Successful Discovery Culture Case History of Oyu Tolgoi Discovery

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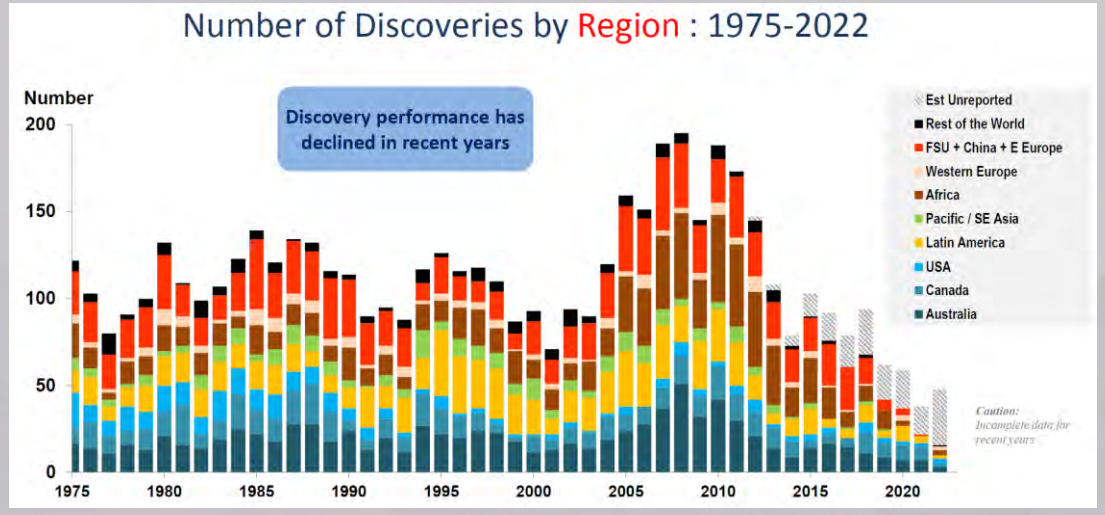
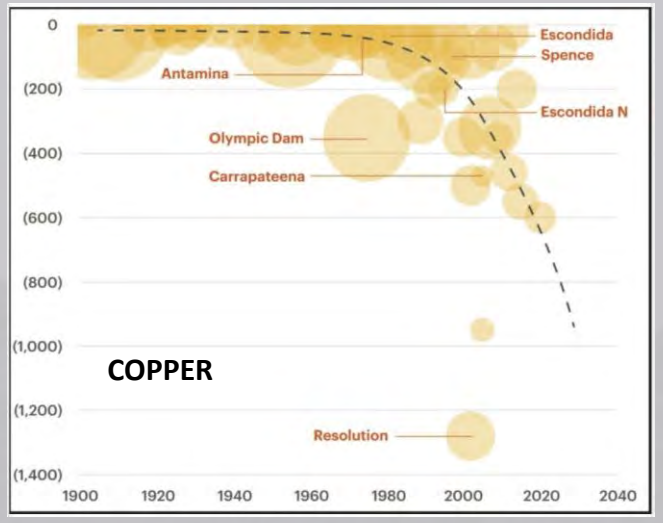
Introduction

- Mining industry challenges
  - Adequate mineral resources for future metals demand
  - Climate, social, and environmental pressures
  - Health & safety constrains
  - Geopolitical issues
  - Innovation & technological change
- Mineral loss due to intensive mining
- Sustaining growing global mineral demand
  - Mineral discovery costs ↗
  - Mineral discovery rates ↘
  - New mineral discoveries coming from deeper levels
  - Future mineral discoveries - partly covered or/and essentially “blind” ore bodies

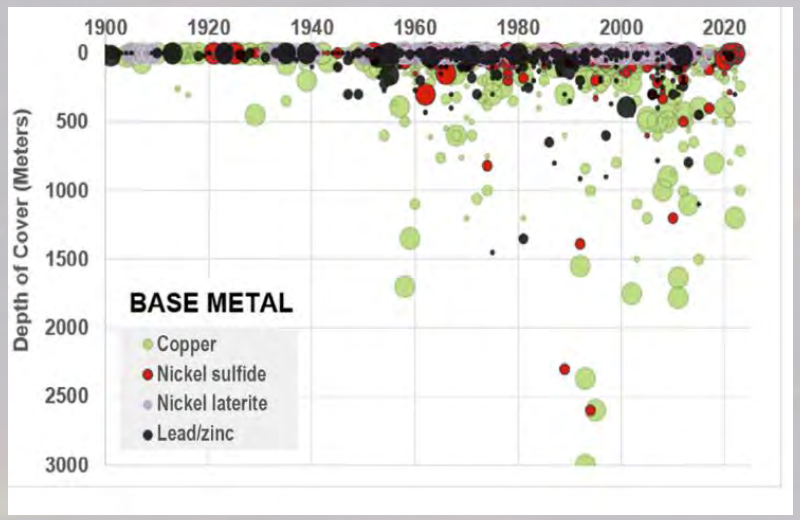
Fewer and Deeper Discoveries

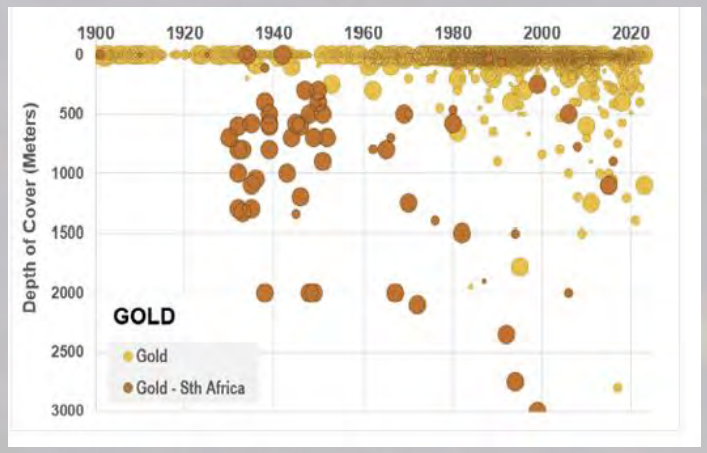


R. Schodde, Exploration: Australia vs World, 2023



BHP Economic and Commodity Outlook, August 2024





R. Schodde, SEG Discovery, 2025

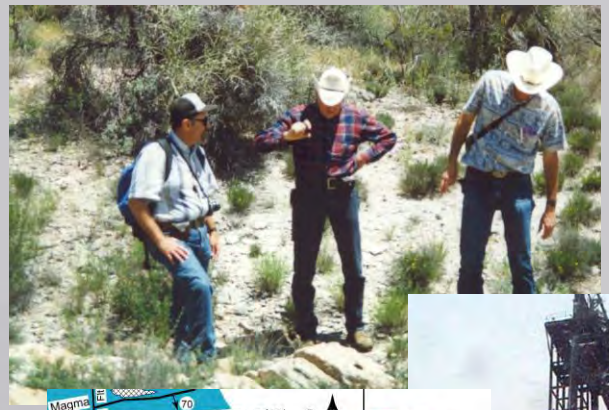
Introduction continued

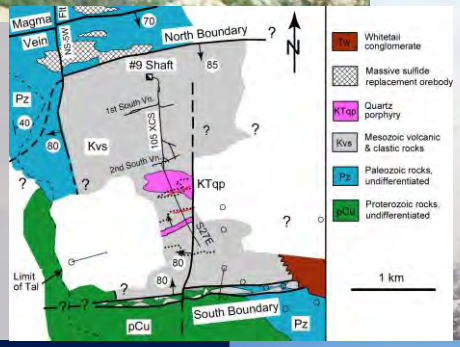
- Mining companies' vertical organizational structure
- Corporate culture setting - typically from top to bottom
- Human factor remains and will be critical in near future
- Corporate cultures follow company structure
- Culture is a soft issue – difficult to change
- Exploration divisions and budgets - commodity price swings and corporate strategy changes

Magma Copper's Cultural Transformation

- Spin-off from Newmont with numerous problems
- Counterproductive tensions between corporate management and production units
- Company management (CEO B. Winter), new leadership vision through cultural transformation (previously Landmark, now Vanto Group)
- Critical changes:
  - empowering lower-level employees
  - enabling miners, metallurgists, and geologists to design and implement their new future
  - accepting employees' vision from the bottom up
- Magma's productivity significantly increased
- Magma went from value-destructive to a profitable organization

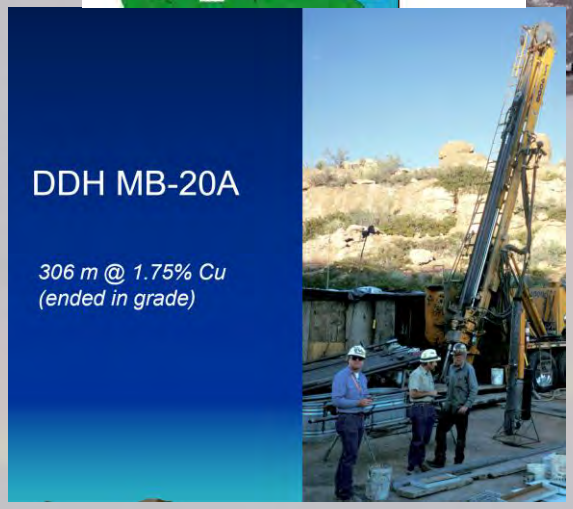
Magma Porphyry (Resolution) Discovery

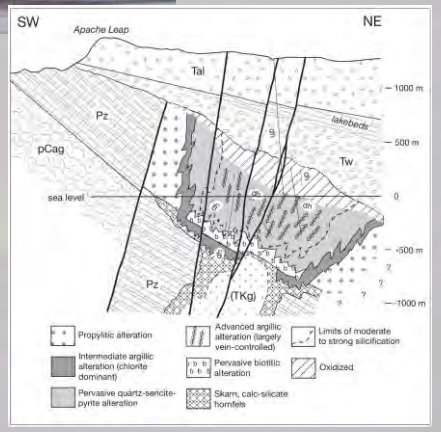




Magma Porphyry milestones:

- Initial concept – search for parallel Magma veins in southern block from shaft 9
- New interpretation of structural geology and persistent deep drilling
- 1995 sub horizontal underground hole S27E intercepted QSP with dense Q veinlets – top of porphyry
- 1996 inclined hole beneath S27E intercepted mineralized porphyry
- 1996 BHP acquired Magma Copper
- 1998 MP resource estimate 500 Mt @ 1.2 % Cu, 0.02% Mo
  - 2001 Rio Tinto's Kennecott Expl. signed earn-in agreement with BHP
  - 2004 Resolution Copper Mining LLC created Rio Tinto (55%), BHP (45%). "Magma Porphyry" was renamed "Resolution"
  - Current mineral resource **1.8 Bt @1.54% Cu** and 0.035% Mo





