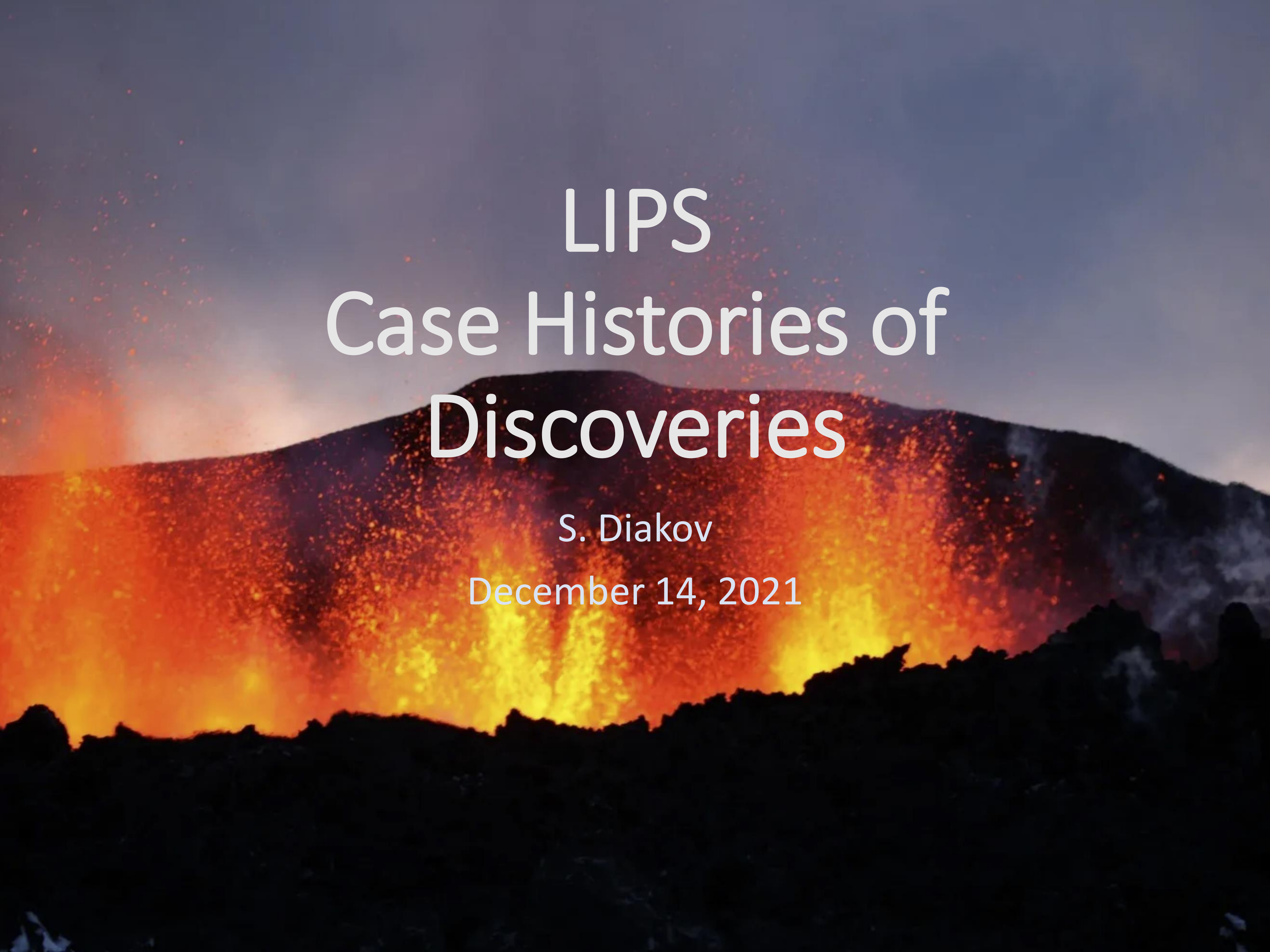


LIPS
Case Histories of Discoveries

S. Diakov

December 14, 2021

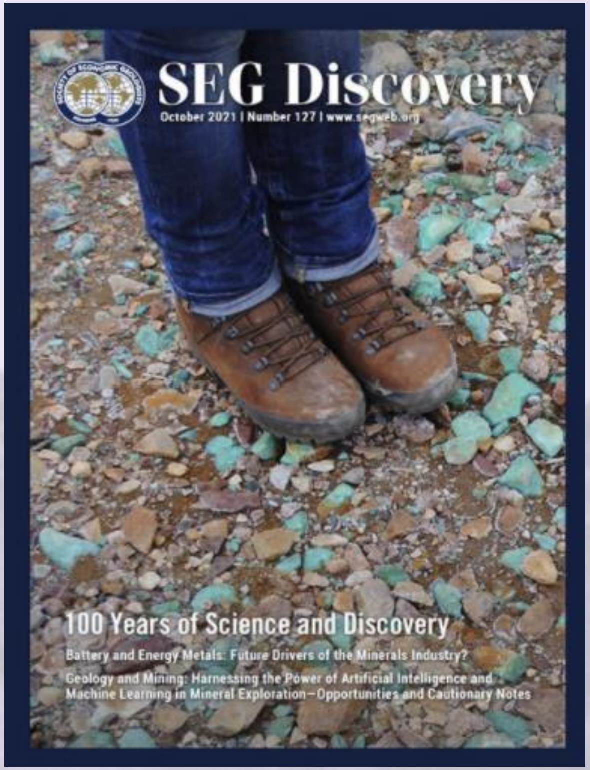
Content

- Introduction
- Global Mineral Exploration – current status of business
- Why case histories of successful discoveries are important?
- Examples of case histories:
  - Mafic LIP – Norilsk
  - Silicic LIP – Oyu Tolgoi
- General remarks
- Conclusions

Introduction

Why case histories?

- Instructive, source of good learnings from past discoveries
- Similarity and analogues
- Each deposit is individual and unique despite some similarities
- Selection of effective exploration techniques/tools crafted for the given geological situation

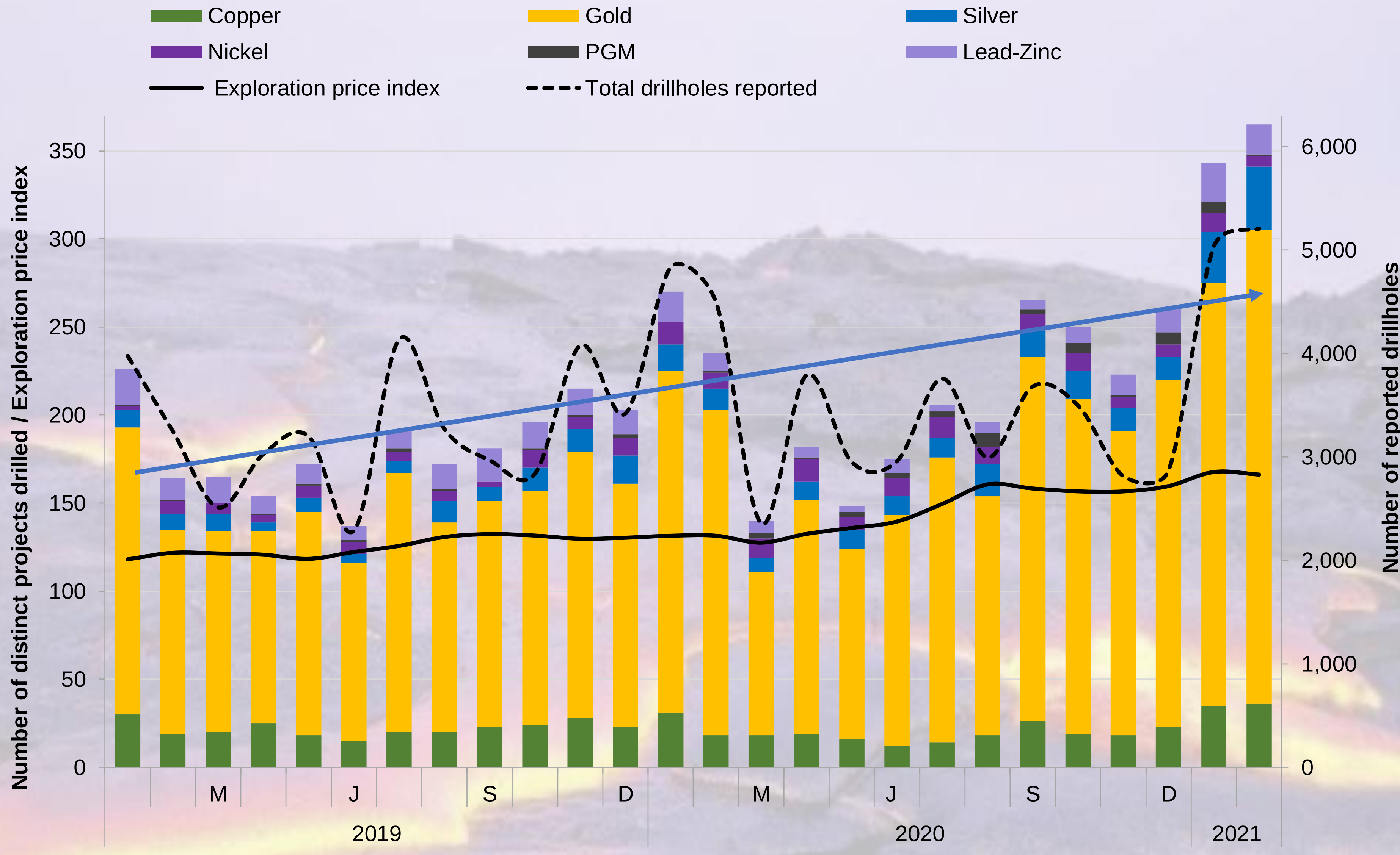


- Exploration tools tested by successful application in the past exploration
- Testing of geological models and concepts
- Each case history is also individual as most deposits are but present valuable lessons for exploration challenges

Case Histories – D. Lowell

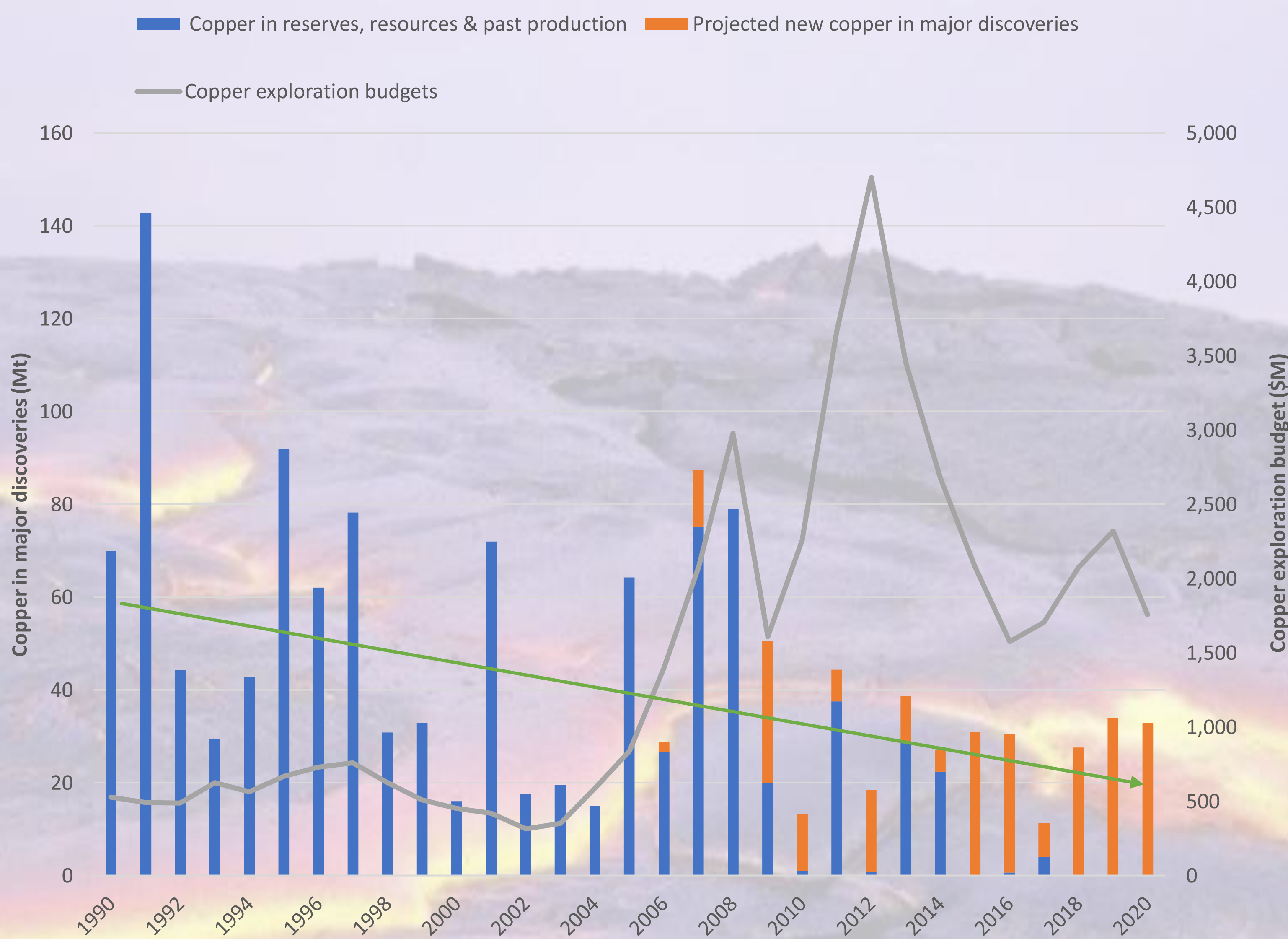
- Exploration maturity of the globe. Outcropping targets have been tested to various degree
- Deposits remaining to be found are either completely covered by postmineral formation or overlain by non-ore pre mineral rocks
- Future discoveries will require greater use of indirect techniques – geological projection, geochemical and geophysical work
- Efficacy of exploration methods (geochemical and geophysical) reduce progressively with depth
- Discoveries are a subjective matter, they result from team efforts of geologists, supported by various level of management, sometimes aided by geophysists and geochemists
- Deeper exploration will require more intensive drilling

