflow

HEAP LEACH PROCESSING HUB – EMERGING OPPORTUNITIES



WHIM CREEK HEAP LEACH TO BECOME PROCESSING HUB?

Develop Global and ANX confirms Scoping Study

Oxide/Transitional Ores from Develop Global's Sulphur Springs project may be treated on the Whim Creek heap

Anax and Greentech confirm Base Metal Alliance collaboration

Oxide/Transitional Ores from Greentech's Whundo project may be treated on the Whim Creek heap

Hub Concept – Processing option from a number of stranded deposits in the Pilbara

CHALCOPYRITE LEACHING – CHALLENGES AND OPPORTUNITIES

Seen as potentially important to provide additional copper to meet demand

MiningNews.net 25 March 2024

MINERS

Spare SX-EW capacity could be utilised on primary copper ore, says Goldman Sachs

'Big copper' doing a lot of testwork on new technologies able to use existing infrastructure

"We believe new leach technologies may be able to economically compete with proposed new concentrators such as those at Escondida and Bagdad."

Rio Tinto, which has a 30% stake in Escondida, could also add to the output from primary ore by utilising its Nuton bio-heap leaching technology.

MAJORS FOCUSSING ON DEVELOPING VIABLE PRIMARY COPPER ORE HEAP LEACH

Passivation is the big challenge with chalcopyrite leaching



WRAP UP

- □ BIO LEACHING OF PRIMARY COPPER ORES RECEIVING STRONG GLOBAL FOCUS TO 'CRACK THE NUT'
- □ BIO LEACH USING EXISTING HEAP LEACH INFRASTRUCTURE TO PLAY A KEY ROLE ANAX METALS' WHIM CREEK PROJECT
- INNOVATIVE FLOWSHEET WITH 'GATEKEEPER' PRE-CONCENTRATION TECHNOLOGY OPTIMISES THE FEED SPLIT TO CONCENTRATOR AND BIO HEAP
- **PRIMARY ORE BIO LEACHING RESULTS SHOWING PROMISING RESULTS**
- □ WHIM CREEK HEAP LEACH FACILITY SPARE CAPACITY WILL BE KEY TO DRIVING PILBARA HUB PROCESSING CONCEPT
- DEVELOP GLOBAL JV EMERGING HUB OPPORTUNITY