Magma Porphyry Discovery Team's Approach

- Innovative ideas for geological interpretation
- Bold concept
- Support and encouragement from corporate
- Perseverance for testing new ideas
- Courage to accept new concepts and commit to persistent drill testing
- Ability to change and adjust exploration program under new geological evidence
- Effective teamwork

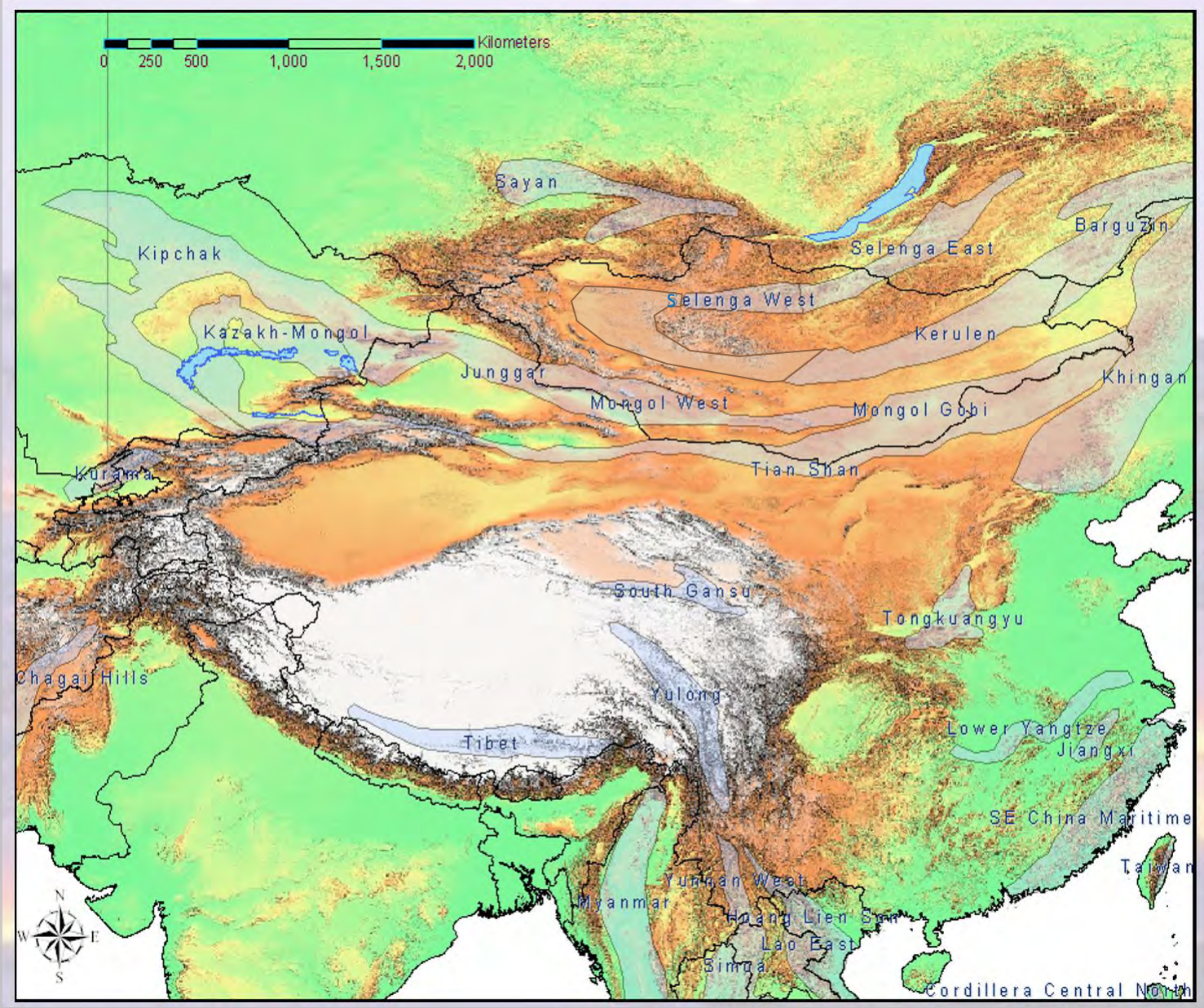
Oyu Tolgoi History Started in Arizona

Superior, AZ

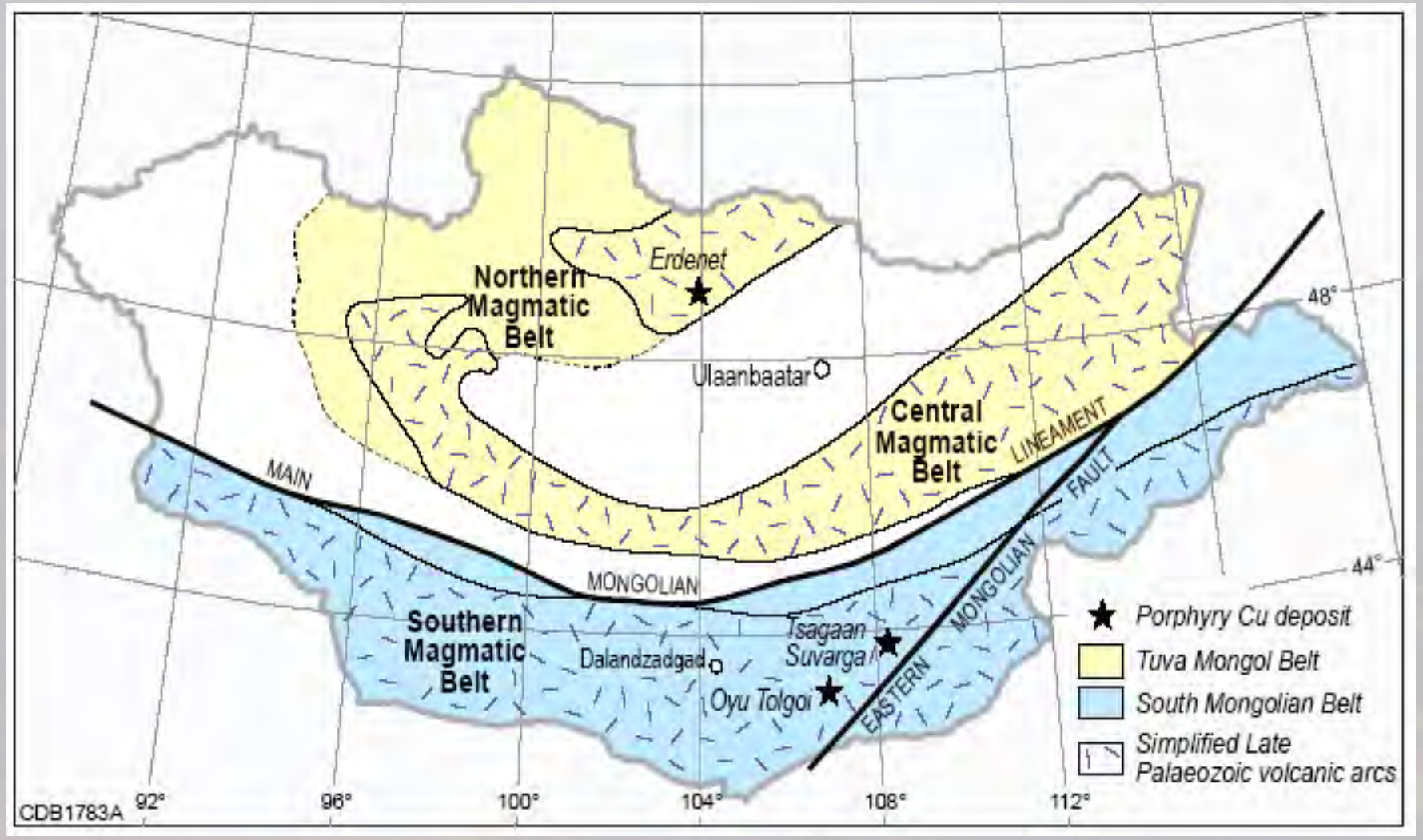
Erdenet Mining invited Magma Copper for joint exploration in Mongolia

San Manuel ISL operation

PZ Volcanic Belts of Altaids



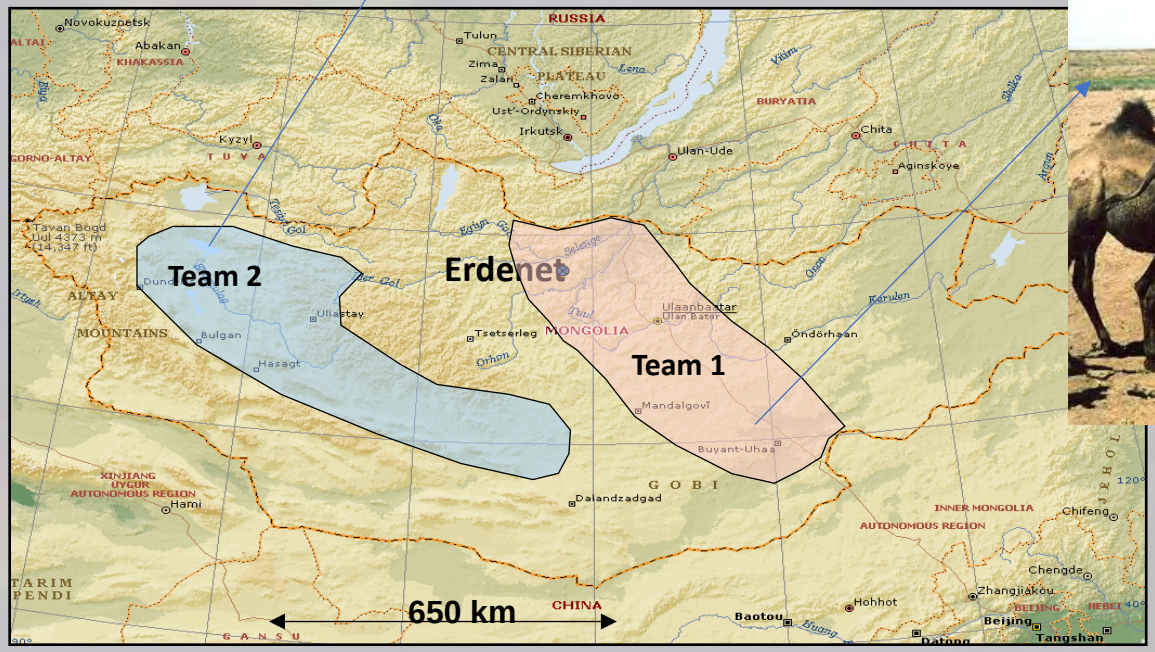
Mongolia Volcanic Belts



First Steps in Mongolia

- April 1995 - Erdenet-Magma JV (50/50)
- May 1995 - Metallogenic database review. Assembling multicultural, diverse team dedicated to discoveries
- Identification of volcanic belts with residual exploration potential
- 75 copper prospects selected for field recon and validation.
- Focus on copper manifestations (porphyry, VMS, skarns, sed-hosted Cu)
- Summer 1995 - two field teams visited 73 various types of copper occurrences across Mongolia
- Sept 1995 – Team strategy discussion
- Strategy change – search for porphyries with secondary supergene enrichment, no copper or only minor copper on the surface
- Focus on large-scale silica-clay alterations
- Southern Mongolian Gobi – favorable conditions for supergene enrichment formation