Global Exploration Drilling



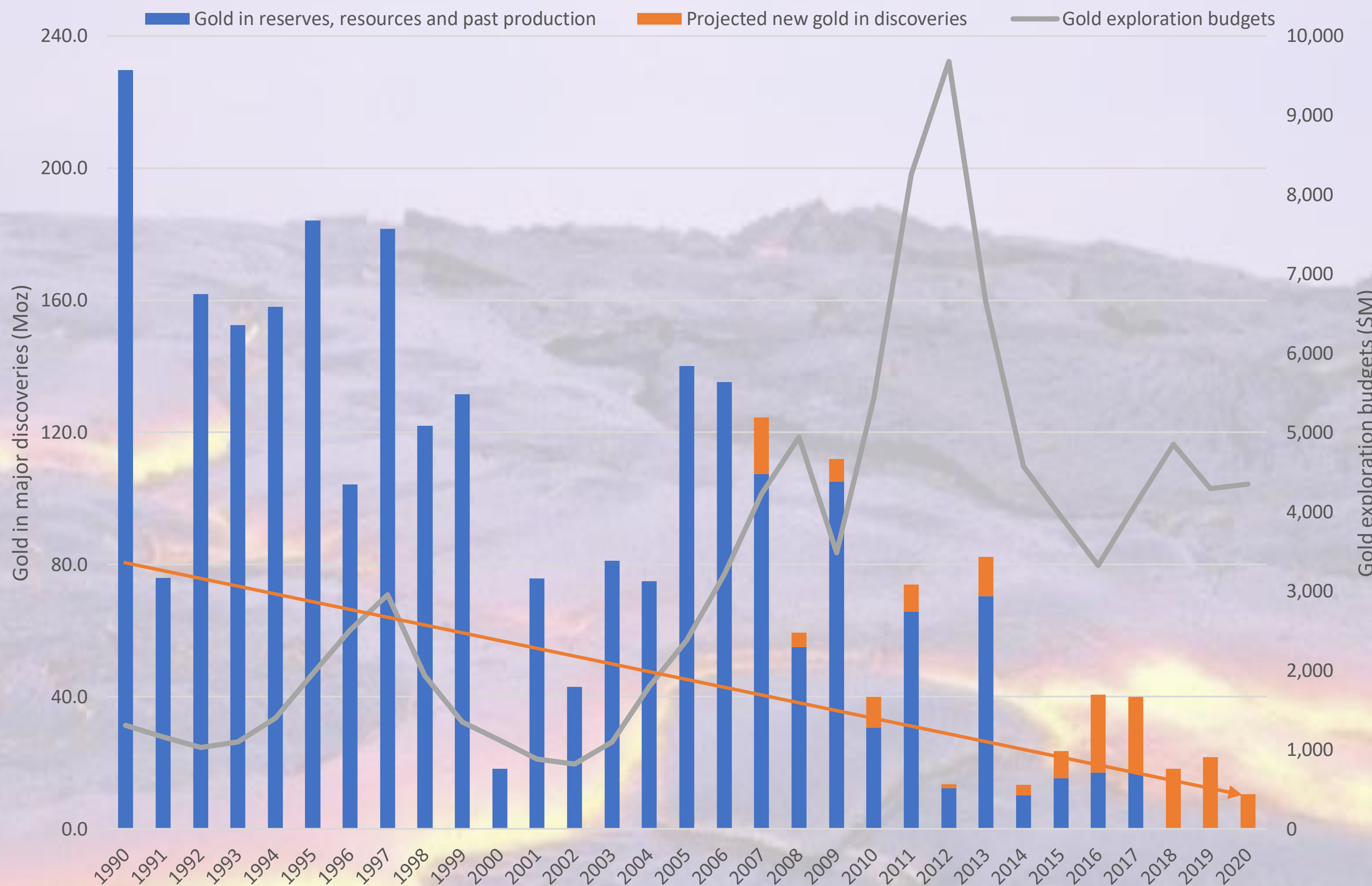
Source: S&P Global Market Intelligence
Data: February 2021

Global Copper Discoveries



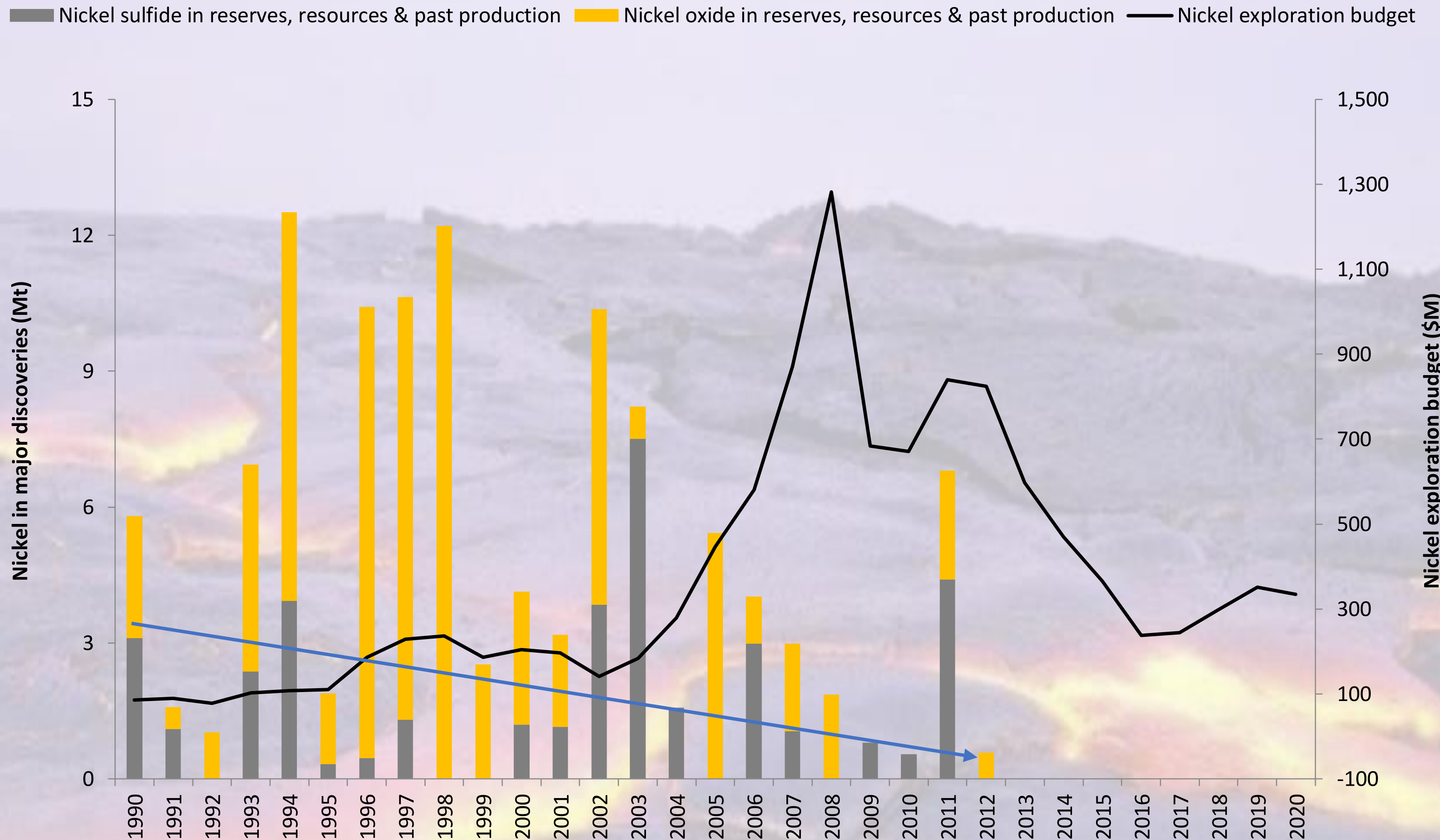
Source: S&P Global Market Intelligence
Data: April 22, 2021

Global Gold Discoveries



Source: S&P Global Market Intelligence
Data: June 24, 2021

Global Nickel Discoveries



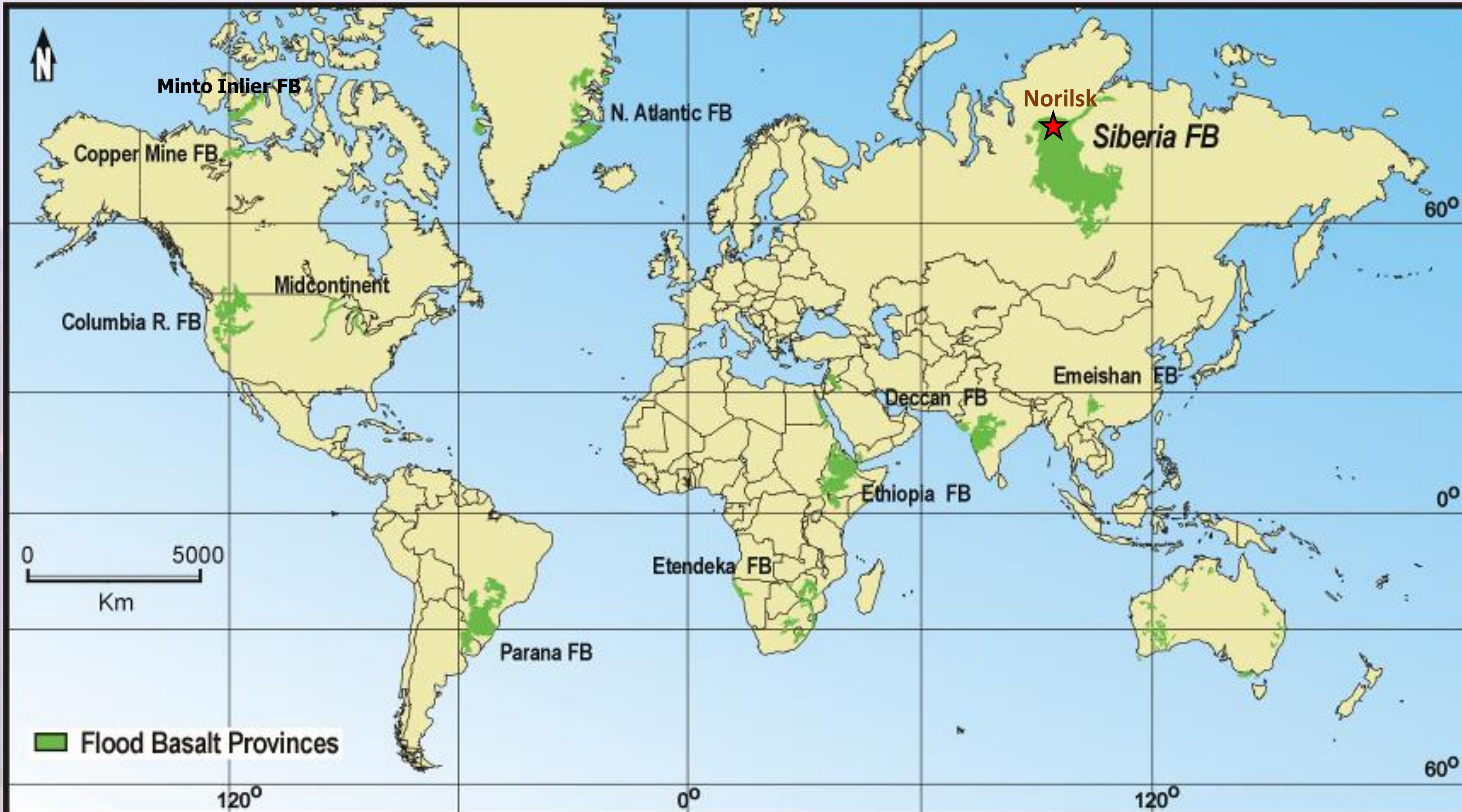
Source: S&P Global Market Intelligence
Data: June 25, 2021

Case Histories General Notes

- Exploration techniques progressed significantly in the past decades
- Traditional geophysical (IP, MT, gravity, seismic) and geochemical (gas, bio, BLEG, mobile elements) methods advanced
- Many aspects old discoverers encountered are still essential in modern days and becoming even more challenging as exploration is going deeper
- Different types of pre-mineral and post mineral cover:
  - Thickness of the cover
  - Physical properties
  - Geochemical features
  - “Active” vs “passive” cover
- Deep exploration tools require greater depth penetration, finer detection limits and better efficacy (including economics)
- Adequate geological models

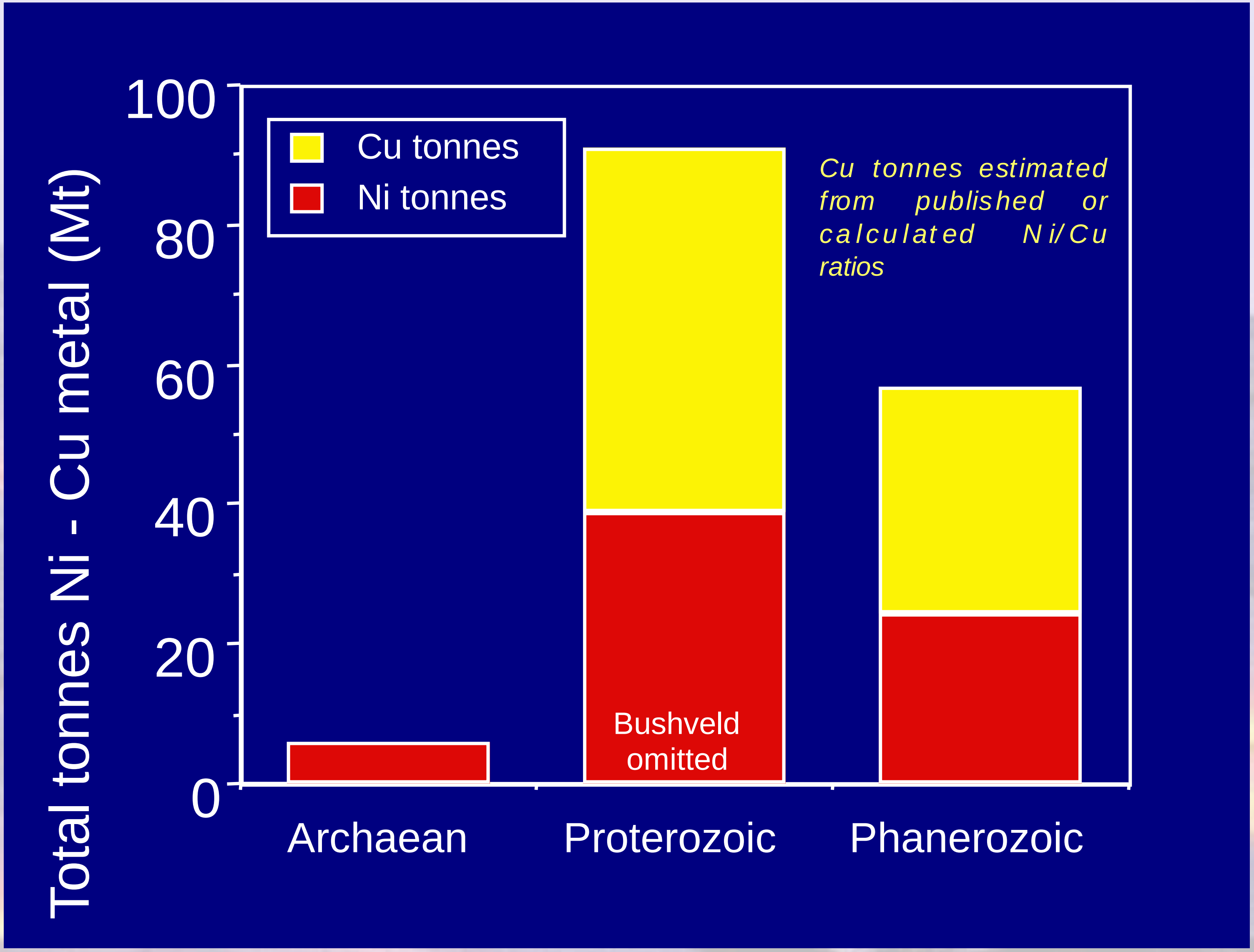
Mafic LIPs
Norilsk Discovery Case History