1995 Field Reconnaissance



Oyu Tolgoi Early-Stage Milestones

- Jan 1996 – BHP acquisition of Magma Copper
- June 1996 – Erdenet-BHP JV dissolved
- July 1996 – BHP continued exploration in Mongolia
- Sept 1996 – Focus on porphyry occurrences with leached caps in the Gobi Desert
- Discovery of Central Oyu leached cap hosted by Paleozoic andesite-basaltic volcanics
- Tenement application for 1,200 sq. km license over main structures and various zones of alteration
- Feb 1997 – exploration license was granted to BHP Mongolian rep office

Gobi Basalt Clippers

Porphyry Exploration Criteria

- Size and quality - porphyries >500Mt @ >1% Cu eq.
- Porphyry systems with grade enhancer
- Concentric alteration zones (potassic core in phyllic zone around it hosted by propylitic envelope)
- Footprint of 1 to 2 km in diameter
- Leached quartz stockwork, hematitic iron oxides, no surface copper sulfides
- Open pittable ore body - relatively shallow <400m deep drilling targets
- Friendly mining jurisdiction, respect for ESG

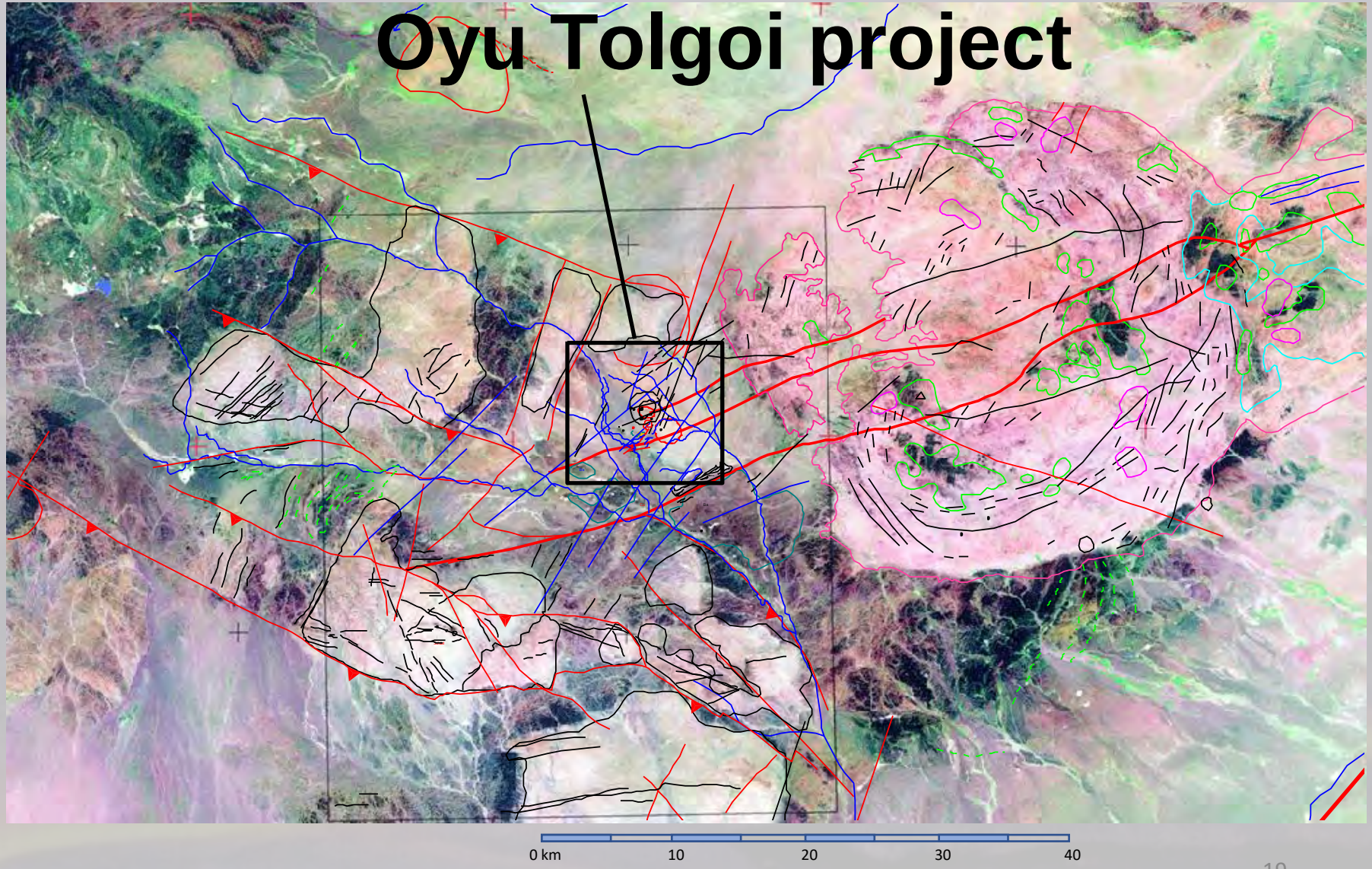
1996 Shuteen iron oxide cap

Central Oyu Leached Cap

OT Early-Stage Discovery Milestones

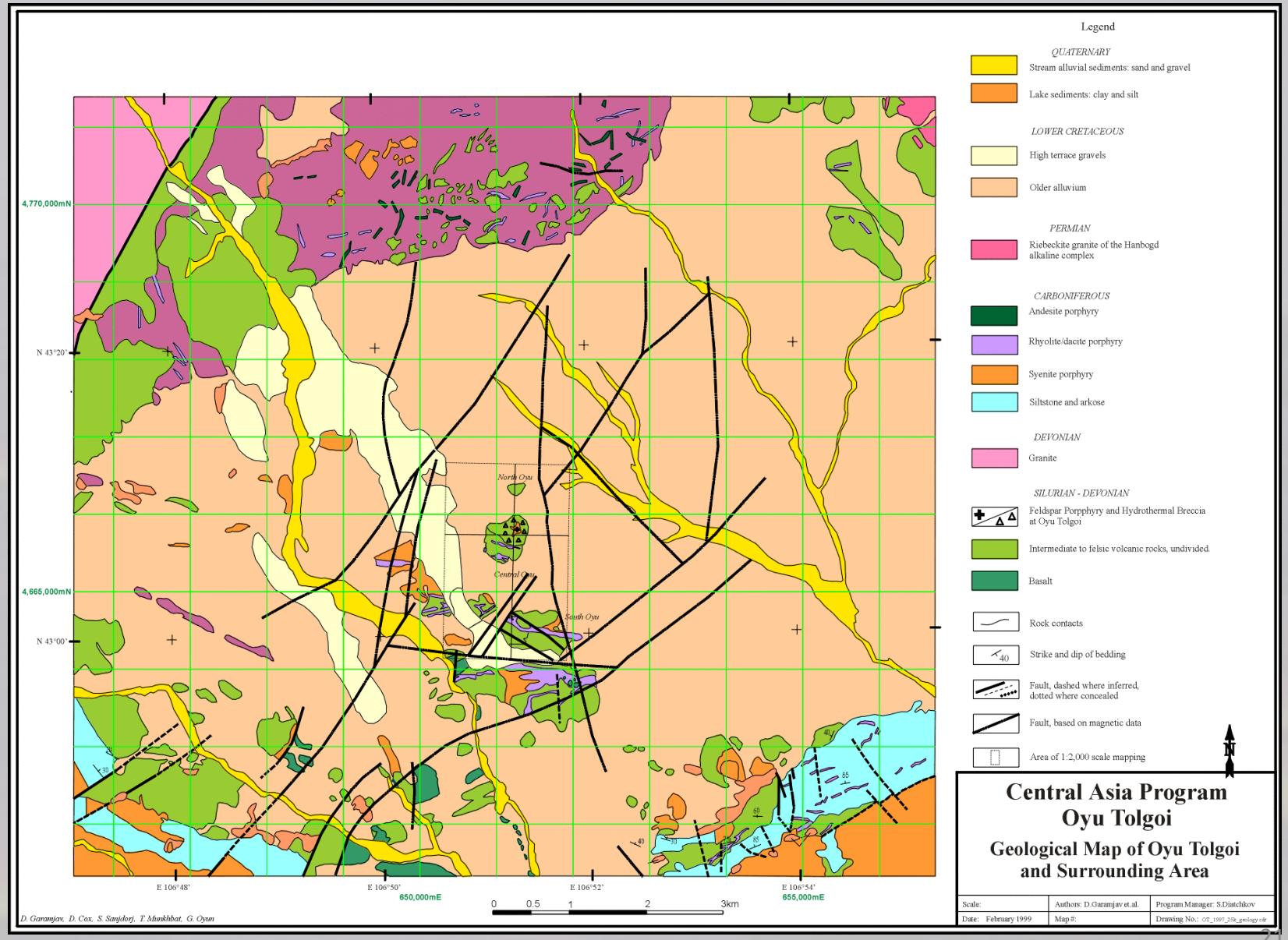
- Apr 1997 – Ground geophysics (mag, grad IP) and rock/soil geochemistry
- May 1997 – 1:10,000 scale geological mapping
- Jul 1997 – Significant magnetic anomaly at South and SW Oyu. IP anomalies over Central Oyu, South, and SW Oyu, with weak anomaly at North Oyu
- Aug 1997 – Rock-chip geochem strong As-Mo anomaly at Central Oyu and Cu-Au anomaly at South and SW Oyu, ambiguous results from soil and stream geochemistry
- Sept 1997 – Selection of most appealing geochemical-geophysical anomalies for drill testing: Central Oyu, South Oyu, and SW Oyu
- Extensive debates about most applicable model: Escondida (supergene) vs Grasberg vs (hypogene mineralization)
- BHP Management's decision in favor of Escondida model

OT District Structures

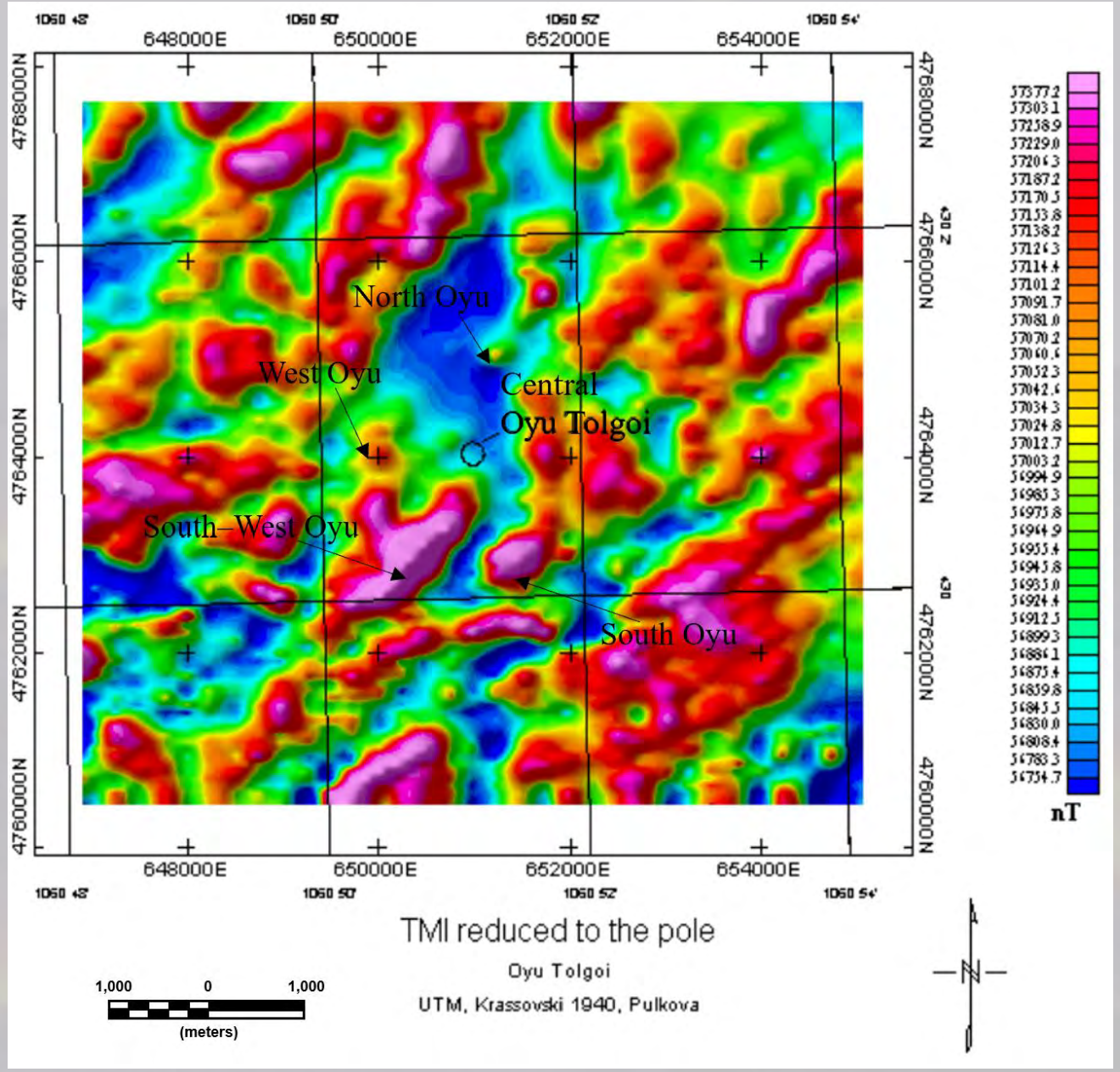


Oyu Tolgoi Camp 1997

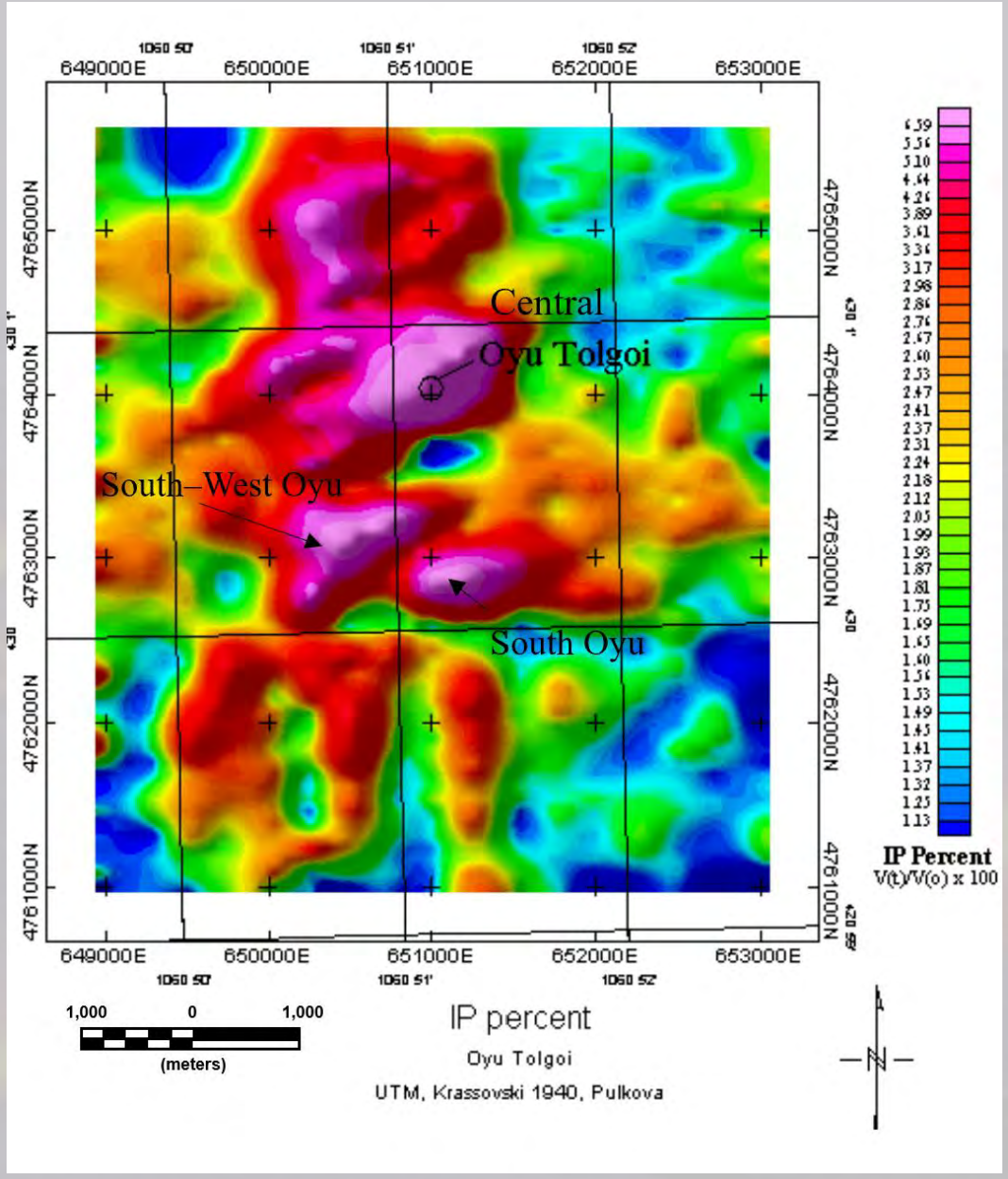
Oyu Tolgoi Geology Map



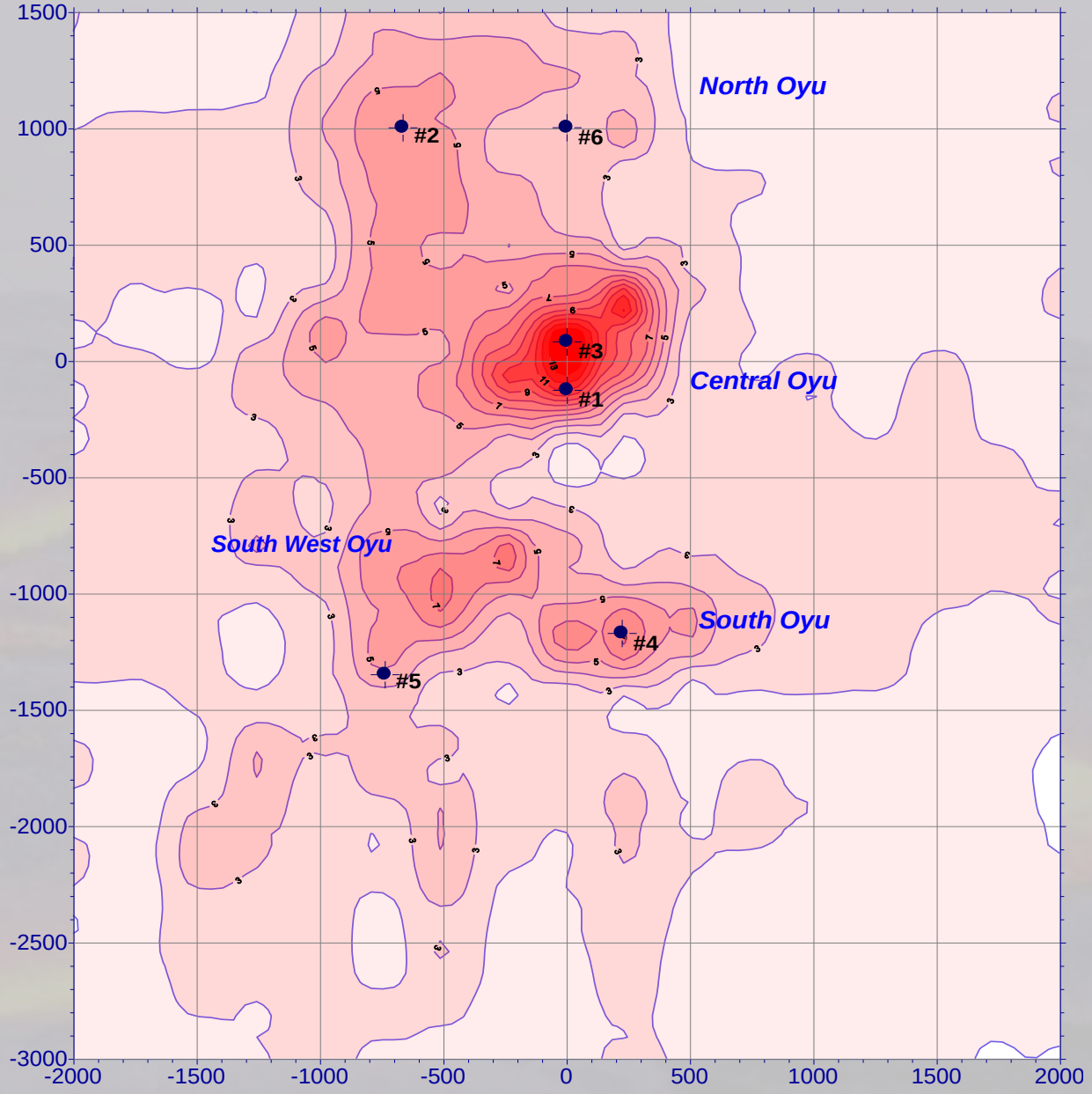
Oyu Tolgoi Ground Mag



Oyu Tolgoi IP Survey Results

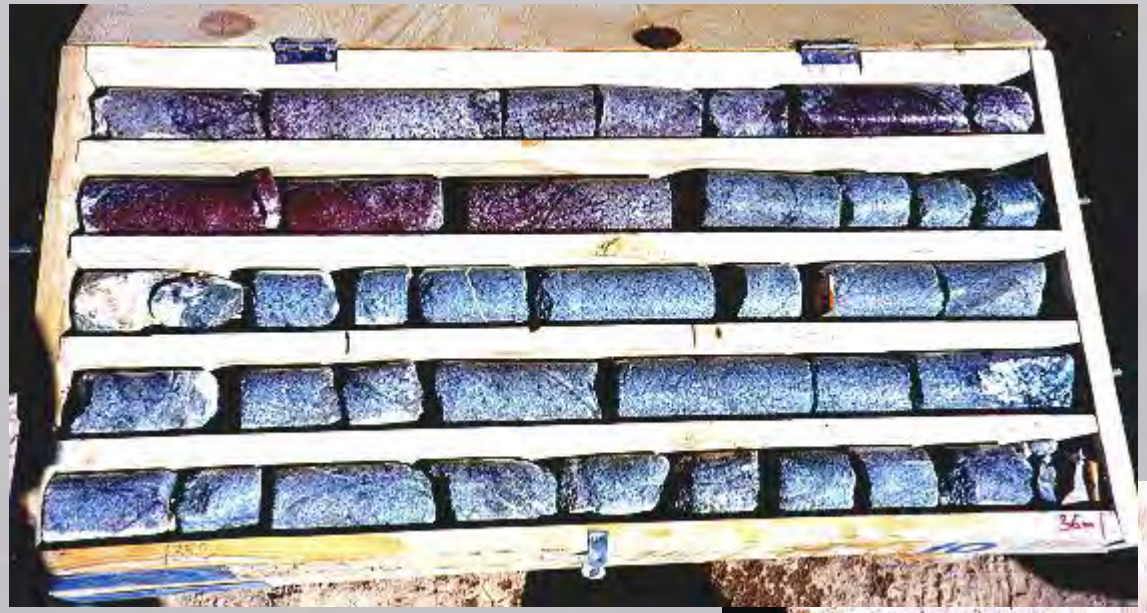


OT Initial Drillhole Location

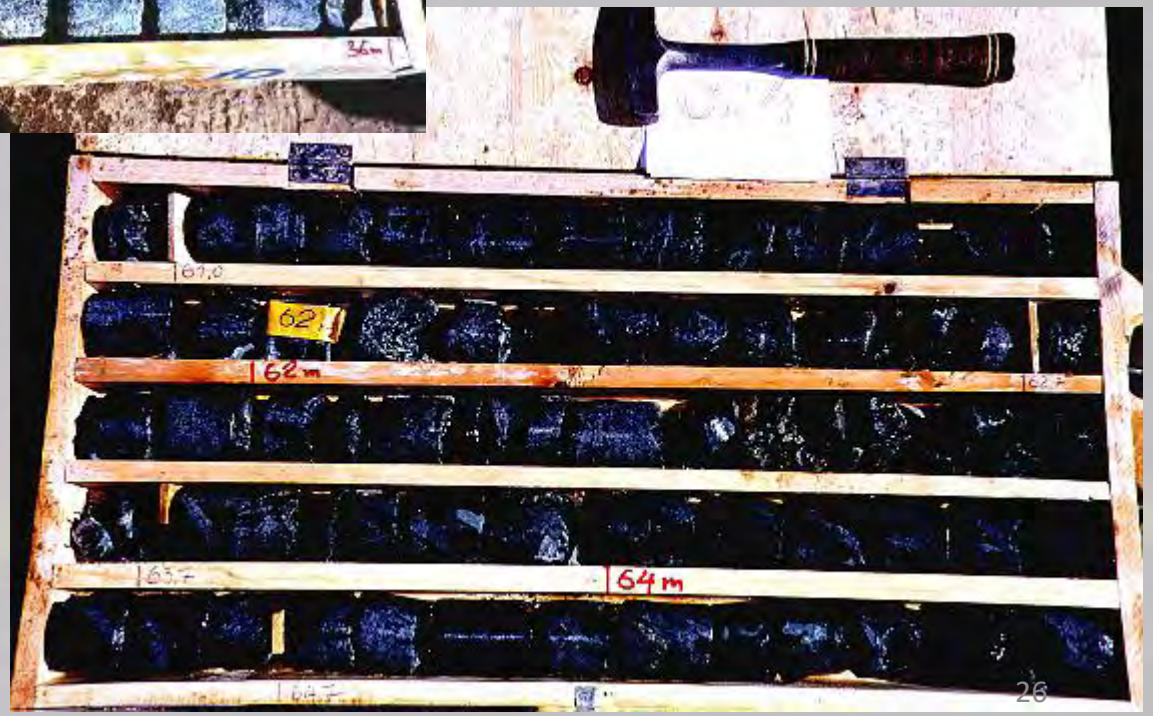


Drilling of Central and South Oyu Tolgoi

Discovery Drill holes OT-3 & OT-4

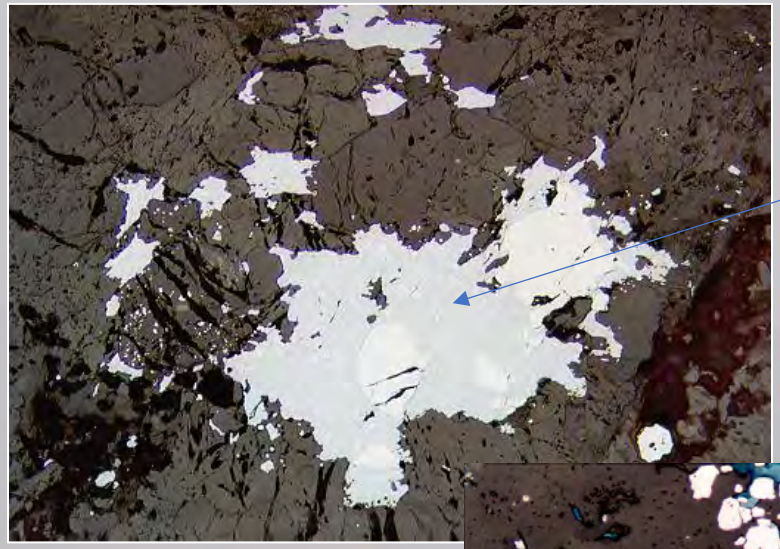


OT-3. Grey-blue - disseminated supergene chalcocite mineralization, red color - hematite



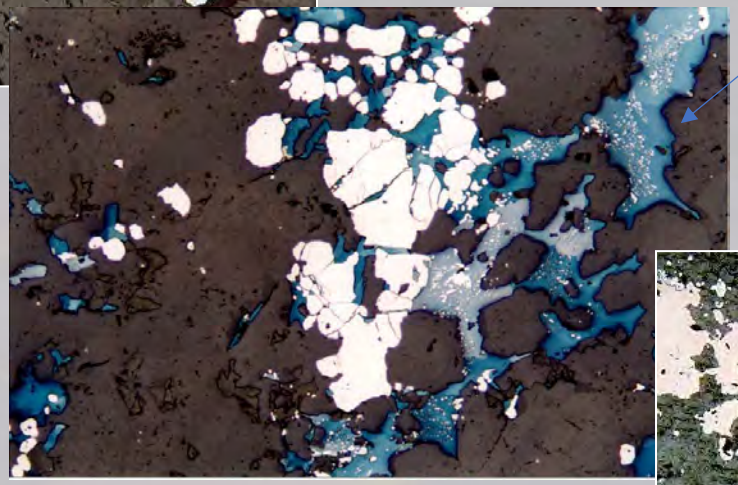
OT-4. Black-blue - quartz-magnetite-bornite hypogene mineralization in stockwork

Oyu Tolgoi Mineralization



Chalcocite mineralization
Central Oyu

Covellite mineralization
Central Oyu



Bornite mineralization
South Oyu

Review of OT First Drill Core

OT Early-Stage Discovery Milestones

- Sept 1997 – drilling start-up. Hole OT-3 at Central Oyu intersected chalcocite horizon **30 m** @ **+ 2.0% Cu**
- Oct 1997 – Hole OT-4 at South Oyu intersected hypogene bornite **73 m** @ **1.65% Cu** & **0.15 g/t Au** – confirmation of Grasberg model
- 1998 – additional ground magnetics, 13 drill hole program. Hole 10 intersected **32 m** @ 0.8% Cu and **1.1 g/t Au**
- 1999 – airborne magnetics. Additional 4-hole drilling program failed to confirm giant chalcocite blanket
- 1999 – BHP reduces its global exploration programs. Oyu Tolgoi was recognized as Tier 2 Cu porphyry deposit and was put up for JV divestment
- Effective low-cost exploration program
- Search for suitable partners (>10 copper companies approached, WMC interested but declined, sole interest from Ivanhoe Mines)
- May 2000 – BHP farms out Oyu Tolgoi to Ivanhoe Mines