Global Flood Basalt Provinces



After Coffin and Eldhom, 1994 and Chorlton, 2000

Ni-Cu-PGE Deposits in Time

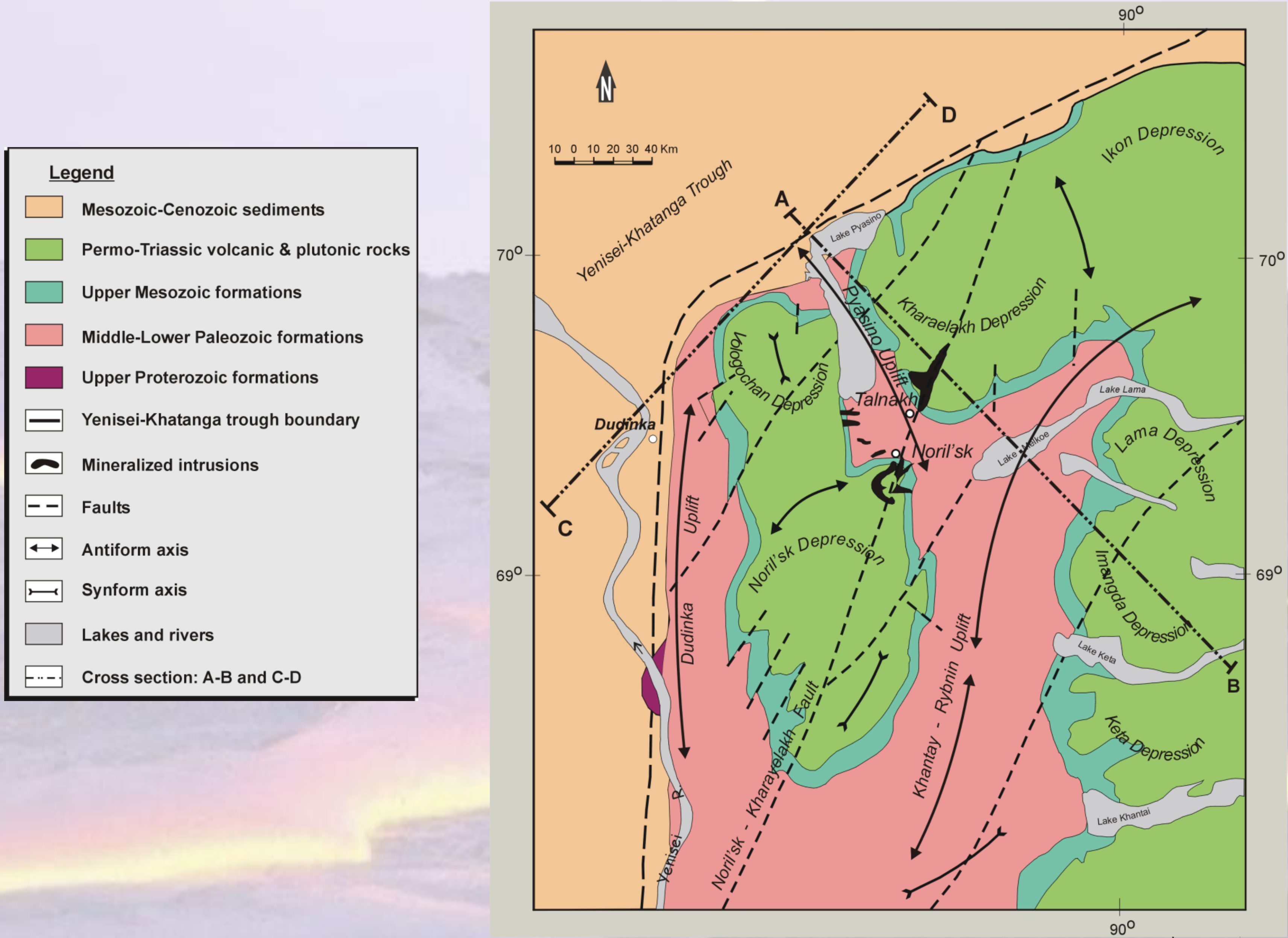


Norilsk Regional Geology Summary

- Location - NW extreme of the Siberian Platform, stable craton since the end of the Precambrian
- Basement - Proterozoic metamorphic rocks. Above lower Paleozoic marine sediments 3 to 9 km thick, Devonian carbonates, sulphate-rich evaporites
- Carboniferous-Permian continental sediments (20 to 600 m coal beds)
- ~4 million km^3 (2 to 4 km thick flood P-T basalts (Siberian traps)
- The basalts and feeder intrusions form elliptical "troughs" from 50 to 150 km in length and from 40 to 90 km in width *volcano-plutonic depressions* (VPD)
- VPDs possibly formed during discharge of lava from magma chambers
- Volcanic sequence thicknesses increase towards the center of the depression
- Lower part of the volcanic rock sequence is characterized by presence of high-magnesium basalts and alkaline hyper basic basalts

(Diakov, 2001)

Norilsk Regional Geology



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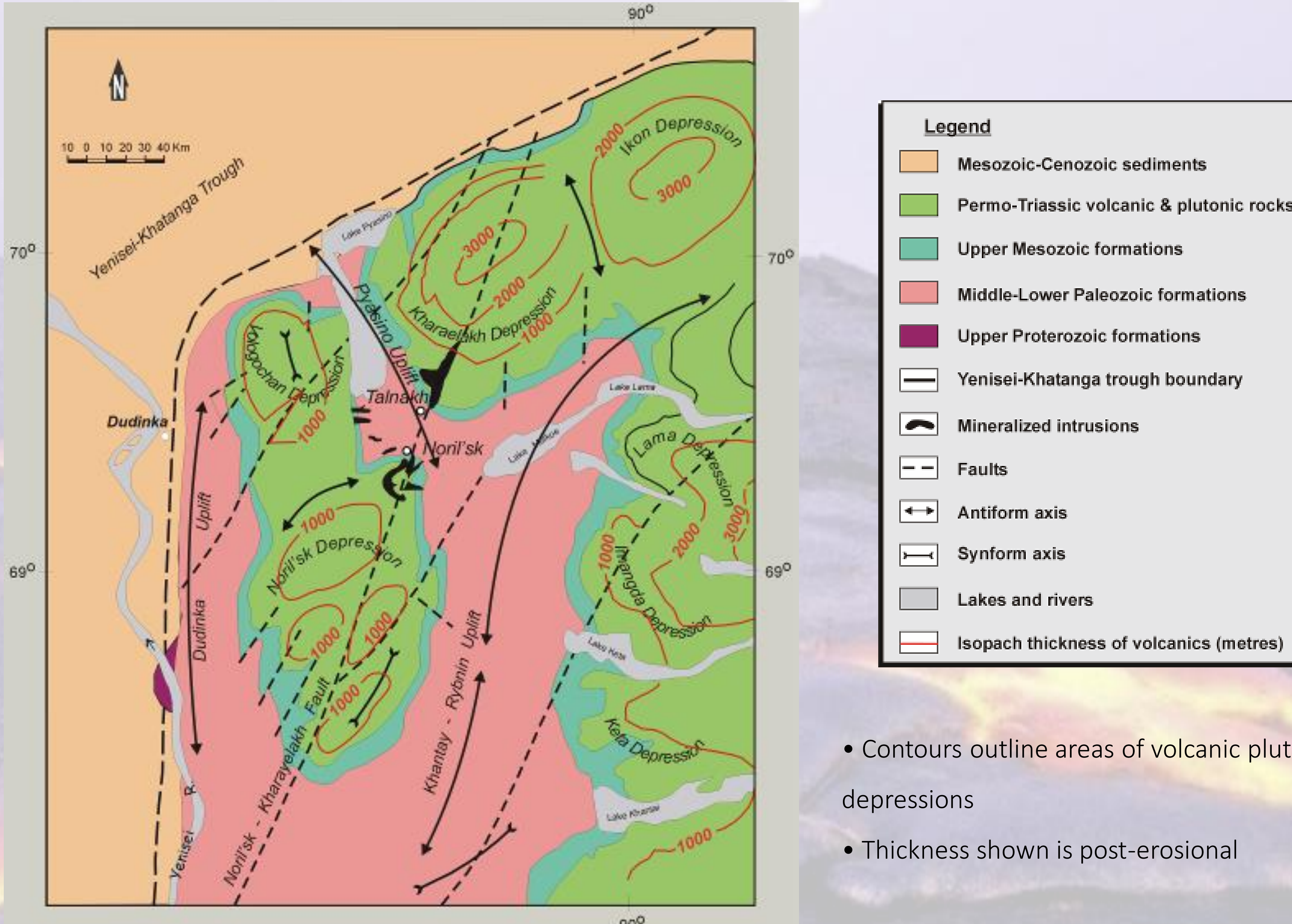
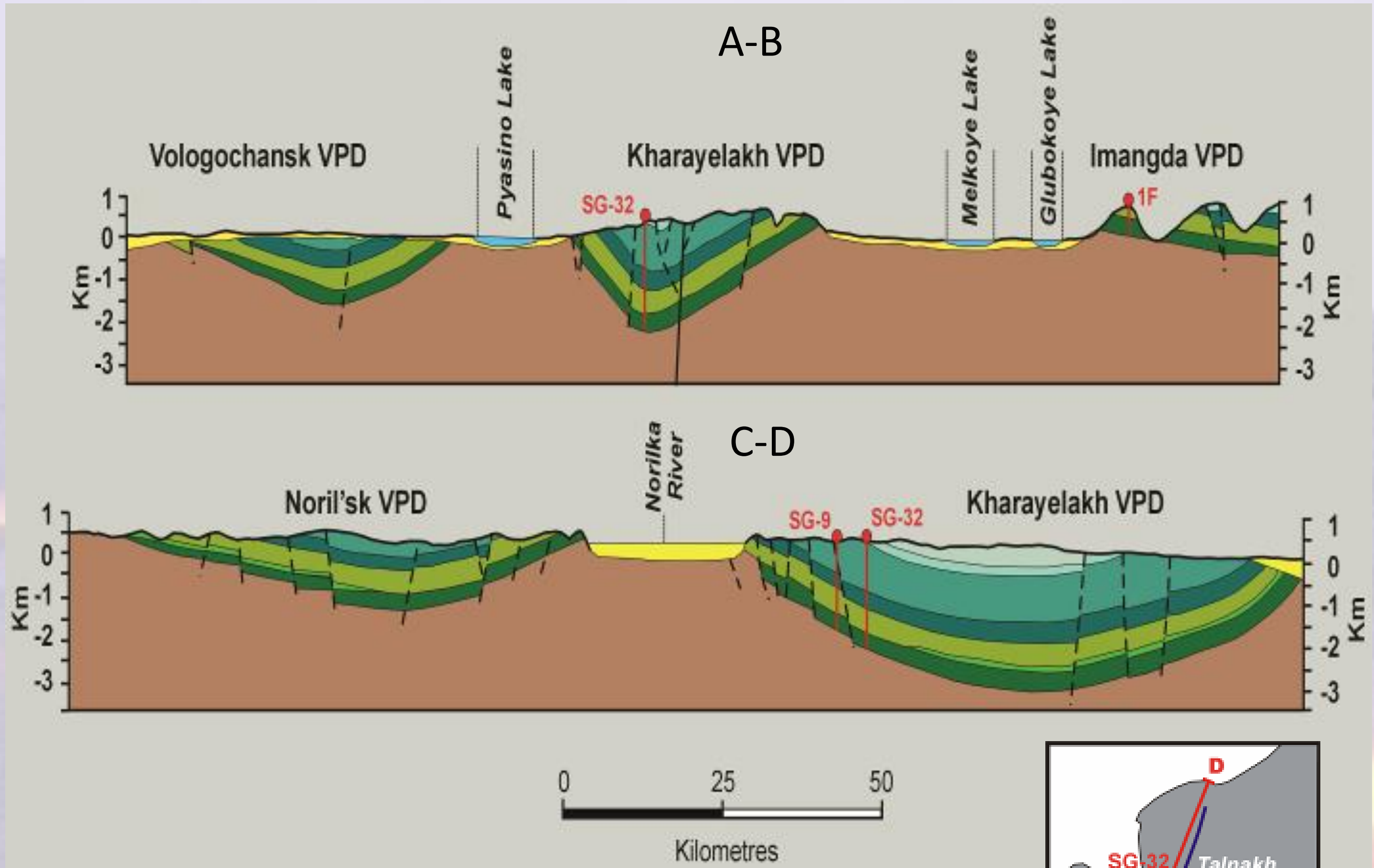
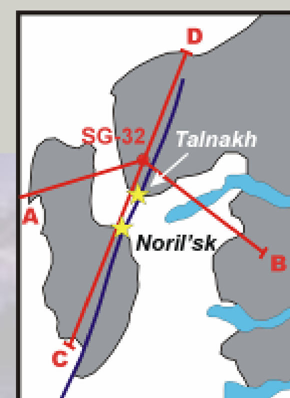
Distribution of Volcanic Thickness

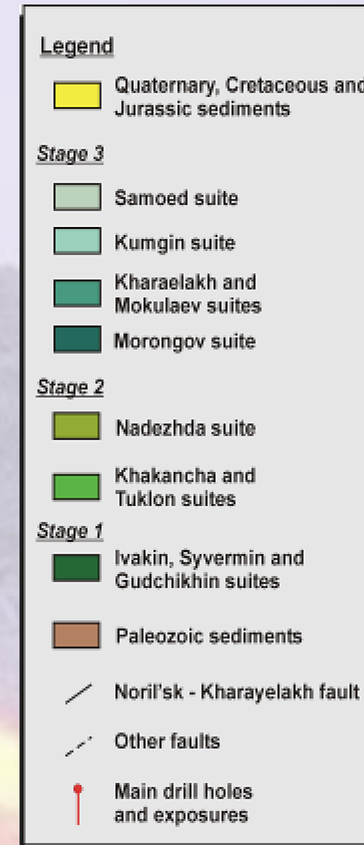


- Contours outline areas of volcanic plutonic depressions
- Thickness shown is post-erosional