OT Estimated Resource

- South Oyu

331 Mt @ 0.48% Cu , 0.30 g/t Au

- Central and North Oyu

107 Mt @ 0.62% Cu, 0.11 g/t Au, 0.01% Mo, including:

Supergene 10 Mt @ 1.1% Cu, 0.1g/t Au

Hypogene: 90 Mt @ 0.58% Cu, 0.08 g/t Au, 0.01% Mo

- Total resource 438 Mt @ 0.52 % Cu, 0.25g/t Au

OT Potential Resource: 1 Bt @ 0.55% Cu, 0.25 g/t Au

Oyu Tolgoi Effective Exploration Methods

Target and purpose	Exploration methods in order of their sequence									
	Regional					Detailed				
	Geological mapping 1:200,000 - 1:50,000	Geochemistry 1:25,000 - 1:5,000	Geophysics							Drilling
			Airborne surveys		Ground surveys					
			Magnetics	Gravity	Seismic	EM	AMT	Electric		
								SP	IP	
Structures	x	x	x		x					+
Porphyry intrusions	+		+	x						+
Mineralization:			x						x	+
Outcropping	+	+	+			+	x	x	+	+
Sub-cropping		x	x			x	x		+	+
Deeply buried							x		x	+

+ most effective
x potentially effective

Oyu Tolgoi Discovery Team

- Dondog Garamjav
- Dennis Cox
- Samand Sanjdorj
- Sergei Diakov
- Tumur Munkhbat
- Sam Carter

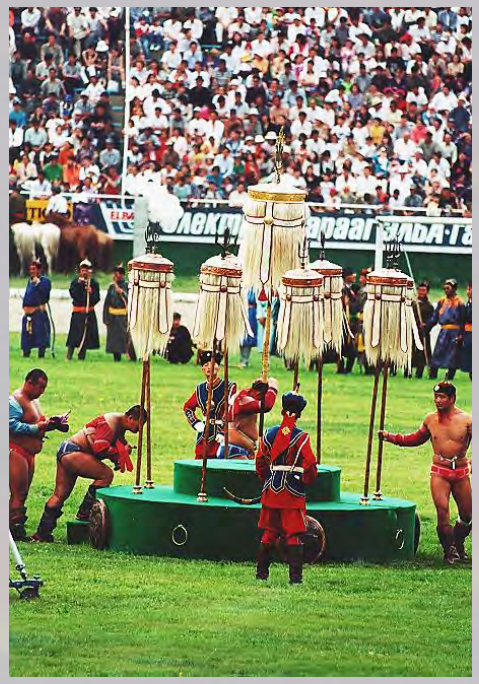
OT Summary – what did not fit the model?

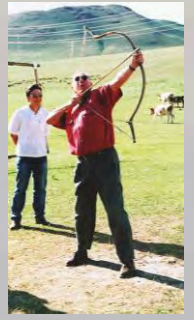
- Porphyry mineralization in Devonian volcanics. Pz porphyry systems in the Altaids volcanic belts remain preserved under Mz cover
- OT – cluster of porphyry centers occurring along the main structural NE trend
- Presence of zones with high hypogene Cu grades (primary chalcocite, covellite, and bornite)
- North Oyu (future Hugo Dummett) ore body was under the post-mineral sediment cover > 200m, totally “blind”
- Several porphyry centers along a major fault structure
- Elongated shape of mineralized stockworks – not a concentric model
- “What you see is what you get” approach can be deceptive

Learnings from BHP OT Discovery

- Exploration team composition
- Favorable Successful Discovery Culture environment
- Innovative approach, new angle of view on previously underexplored terrains
- Attention to subtle features, both project- and district-wise
- Understand geological background and structural history
- Apply modern technology. Select the most efficient exploration tools
- Do not neglect old, still effective tools
- Study both cover and host rocks, and understand their nature
- Multidisciplinary approach for target delineation (remote sensing, geology, geochemistry, geophysics, petrology, and mineralogy)
- Test targets by drilling and review the results vigorously
- Strong teamwork and ESG alignment

BHP ESG Highlights





Mineral Discovery Culture
Multifaceted Crystal

- Discovery-Focused Teams
- Scientific Rigor and Innovation
- Team Dynamics and Diversity
- Strategic Positioning and Market Timing
- Access to Ground and ESG Alignment

Successful Discovery Culture

P I C T

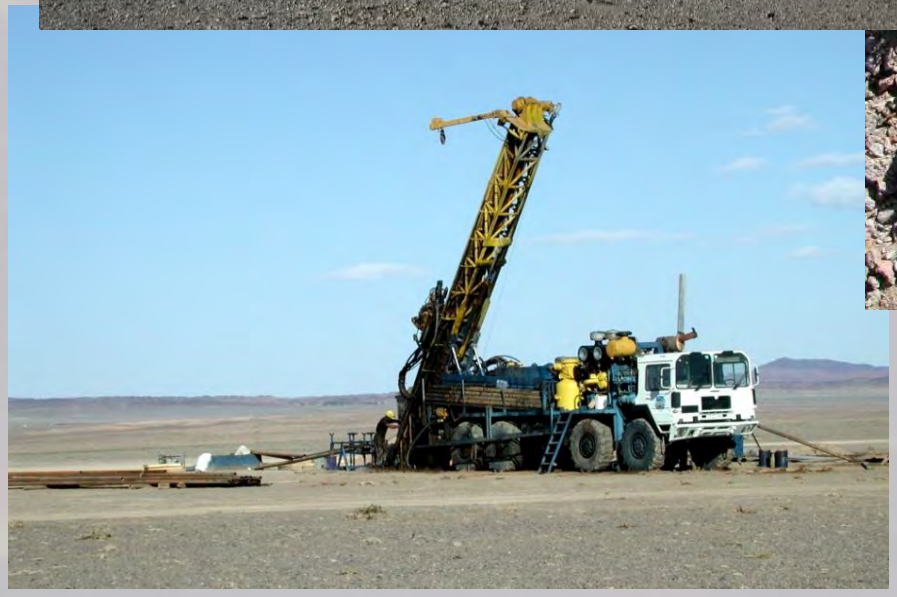
- **P**ersistence
- **I**nnovation
- **C**ourage
- **T**eamwork

Ivanhoe OT Exploration Milestones

- May 2000 – BHP Farmout Agreement with Ivanhoe Mines signed. Local BHP team transferred to Ivanhoe Mines and continued working on OT
- Summer 2000 – Initial drilling program targeted secondary enrichment following BHP footsteps (shallow RC drill holes, areal coverage). Only a small chalcocite blanket found
- June 2001 – Change in exploration methodology from chalcocite blanket to hypogene mineralization (deeper drilling, inclined diamond drill holes)
- July 2001 – Drill hole OTD 150 (duplication of BHP OT-10) at SW Oyu proved copper-gold hypogene mineralization - **508 m @ 1.17 g/t Au** and **0.81% Cu** intercept – recommendation from Garamjav
- Feb 2002 – OT land reduction
- May 2002 – Ivanhoe completes expenditure obligation
- July 2002 – BHP transfers full ownership of OT licenses to Ivanhoe Mines

Deep Drilling at SW Oyu Tolgoi

SW Oyu drilling



Central Oyu leached capping with Q stockwork

Ivanhoe Advancing OT Success

- Sept 2002 – Persistent fence drilling at Oyu Far North
- Oct 2002 - Significant hypogene mineralization intercept **638m @ 1.6% Cu** and **0.07 g/t Au**, including **114m @ 3.58% Cu** and **0.23 g/t Au** - OTD 270 drill hole
- Step up in drilling, powerful drill rigs capable of reaching below 1,000 m depth
- Nov 2003 – Ivanhoe acquired 2% royalty from BHP Billiton, full ownership of Oyu Tolgoi project
- Feb 2004 – Independent scoping study - OT has the potential to become a world-class copper-gold mine
- 2005 – Falcon airborne gravity regional survey – JV with BHP

Hugo Dummett ore body

- Hugo Dummett, SEG President, tragic car accident in South Africa – August 2002
- Cordillera Roundup in Vancouver – January 2003 - Proposal to Ivanhoe to name North Oyu after Hugo
- 2003 – North Oyu ore body became Hugo Dummett deposit
- Mine to be built will be Hugo Mine

Far North - Hugo Dummett Drilling

Photo Ivanhoe Mines

Ivanhoe OT Hypogene Mineral Intercepts

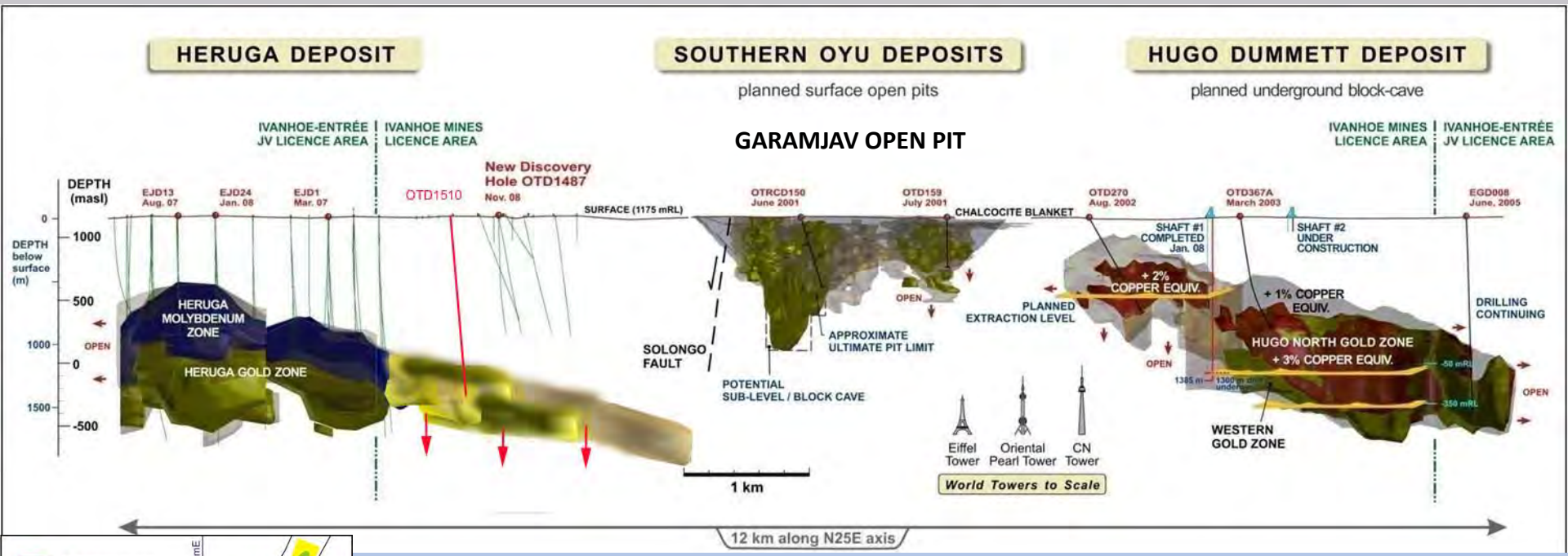
July 2001 – OTD 150 at Southwest Oyu **508 m @ 1.17 g/t Au** & **0.81% Cu**

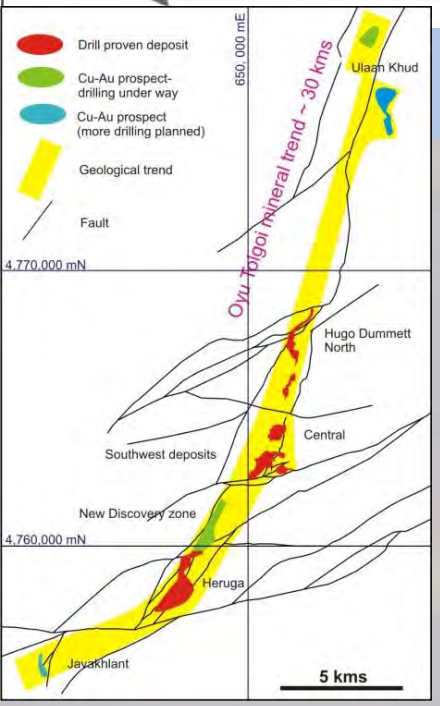
October 2002 – OTD 270 at Far North Oyu **638 m @ 1.61% Cu** & **0.07 g/t Au** below 222 m depth

Photos Ivanhoe Mines

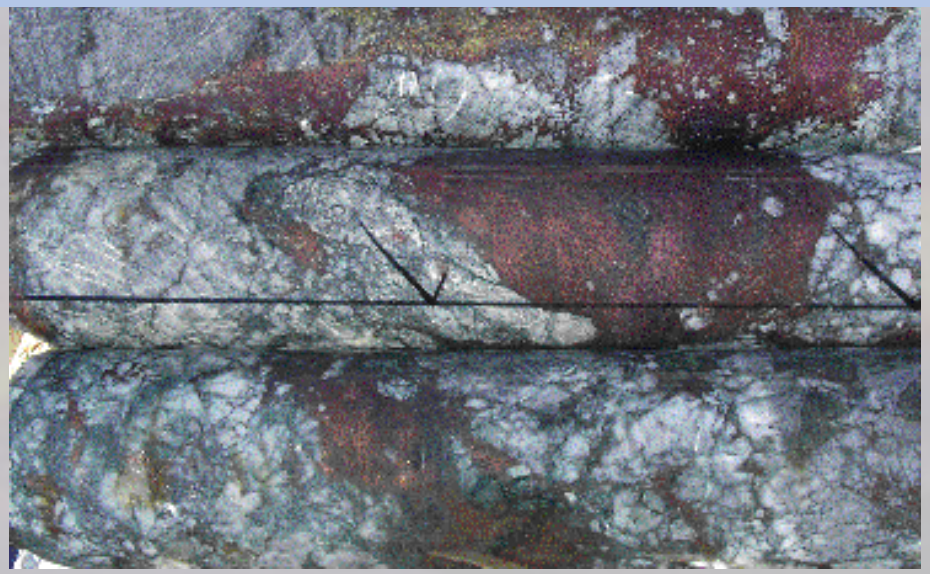
Ivanhoe Advancing OT Discovery – Rio Partnership

- 2006 – Rio Tinto strategic partnership with Ivanhoe Mines
- Oct 2007 – Heruga deposit discovery, Rio Tinto acquires 10% of Ivanhoe's Oyu Tolgoi
- Mar 2008 - Ivanhoe OT project estimated copper resource at 35Mt copper and gold resources at 45.2Moz
- Oct 2009 – Ivanhoe and Mongolian Government signed Investment Agreement to put OT project into production in 2013 by Ivanhoe investing $4B, agreement to 66%/34% interest split
- 2010 – Rio Tinto establishes control of OT through investment in Ivanhoe Mines. Full-scale construction at OT started
- Mar 2011 – Ivanhoe and BHP discovered new shallow Cu-Mo-Au zone at Ulaan Khud, 10 km north of OT. Now OT mineralized trend >23 km
- 2011 – First copper concentrate production from Oyu Tolgoi





Measured and indicated resource of 1,390 Mt at 1.33 % Cu, 0.47 g/t Au, and an inferred resource of 2,200 Mt at 0.83 % Cu, 0.37 g/t Au (at 0.6% $Cu_{eq.}$ cut-off)

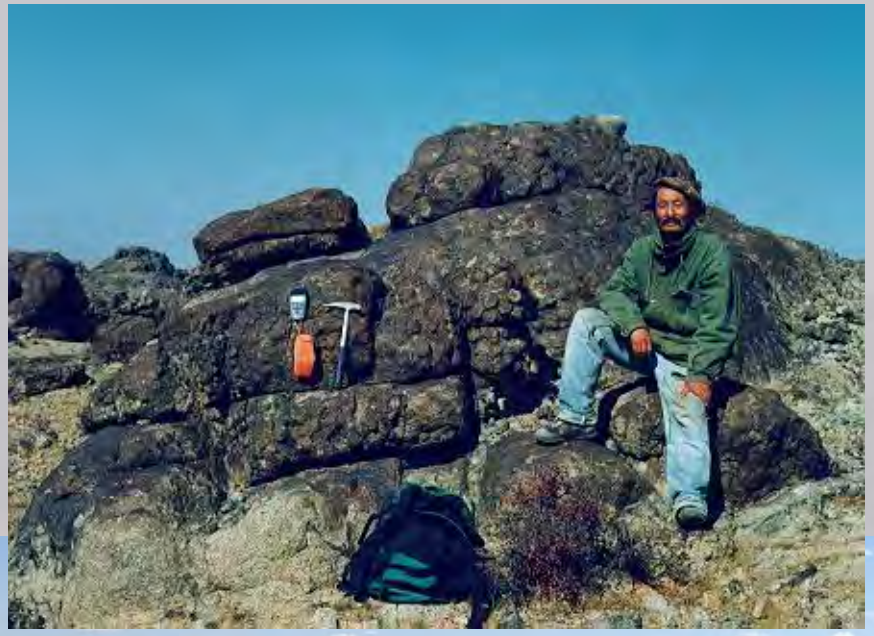


Oyu Tolgoi Resource 2008

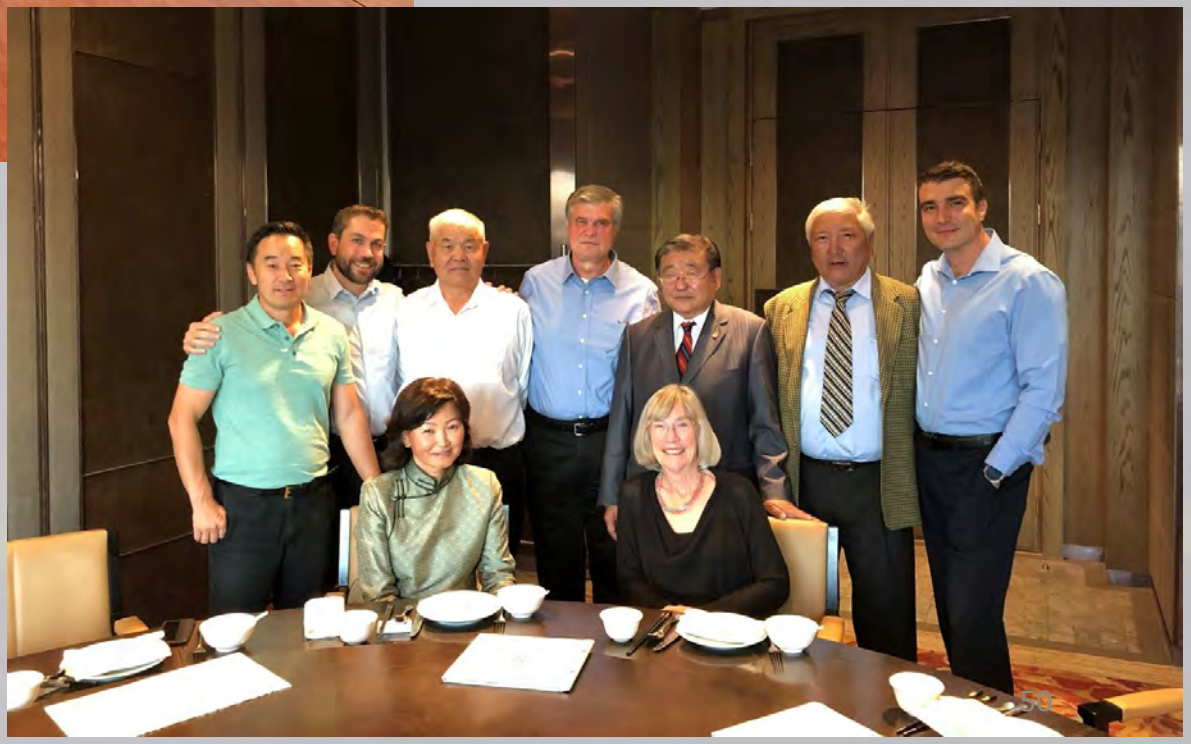
Resource category	Tonnage (Mt)	Cu (%)	Au (g/t)	$Cu_{eq.}$ (%)	Contained metal		
					Cu (Mt)	Au (Moz)	$Cu_{eq.}$ (Mt)
Measured	101.6	0.64	1.10	1.34	0.65	3.6	3.0
Indicated	1,285.8	1.38	0.42	1.65	17.7	17.4	21.2
Measured + Indicated	1,387.4	1.33	0.47	1.63	18.3	21.0	24.2
Inferred	2,157.1	0.80	0.35	1.05	17.2	24.2	22.6

Hugo Mine Production Facility

Oyu Tolgoi Garamjav Open Pit



Reunión with Hugo and Garamjav



Successful Discovery Culture Conclusions

- Assemble right exploration teams
- Implement and hone ingredients of Successful Discovery Culture
- Use case histories/geological models wisely, understand their pros and cons
- Each mineral deposit is unique in its own characteristics
- Each exploration program needs to be crafted to the local geological conditions
- Combination of discovery-focused teams with adequate exploration techniques/tools warrants better chance for discovery of new deposits
- Drilling remains and will be the most effective exploration discovery tool