Cross Sections through Main VPDs

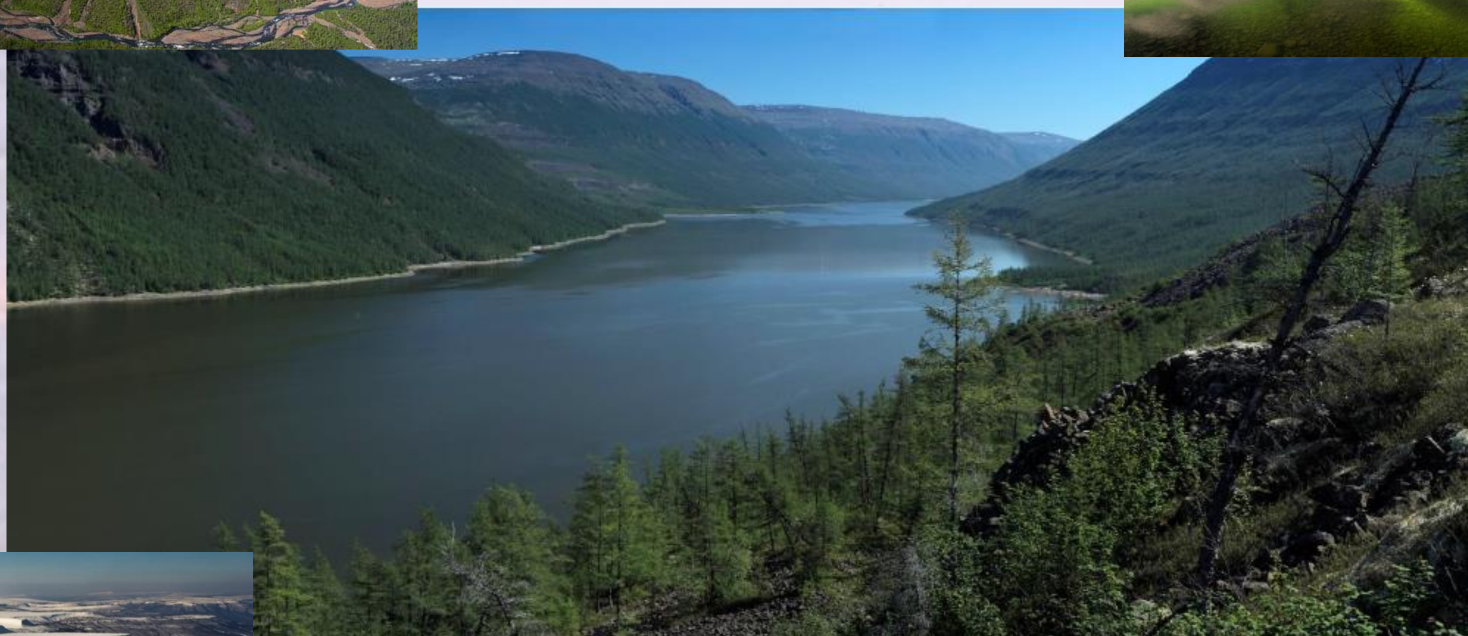


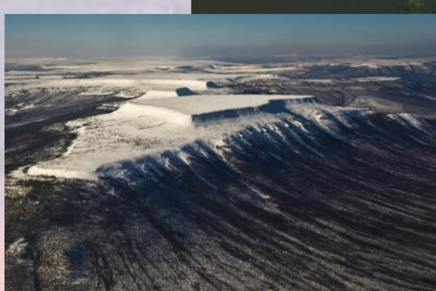




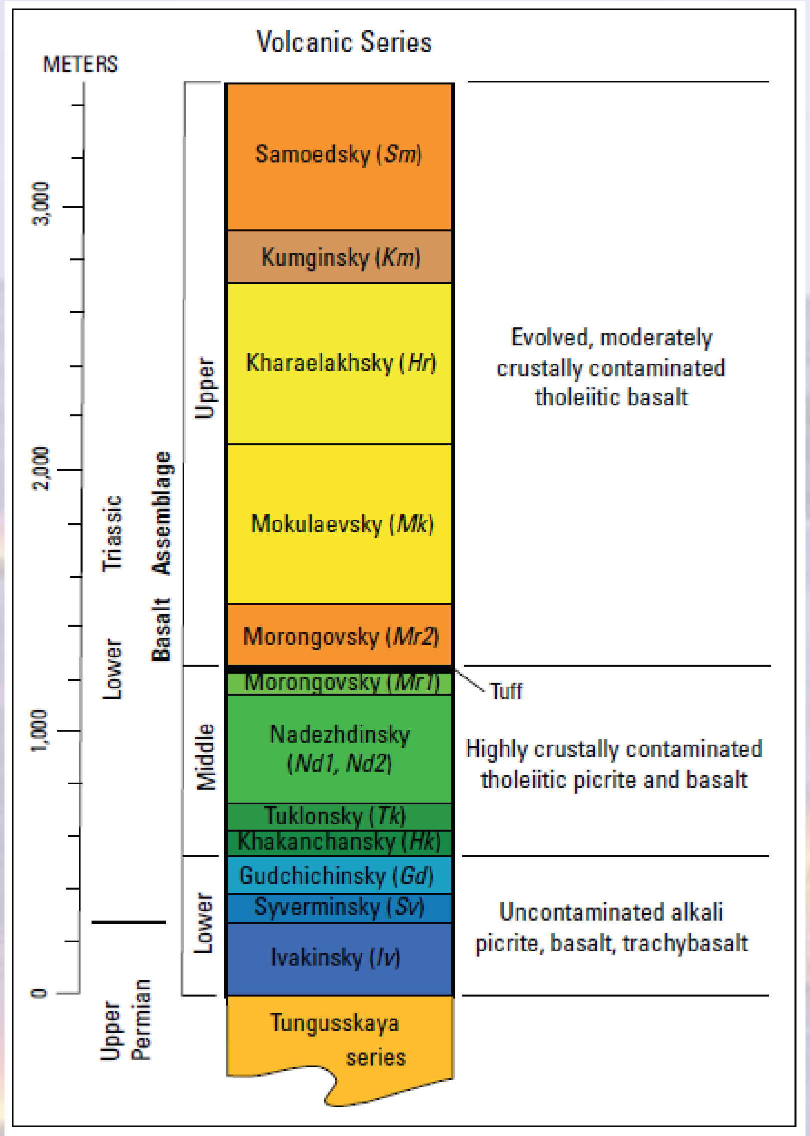
Flood Basalts near Talnakh Town

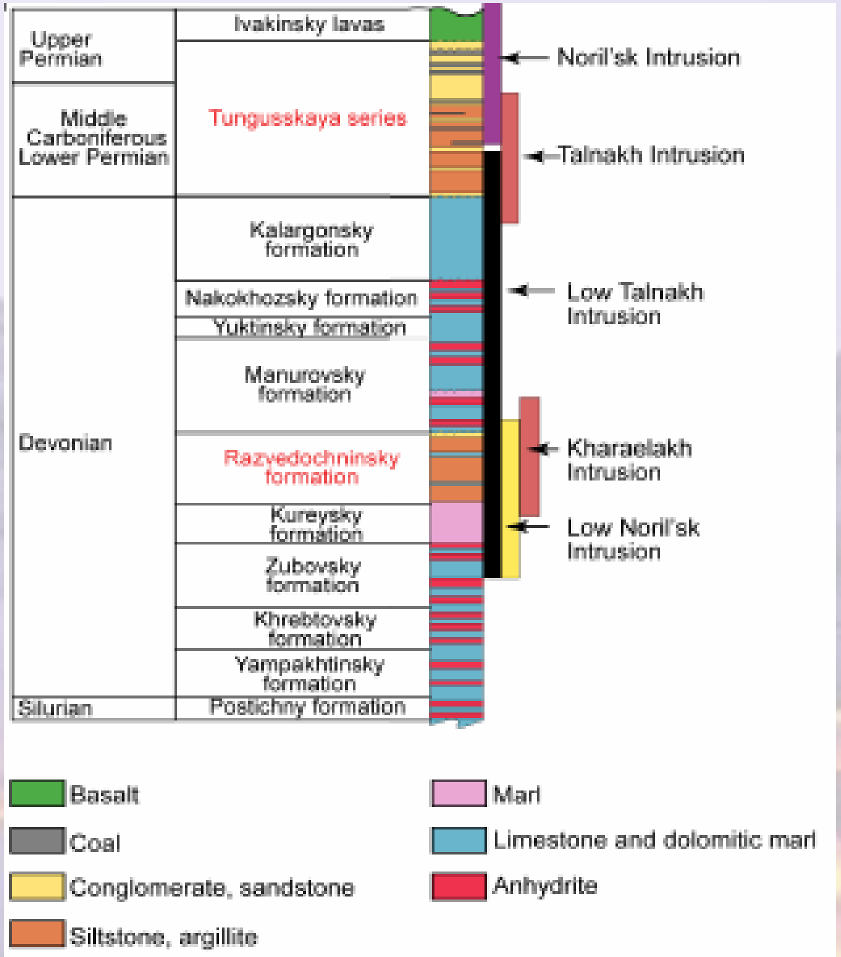
Flood Basalts at Lama Lake, Putorana Plateau