Successful Discovery Culture

P I C T

- **Persistence**
- **Innovation**
- **Courage**
- **Teamwork**

BCM Resources
Thompson Knolls, Utah

- New Case History in waiting.
- Early-stage porphyry search exploration by a junior company
- Thompson Knolls (TK) - new emerging Cu-Au-Mo-Ag porphyry/skarn deposit in the Great Basin, Western Utah
- Mineralization is fully blind under post-mineral cover
- Drilling tested geophysical mag anomaly
- So far, 12 drillholes - 7 mineralized intercepts, both in porphyry and skarnified carbonate rocks
- TK8 intercept in Cu-Au-Ag skarn **510 ft (155.4 m)** @ **0.66% Cu, 0.12 g/t Au, 7.4 g/t Ag,** including **70 ft (21.3 m)** @ **1.25% Cu, 0.2 g/t Au, 15 g/t Ag**

Selected Images of Mineralized Core

Photo 1. Drill hole TK6 30 ft (9.1 m) interval from 3,400 to 3,430 ft (1,036.3-1,045.5 m) assayed 0.97% Cu, 0.14 g/t Au, 0.086% Mo

Photo 2. TK8 drill hole interval from 2,180 to 2,190 ft (664.5-667.5 m) with intense sulfide-magnetite brecciated marble skarn assaying 1.05% Cu, 0.18 g/t Au, 0.005% Mo

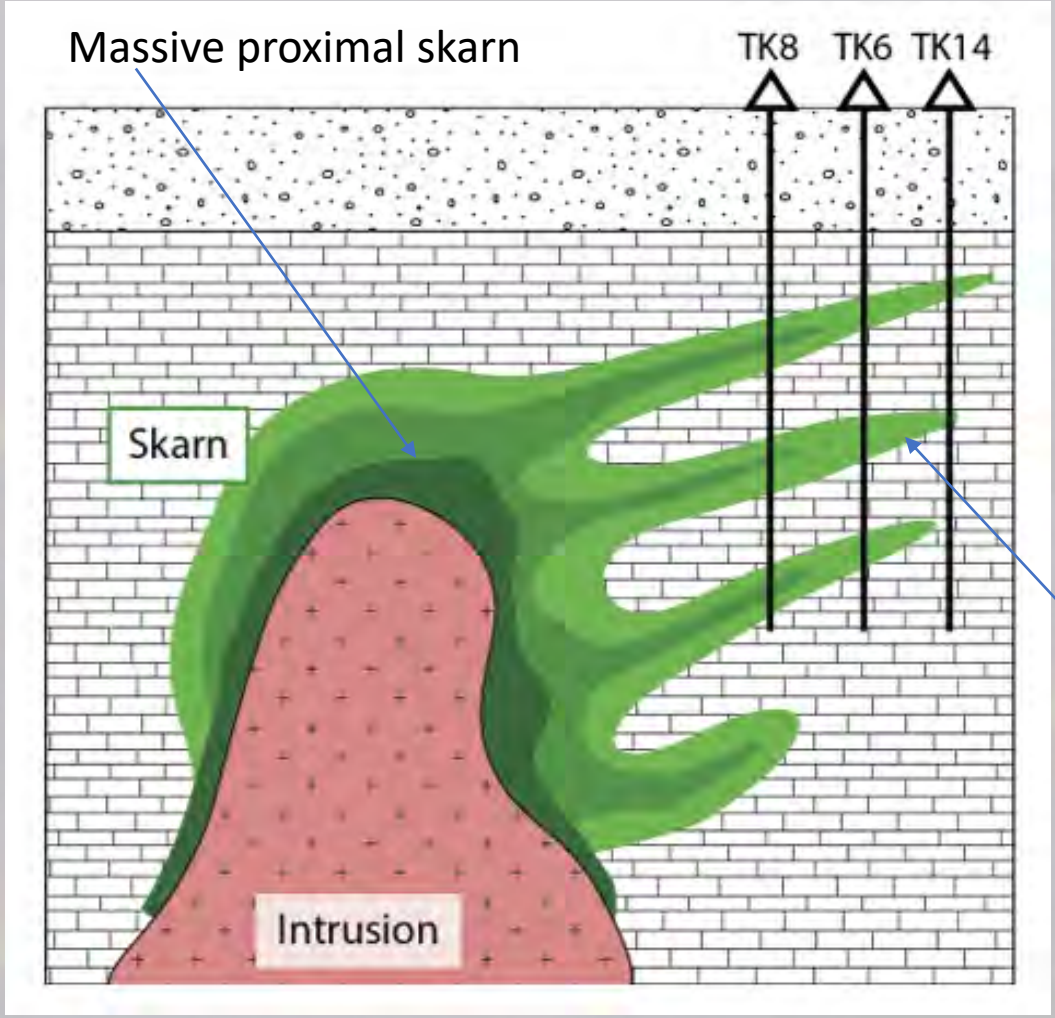
Photo 3. TK8 drill hole 10-ft (3 m) interval from 2,220 to 2,230 ft (676.7-679.7 m) detail with massive sulfide-magnetite-diopside breccia skarn assaying 1.32% Cu, 0.29 g/t Au, 0.002% Mo

Thompson Knolls, Utah

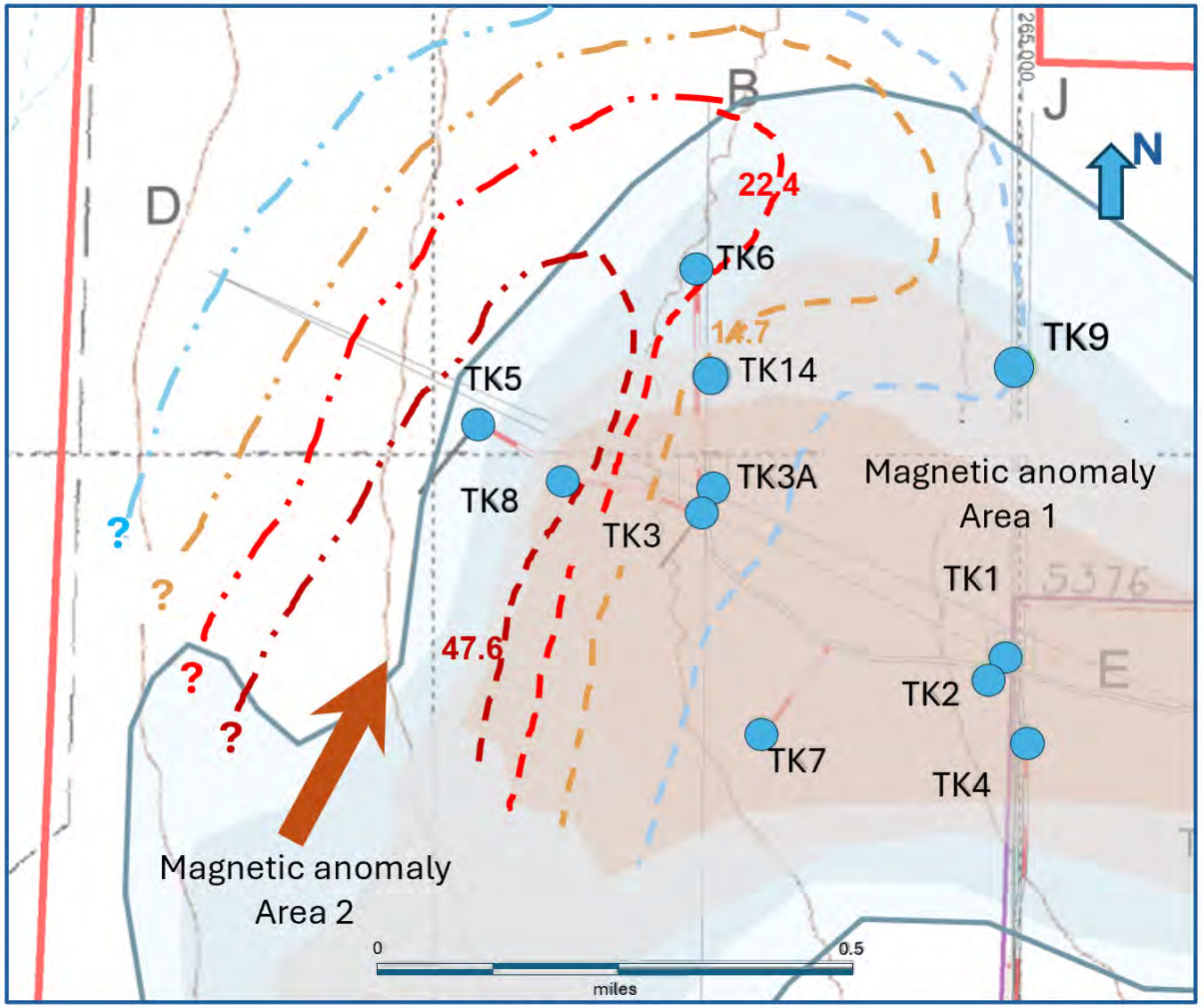
- Favorable TK project location in Western Utah:
  - Utah globally best mining jurisdiction
  - excellent infrastructure in proximity to existing railroads
  - sparsely populated desert area
  - very supportive local farming population
  - no surface waters, water sources available nearby
  - no endangered species
  - easy mine-permitting
- Research analysis by CASERM (CSM) - BCM's drilling so far intercepted distal skarn and marginal porphyry
- Analytical results indicate fluid movement vector during porphyry/skarn mineralization was from SW to NE
- BCM additional drilling SW of TK8 will test new concept

Schematic Geological Model of Thompson Knolls Porphyry/Skarn System

Looking NW



Mineralizing Fluid Movement



Legend

TK Mag anomaly

a b Base metal ratio isolines:
a) supported by drilling results
b) interpreted extensions

Vector of fluid movement

New Discoveries Still Waiting for Persistent Innovative Courageous Smart Exploration Teams

Recommended reading sources

1. S. Zaffron and D. Logan “Three Laws of Performance” https://threelawsofperformance.com/

2. Steve Zaffron, Mary Poulton, Olga Loffredi, and Eric Seedorff. “The New Face of Mining; Breakthroughs in results leveraging the people factor.” Mining Engineering, October 2019

https://smenet.blob.core.windows.net/smecms/sme/media/smeazurestorage/publications/_me-web-small-oct-2019-final.pdf

3. Sergei Diakov, Samand Sanjdorj, Galsan Jamsrandorj. “Discovery of Oyu Tolgoi

A Case Study of Mineral and Geological Exploration.” November 2018, Elsevier Publisher
https://shop.elsevier.com/books/discovery-of-oyu-tolgoi/diakov/978-0-12-816089-3

For more details on BCM’s Thompson Knolls Project in Utah, visit https://bcmresources.com/