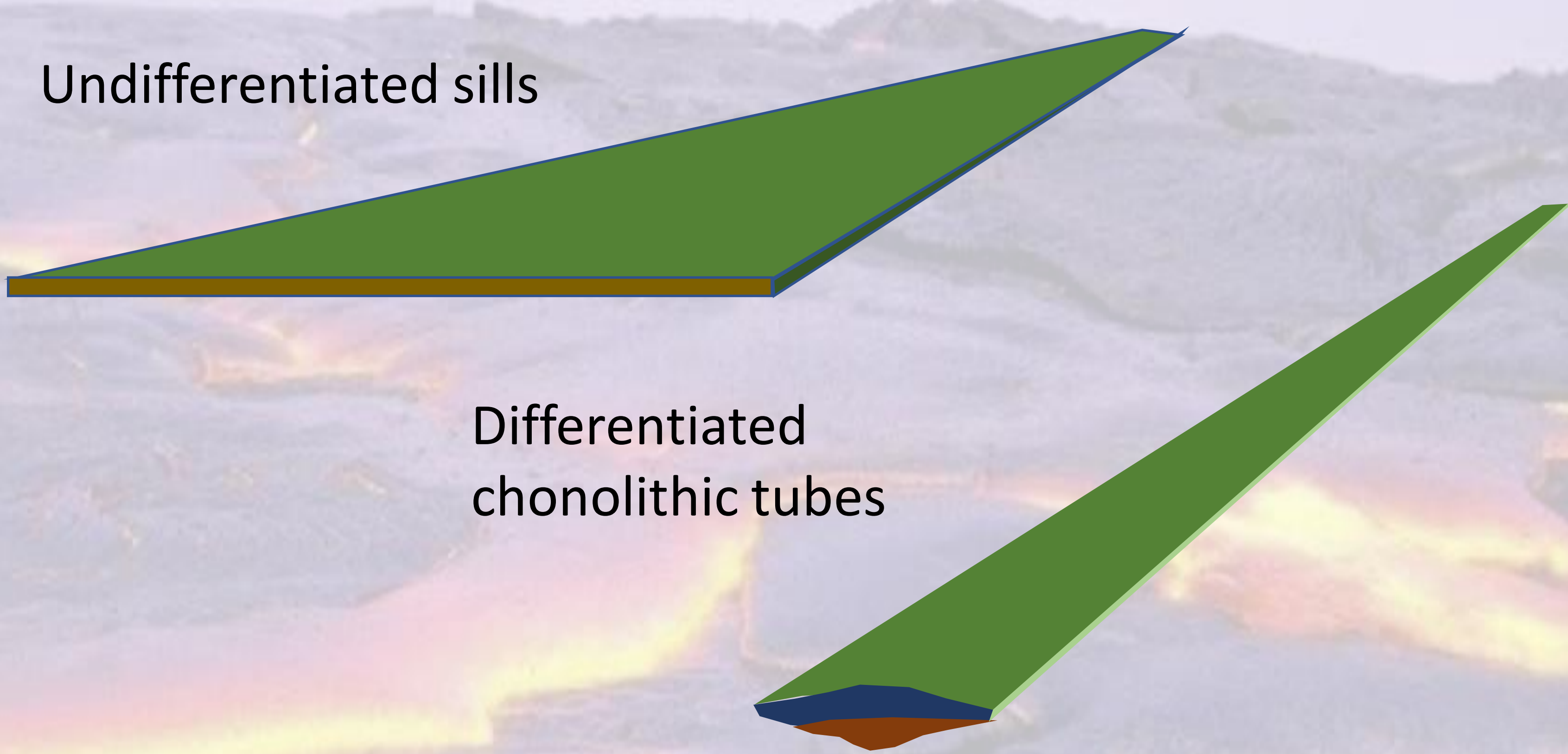


Norilsk District Stratigraphy

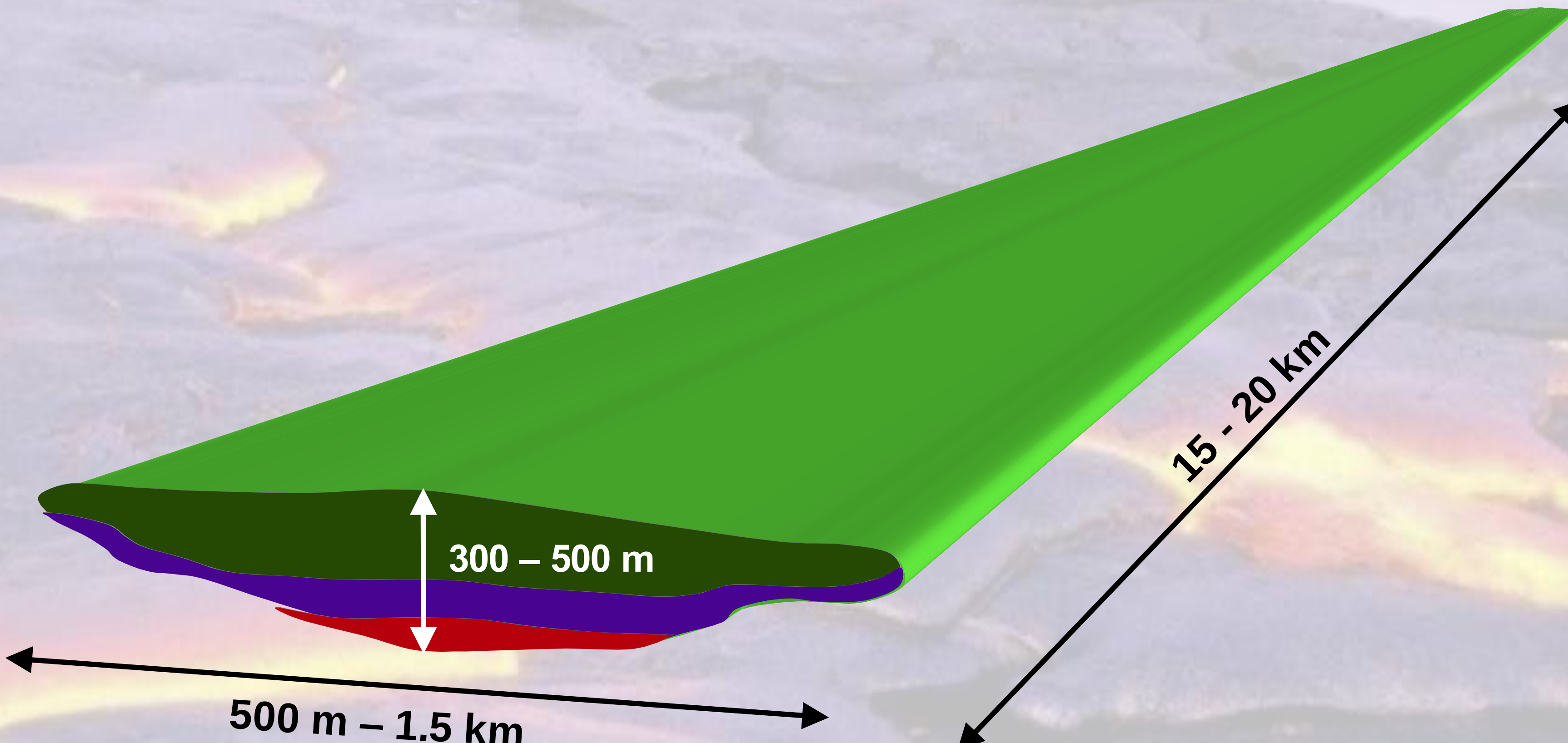




Norilsk Intrusions

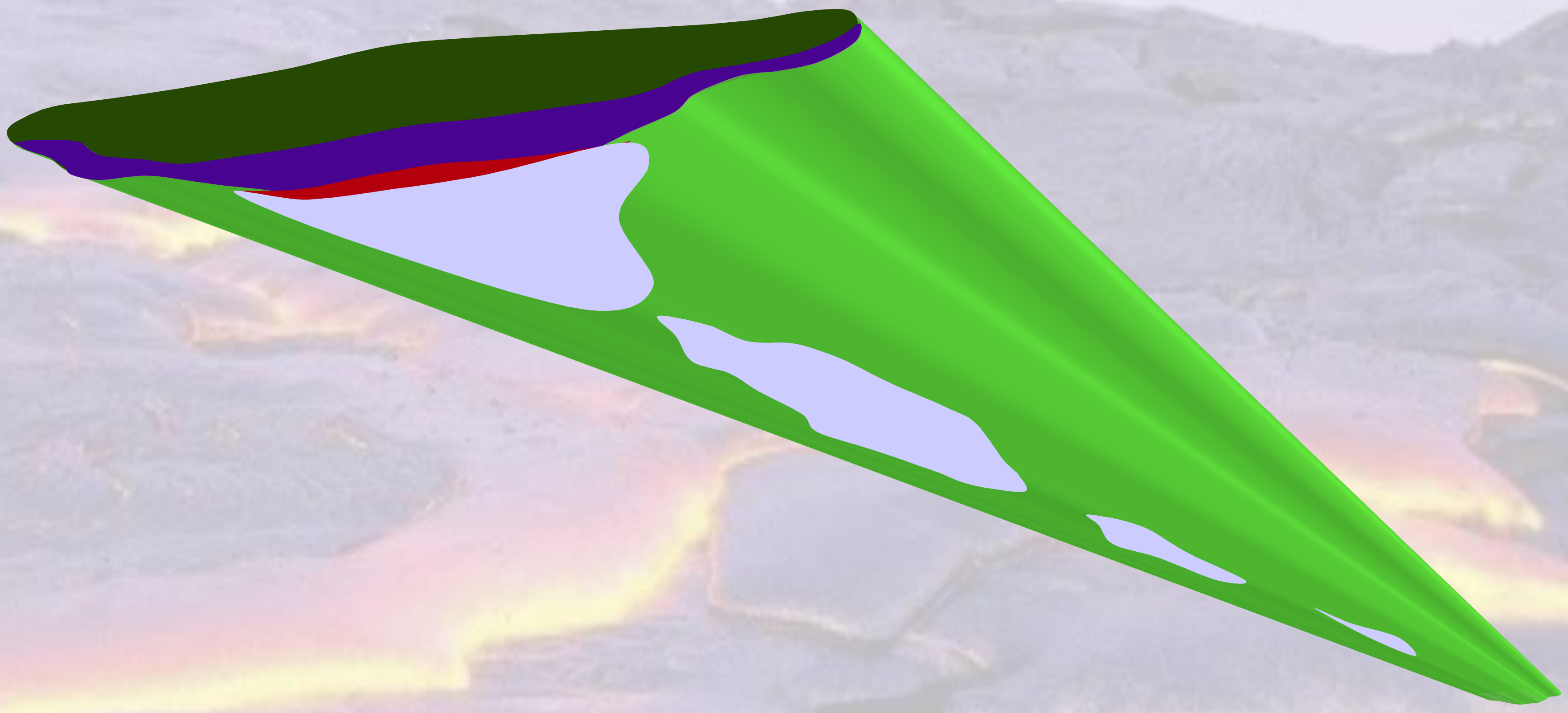


Differentiated Intrusions



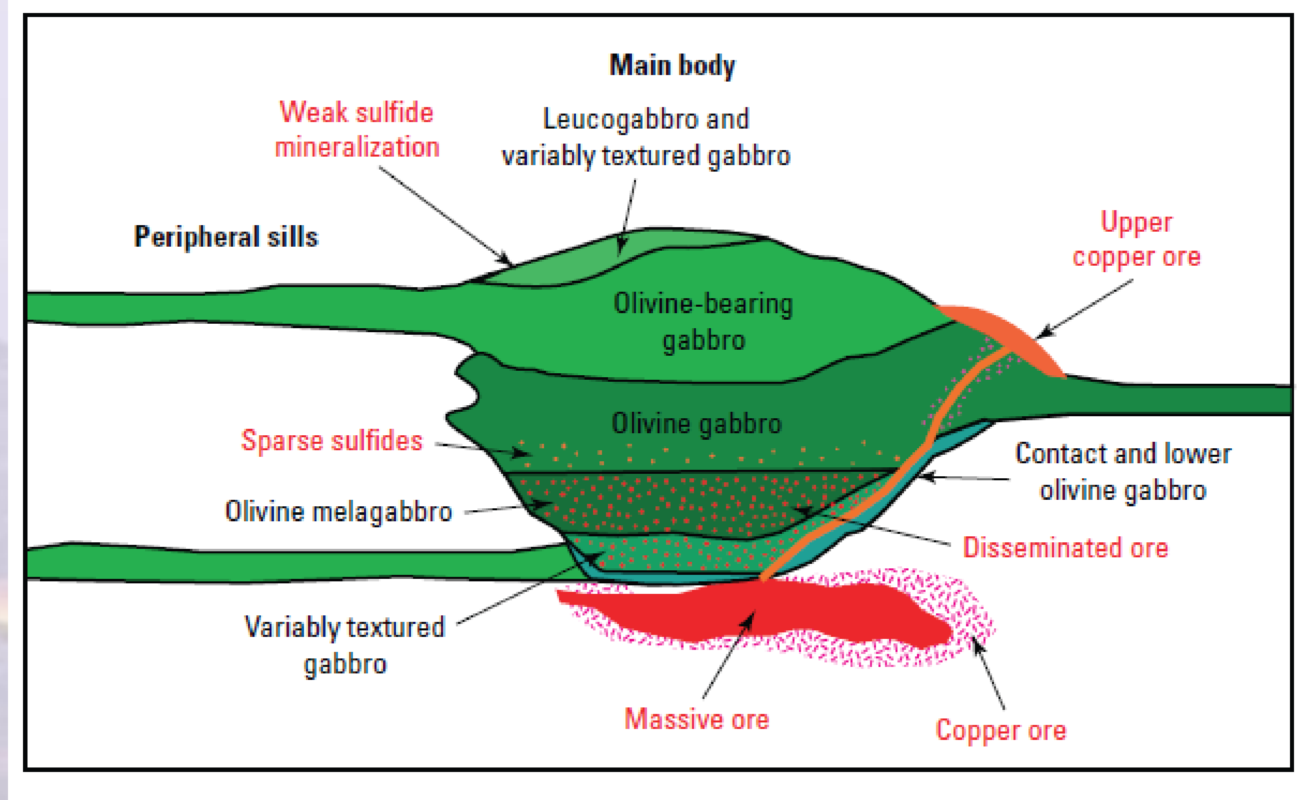
Diakov and others, 2002

Mineralization in Differentiated Intrusions



Diakov and others, 2002

Mineralized Differentiated Intrusions

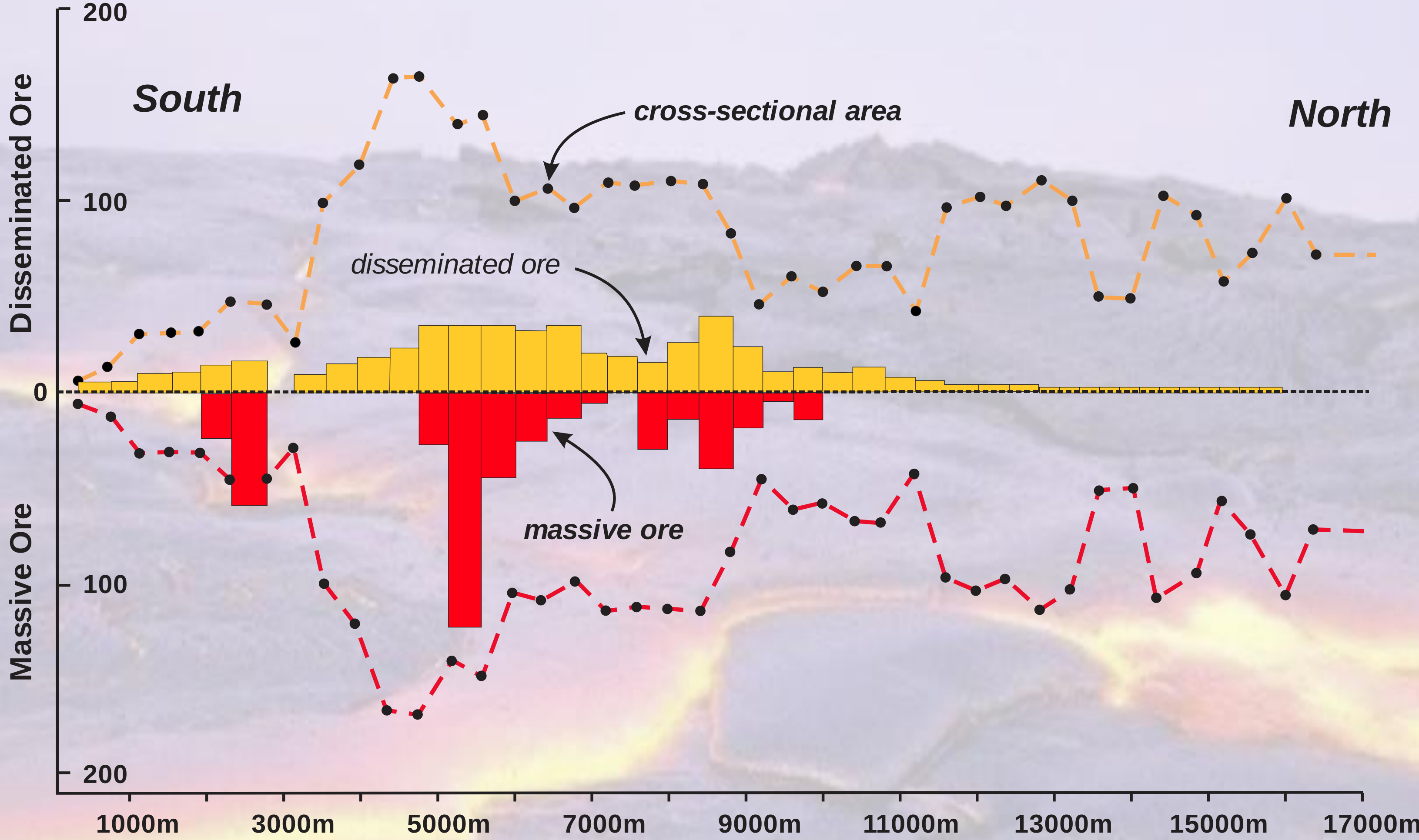


Schematic is from A. Naldrett, 2004

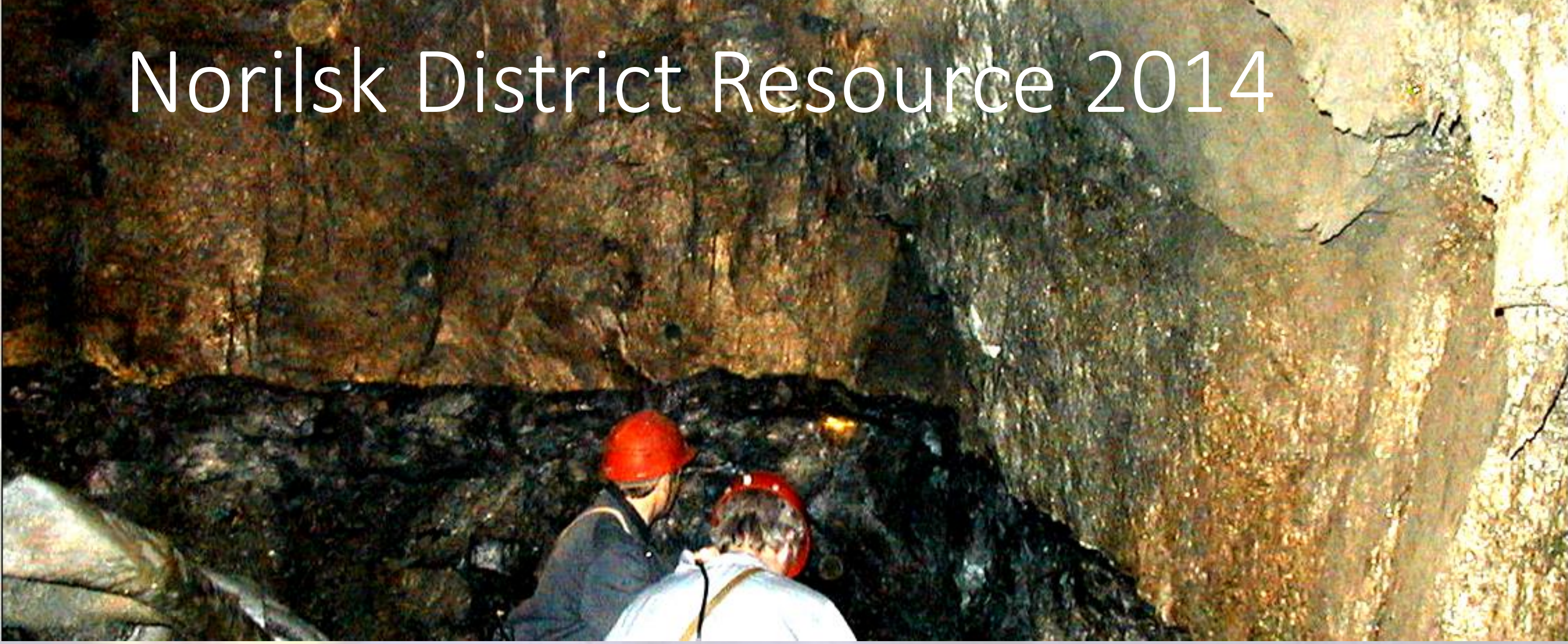
7 distinct differentiated horizons occur in the differentiated intrusions. From bottom to top:

- narrow gabbro-diabase (5-10m thick)
- lower taxitic coarse gabbro-diabase (15-40 m) with olivine inclusions. Occurs in mineralized intrusions.
- picritic gabbro diabase (95-75 m)
- olivine-rich gabbro-diabase (30-70 m)
- gabbro-diorite (tens of m)
- upper discontinuous Cr-PGE-rich taxitic horizon of leucogabbro (up to 40 m thick)

Distribution of Sulfide Mineralization



Norilsk District Resource 2014

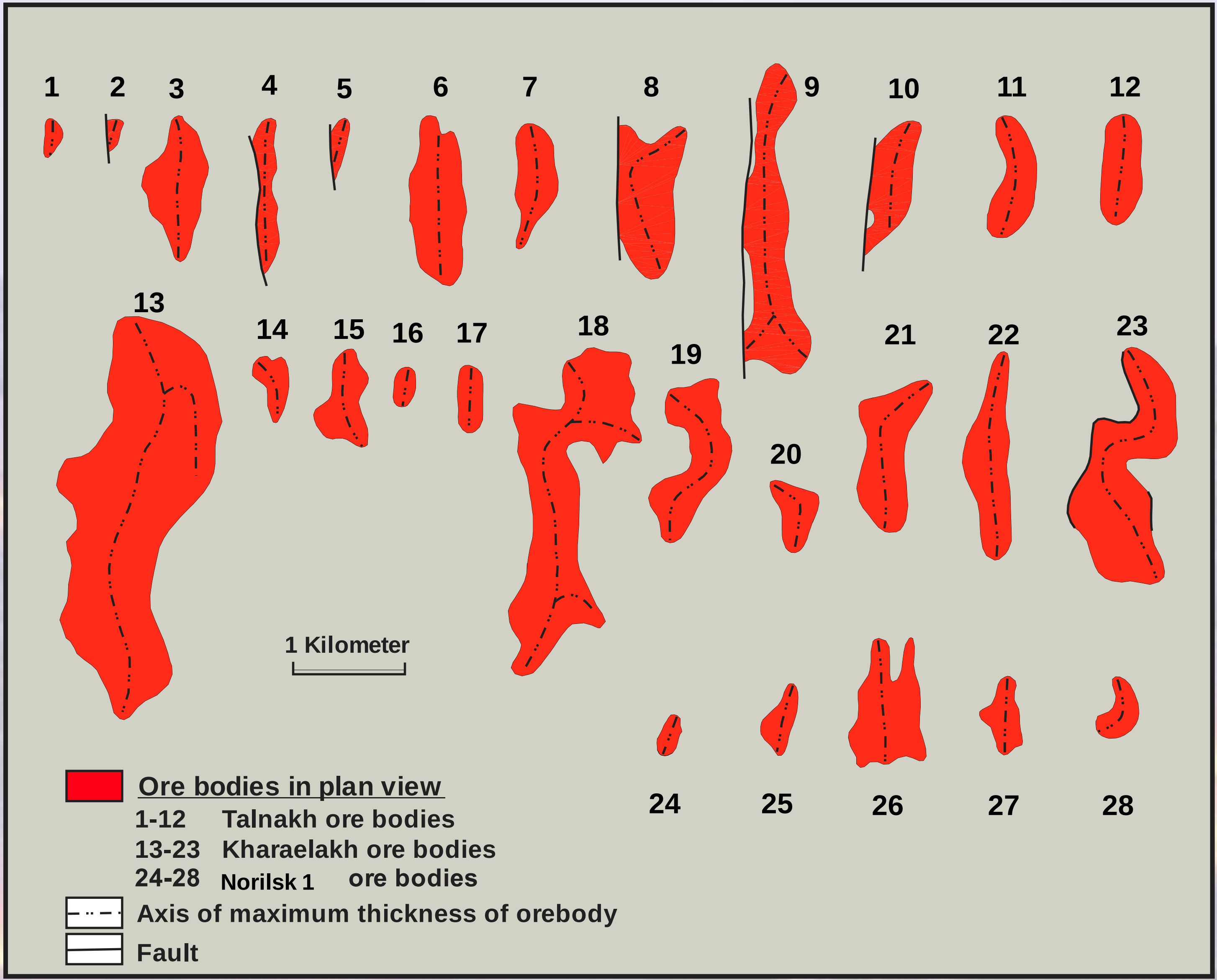


Ore - 2.7 billion tonnes

Nickel	-	24.8 Mt @ 0.9%
Copper	-	37.4 Mt @ 1.4%
Platinum	-	80 Moz @ 0.9 g/t
Palladium	-	290 Moz @ 3.34 g/t

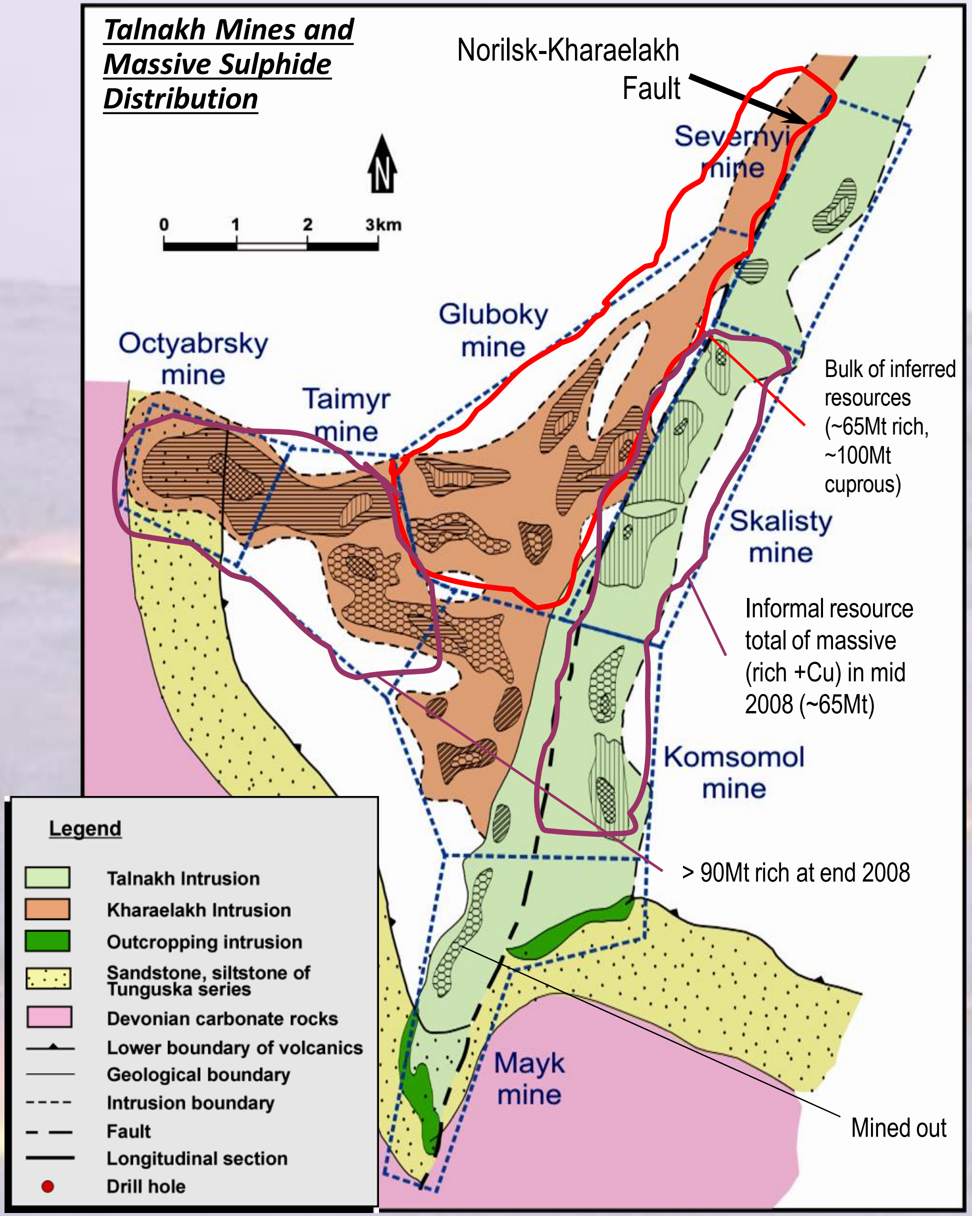
Norilsk Nickel Annual Report 2014

Norilsk District Ore Bodies



Krivtsov et al, 2001

Resources and Reserves at Talnakh Mines



- **Main types of mineralization** in differentiated intrusions:
  - massive sulfide ("rich")
  - net-textured ("cuprous") and
  - disseminated
- Along the Talnakh intrusions this mineralization is traced for >16 km
- **Massive sulfides** occur in embayments at base of intrusions at contacts with host rocks and in the footwall sediments, sometimes 10s of meters below the intrusions
- Disseminated sulfides occur in taxitic gabbro-diabase and picrites, sometimes in the upper parts of intrusive complexes, also superimposed over in hornfelsed host rocks and leucogabbro

Octyabrsky Mine at Talnakh

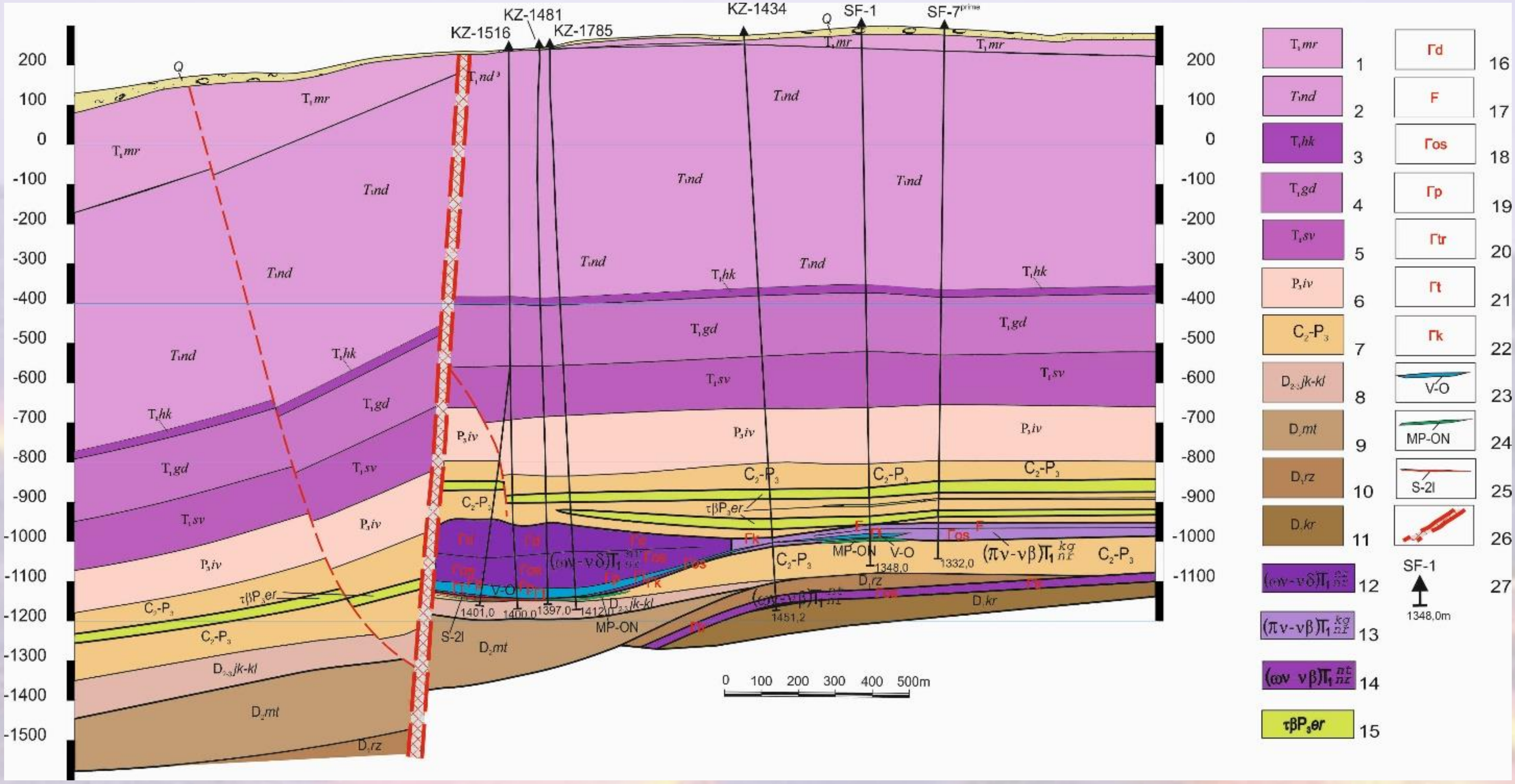
“Rich” and disseminated ore types

“Cuprous” ore chalcopyrite & bornite

Massive sulfide ore

Semi massive sulfide ore types

Talnakh Exploration Drilling



Radko, 2016

Early History of Norilsk

Copper presence at Norilsk was known for > 1,000 years, bronze age artifacts indicate that copper was smelted here from the outcrops with native copper, bornite, covellite and pentlandite mineralization

- 1601 – first settlement Mangazeya - remnants of copper smelting from Norilsk I ore
- 1680 – first expedition by G. Trubnikov to search for copper and silver – no records left
- 1733-1743 – expedition by lieutenant Khariton Laptev to explore northern shores of Russia. Their boat entered river Khatanga. They noted presence of copper and coal in the area
- 1865 – merchant Kiprian Sotnikov with his brothers put first adit to start small scale copper production from oxide ore. One of the slags left from those days and found in 1931 ran 150 g/t of platinum
- 1914 – grandson Aleksander Sotnikov received permits from Russia Mining Department for coal and copper at Norilsk (Dudinka). He started first geological description of the outcrops. Tomsk University Professor Obruchev suggested that samples from Norilsk resemble the mineralization at Sudbury, Canada
- 1919 – A. Sotnikov and adjunct geologist N. Urvantsev conducted mapping at Norilsk and Talnakh. Samples from Mount Ore yielded 2% Cu and 1% Ni. Head of Siberian Government admiral A. Kolchak expressed an interest
- 1922 – after White Army failure, new administration expressed an interest. N. Urvantsev organized a field program to study Norilsk. N. Vysotskiy discovered outcrops of Norilsk I. Exploration drilling started

After A.C. Dolgal, Doctor of Science RAS

History of Discovery of Norilsk

- 1926 – drilling at Norilsk I confirmed the presence of economic mineralization, suggestion to start building a mining plant. Discovery of Norilsk II
- 1933 – drilling exploration all year around. Extreme winter conditions. Snow level up went to the top of the drilling masts. Shifts could not change for months due to danger of people getting lost in deep snow drifts during long dark winter nights
- 1934 – A. Vorontsova and B. Ryzhkov defended the report of the reserves at Norilsk I. State Committee on Reserves approved the numbers and recommended to the Government to start building a mining complex

- 1935 – Construction of Norilsk town and mining-processing facility began
- 1939 - First production from Norilsk Nickel
- 1939 – NN Department of Exploration started its history
- 1942-1943 – Discovery of Chernogor and Imangda deposits
- 1957 – Norilsk I depletion of mineral reserves, need to find another ore body
- 1959 – expedition found mineralized boulders in Kharaelakh Mountains near river Talnakh similar to Norilsk I possibly sourcing from the intrusions nearby. Drilling unsuccessful
- 1960 – V. Kravtsov and others discovered outcrops of the intrusion at the foothill of nearby mountain Otdelnaya. Drilling intercepted disseminated sulfide mineralization (drill holes KZ-21)
- 1962 – drill hole KZ-38 intercepted massive sulfide mineralization of Talnakh deposit
- 1965 – V. Kravtsov & V. Lyulyko discovered Octyabrsky deposit. KZ-584 and T-56 >1,000-meter-deep intercept 10 meter @ 15% copper. Intensive exploration drilling of Octyabrsky deposit

After A.C. Dolgal, Doctor of Science RAS

Norilsk Effective Exploration Methods

Target and purpose	Exploration methods in order of their sequence													
	Regional											Detailed		
	Geological mapping 1:200,000 - 1:50,000	Geochemistry 1:50,000 - 1:10,000		Airborne/ground surveys 1:100,000 – 1:25,000			Seismic profiling	EM	Electric geophysics		Drilling	Drill hole geophysics		
		Secondary aureoles	Primary aureoles	Magnetics	Gravity	EM			SP	IP		Mis-a-la-masse	TEM	RIM
Structure	+			+	+/x	x		+/x						
Intrusions: Outcropping	+	x	x	+	+			x	x	x				
Sub-cropping	+	x		x	x						+			
Deeply buried				x	x		x				+			
Mineraleral potential of intrusive	x / +		+	x	x	+/x		x		x	+			
Localization of mineralization within intrusion	x		x		x	x/+		+		+	+		+	
Tracing of mineralization						x/+		x/+			+	+	+	+

Notes: + - reliable methods; x – methods with potentially ambiguous results
Abbreviations: EM – electromagnetics; SP – self-potential; IP – induced polarization; TEM – time domain electromagnetics; IP – induced polarization; RIM – radio imaging method

Diakov and others, 2002

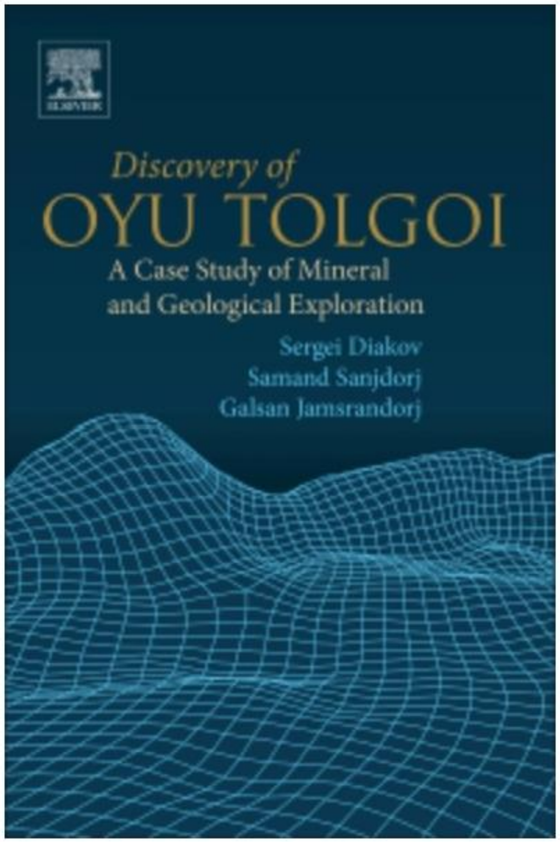
Exploration Guides at Norilsk

- Large Igneous Province (LIP) at the edge of cratons with mantle-tapping structure (triple-junction) controlling tholeiitic volcanism
- Mantle plume, massive flow of magma, presence of large volumes of picritic intrusions
- Host rocks with sulfur sources
- Interaction of magma with host rocks in intermediate magma chambers (IMC) – contamination and production of immiscible sulfide liquid (ISL)
- Dynamic system pumping the magma with ISL to the surface through magma channels
- High temperature magma forming chonolitic channels
- Emptying IMC forms volcano-plutonic depressions (VPD)
- Differentiation of intrusions with sulfide mineralization
- Development of hornfels (contact halos) in the host rocks
- Depletion of chalcophile elements within portions of the basalt pile
- Most sulfide mineralization hosted by intrusions or host rocks beneath intrusions
- Massive sulfide lenses normally follow the intrusions along its axis
- Some ISL escapes intrusions following structures and can be separated from the intrusion
- Fractionation of ISL in massive lenses can form extremely high-grade cores

Norilsk Case History Lessons

- Early discovery of Norilsk 1 – outcropping mineralization in 1920s
- Depletion of the outcropping ore put a challenge for explorers to find blind ore bodies under “active” cover
- Search for new ore bodies across Pyasino lake in 1950s
- Elevated presence of sulphate ions in water wells
- Boulders of massive sulfides found on the slopes of basalts near Talnakh. Debates about their origin. Two viable explanations considered:
  - brought from the upper parts of the volcanic pile by gravitation ;
  - pushed from the bottom up the pile slopes by glaciers
- Sulfide mineralization along differentiated intrusions, structural control – Norilsk-Kharayelakh fault, VPDs, good understanding of regional geology
- Development of hornfelses in the host rocks around differentiated intrusions
- “Active” volcanic cover, permafrost – geochemistry is not effective, geophysics (IP and EM) limited detection capability
- Drilling is most effective discovery tool

Silicic LIPs
Oyu Tolgoi Discovery Case History



Discovery of Oyu Tolgoi

A Case Study of Mineral and Geological Exploration

1st Edition - November 19, 2018

This is the **Latest Edition**

Authors: Sergei Diakov, Samand Sanjdorj, Galsan Jamsrandorj

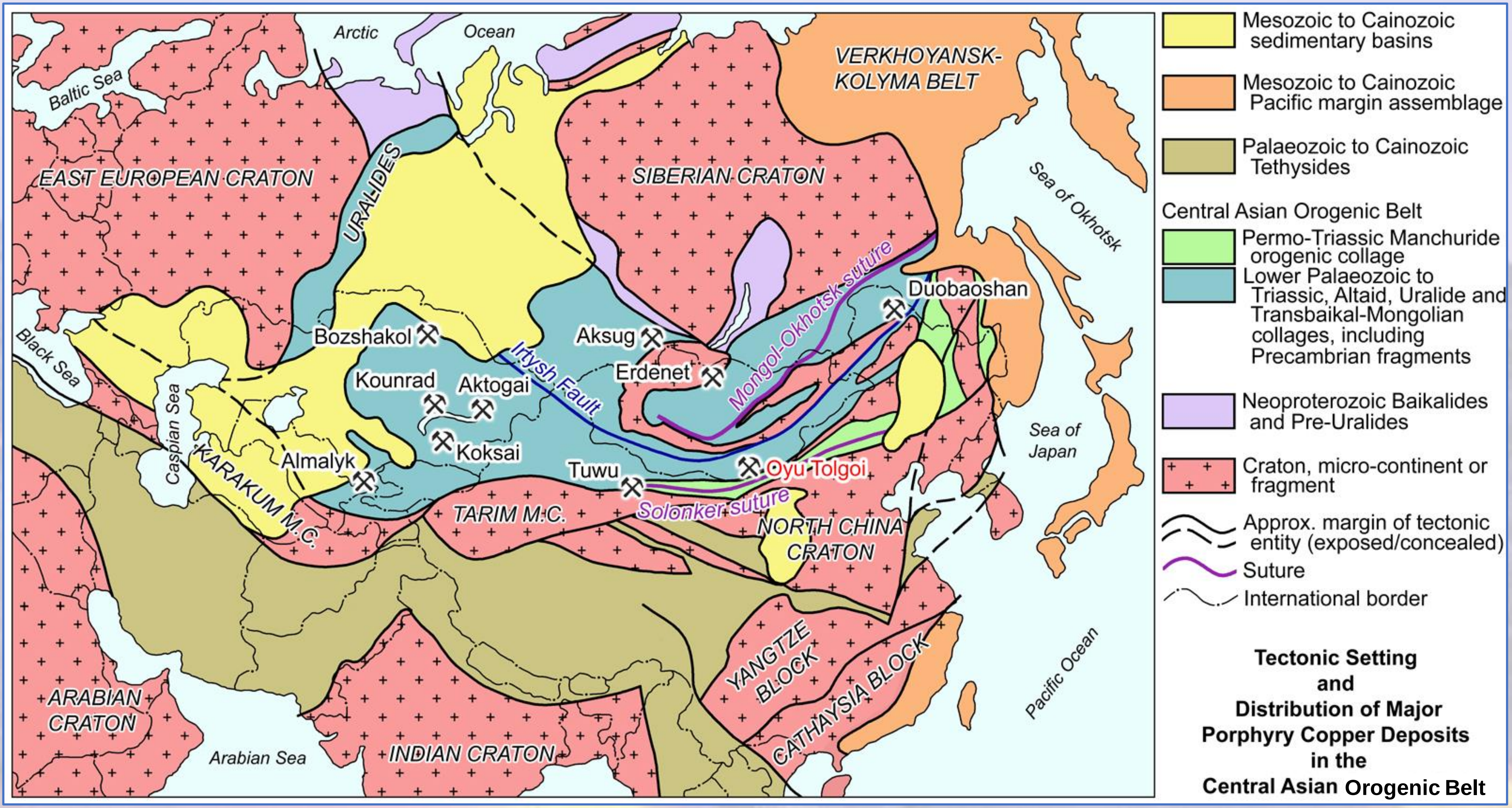
eBook ISBN: 9780128160909

Paperback ISBN: 9780128160893

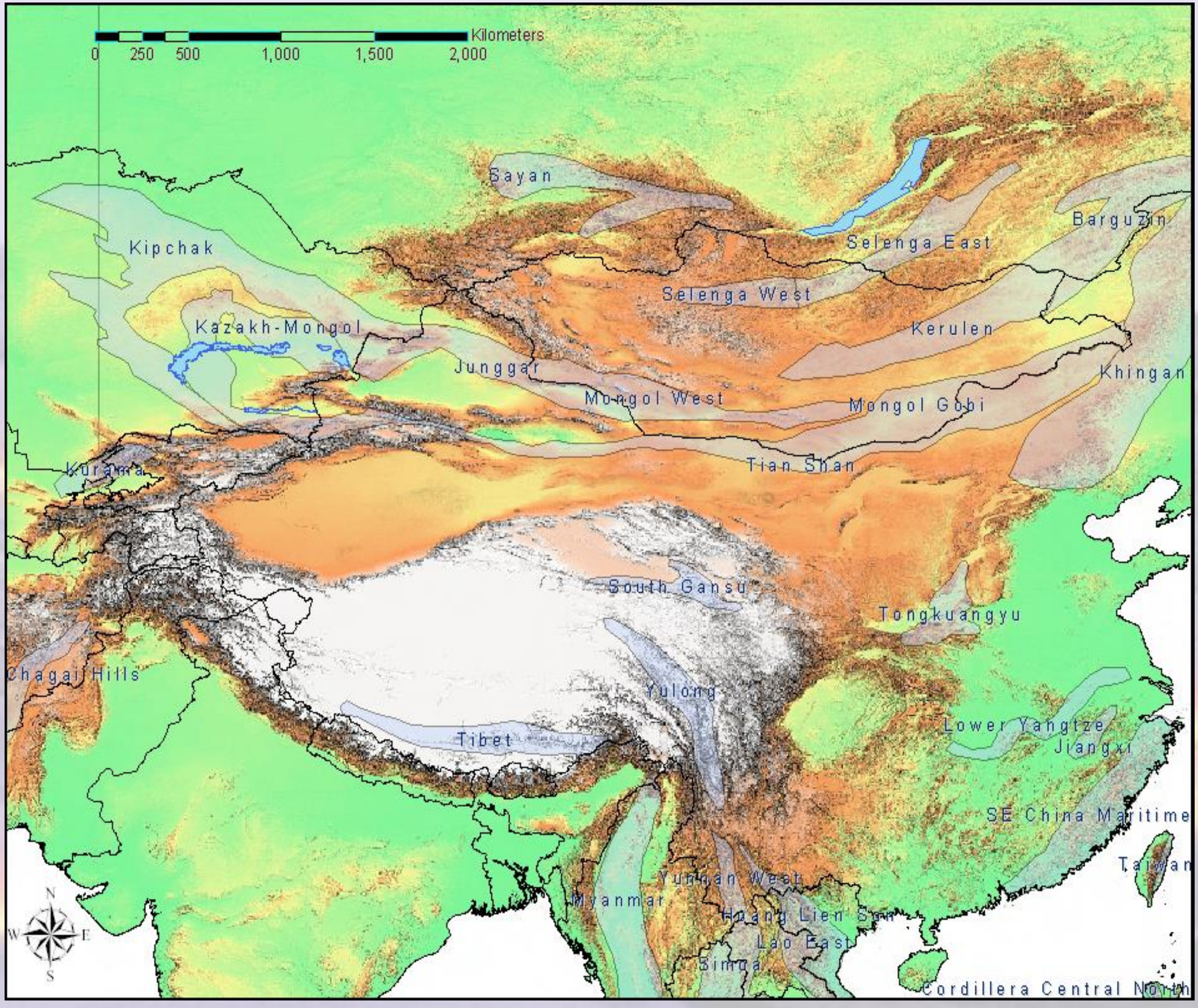
Mongolia Geographic Location

0 mi 100 200 300 400

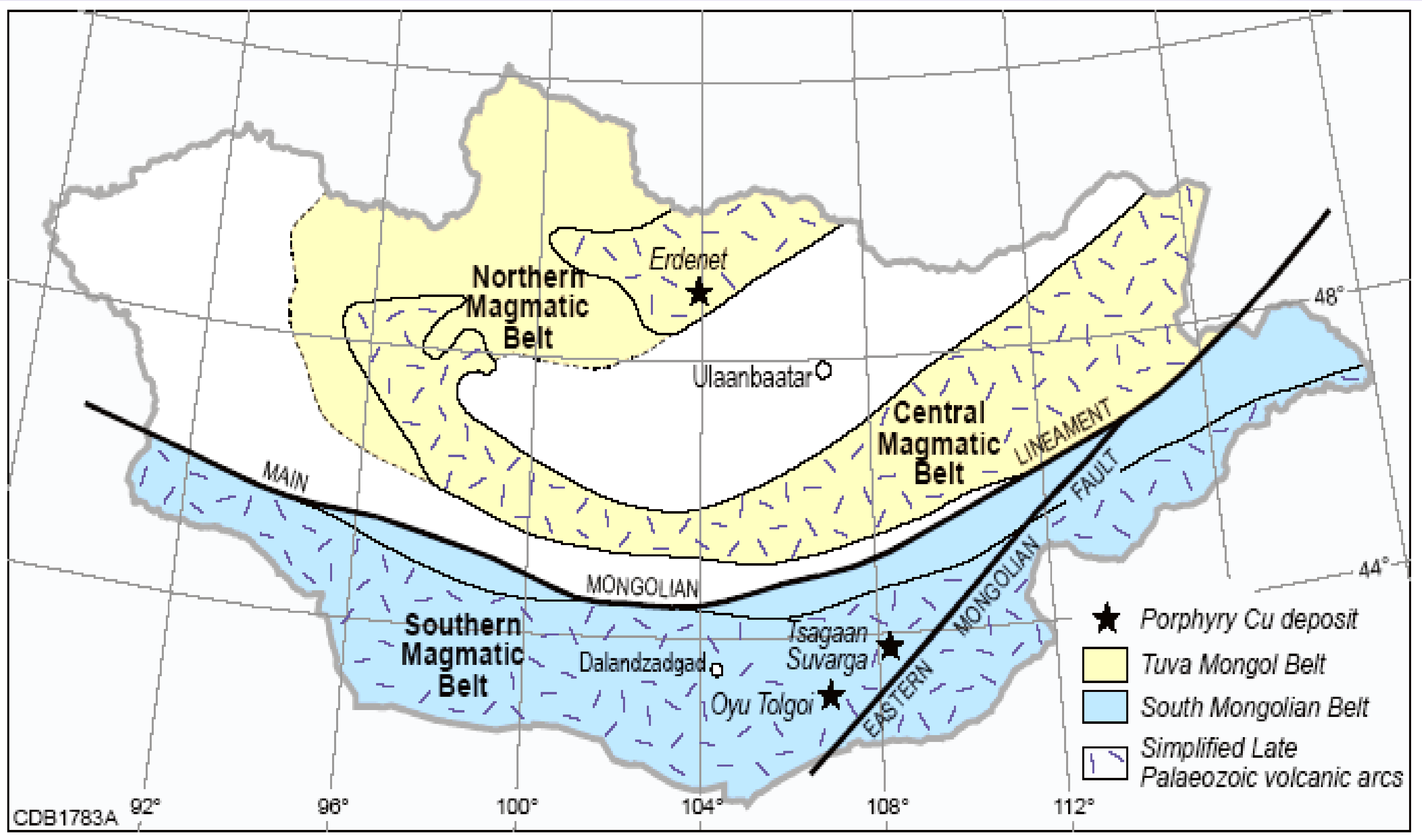
Central Asian Orogenic Belt



Silicic LIP Belts of Altaids



Mongolia Volcanic Belts



History begins in Arizona

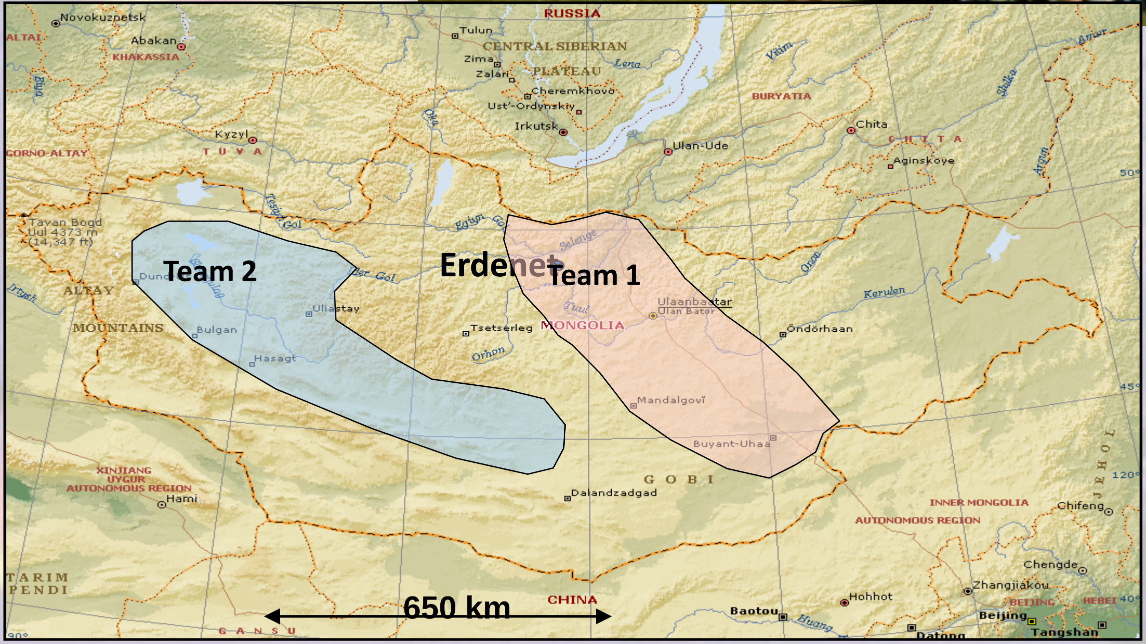
Superior, AZ

San Manuel ISL operation

First Steps

- April 1995 - Creation of Erdenet-Magma JV
- May 1995 - Metallogenic data base review
- Selection of Relatively low exploration maturity, especially along the border with China
- 75 copper potential prospects selected for field recon
- Summer 1995 - two field teams visiting 73 copper porphyritic, VMS, skarns and sed Cu occurrences across Mongolia
- Discussion of strategy. Focus on porphyries with a secondary enrichment
- Focus on Mongolian Gobi in the south

1995 Field Reconnaissance



Gobi Mz Basalt Clippers

1996 field seasons - Shuteen iron oxide cap

OT Discovery Milestones

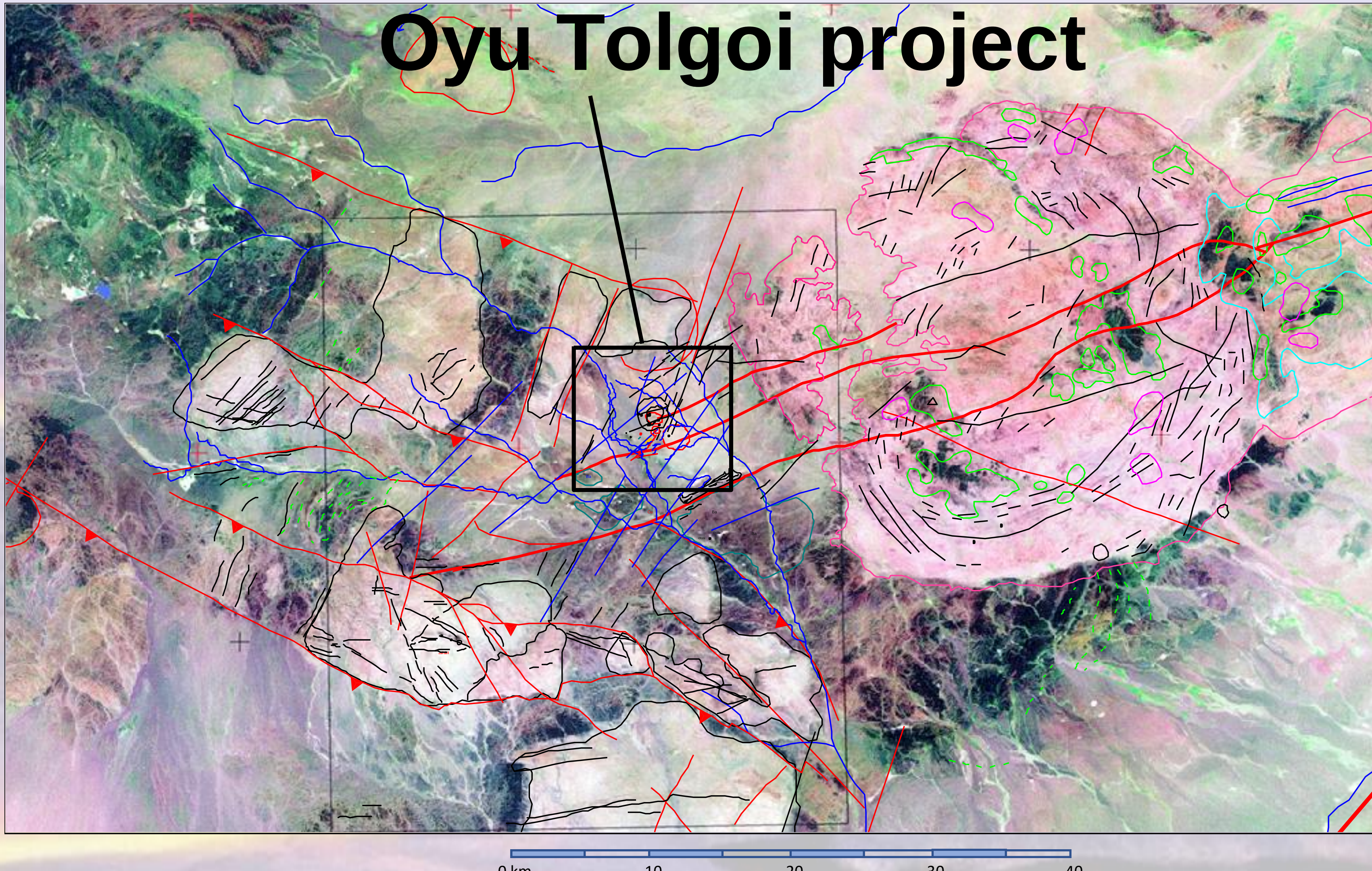
- Jan 1996 – BHP acquisition of Magma Copper
- June 1996 – JV with Erdenet dissolved
- July 1996 – BHP continues exploration
- Sept 1996 – Recon field team review porphyry occurrences in the Gobi, focus on porphyries with leached caps
- Discovery of Central Oyu with intense leached cap and South Oyu potassic quart-magnetite stockwork within the Paleozoic andesite-basaltic volcanics
- Tenement application for 1,200 sq. km license covering main structures and various zones of alteration
- Feb 1997 – Exploration license received

Central Oyu Outcrops of Leached Cap

OT Discovery Milestones

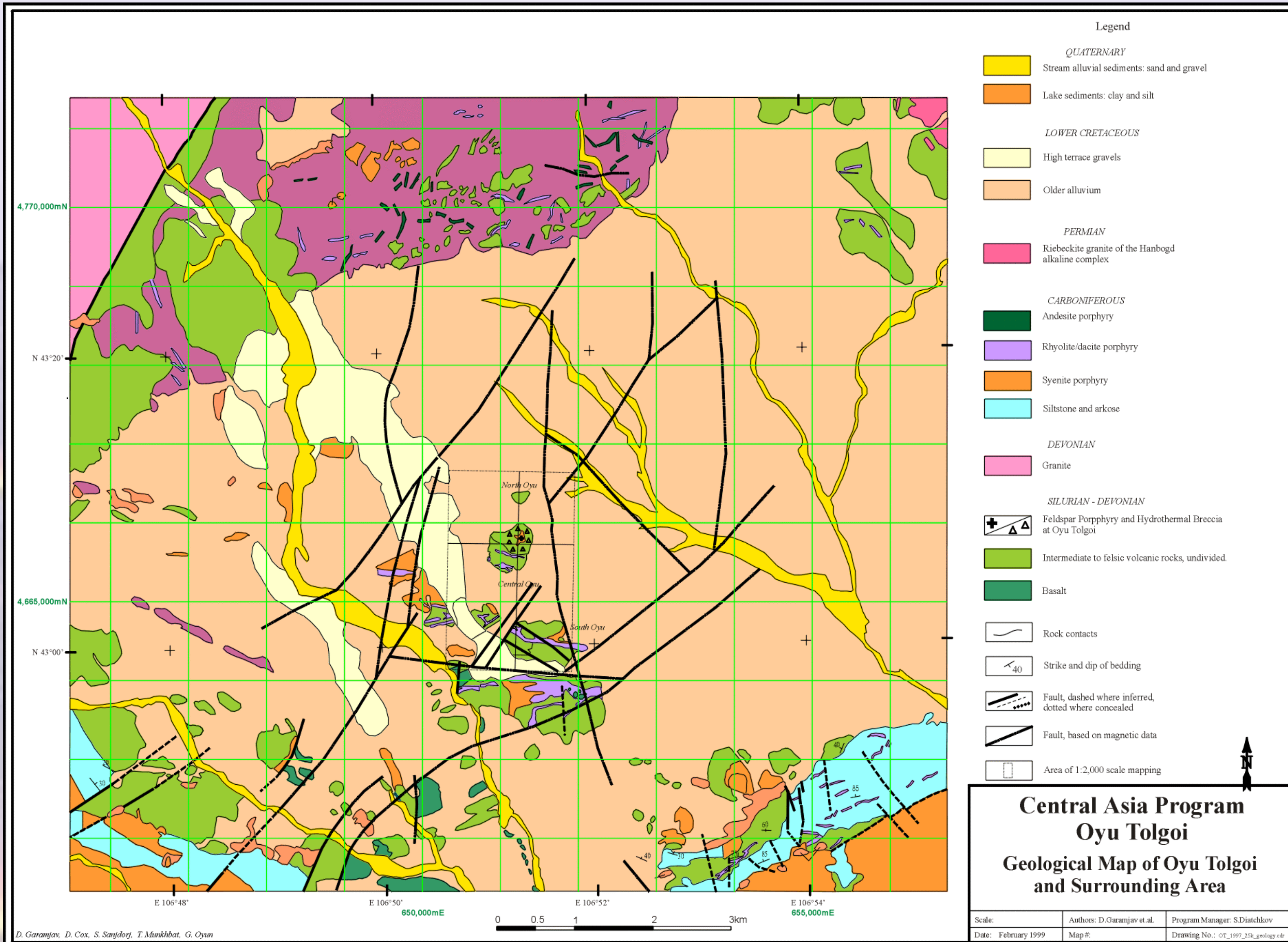
- Apr 1997 – ground geophysics (magnetics, gradient IP) and rock and soil geochemistry
- May 1997 – 1:10,000 scale geological mapping
- July 1997 – pronounced chargeability anomalies over Central Oyu, South and Southwest Oyu and vague anomaly in the north. Significant magnetic anomaly at South and SW Oyu
- Aug 1997 – rock-chip geochemistry strong As-Mo anomaly at Central Oyu and Cu-Au anomaly at South and SW Oyu
- Sept 1997 – decision to drill test most appealing geochemical-geophysical anomalies.
- Intense debate about the applicable porphyry model. Escondida vs Grasberg – supergene enrichment vs hypogene enrichment
- Management decision in favor of Escondida model

OT District Regional Structures

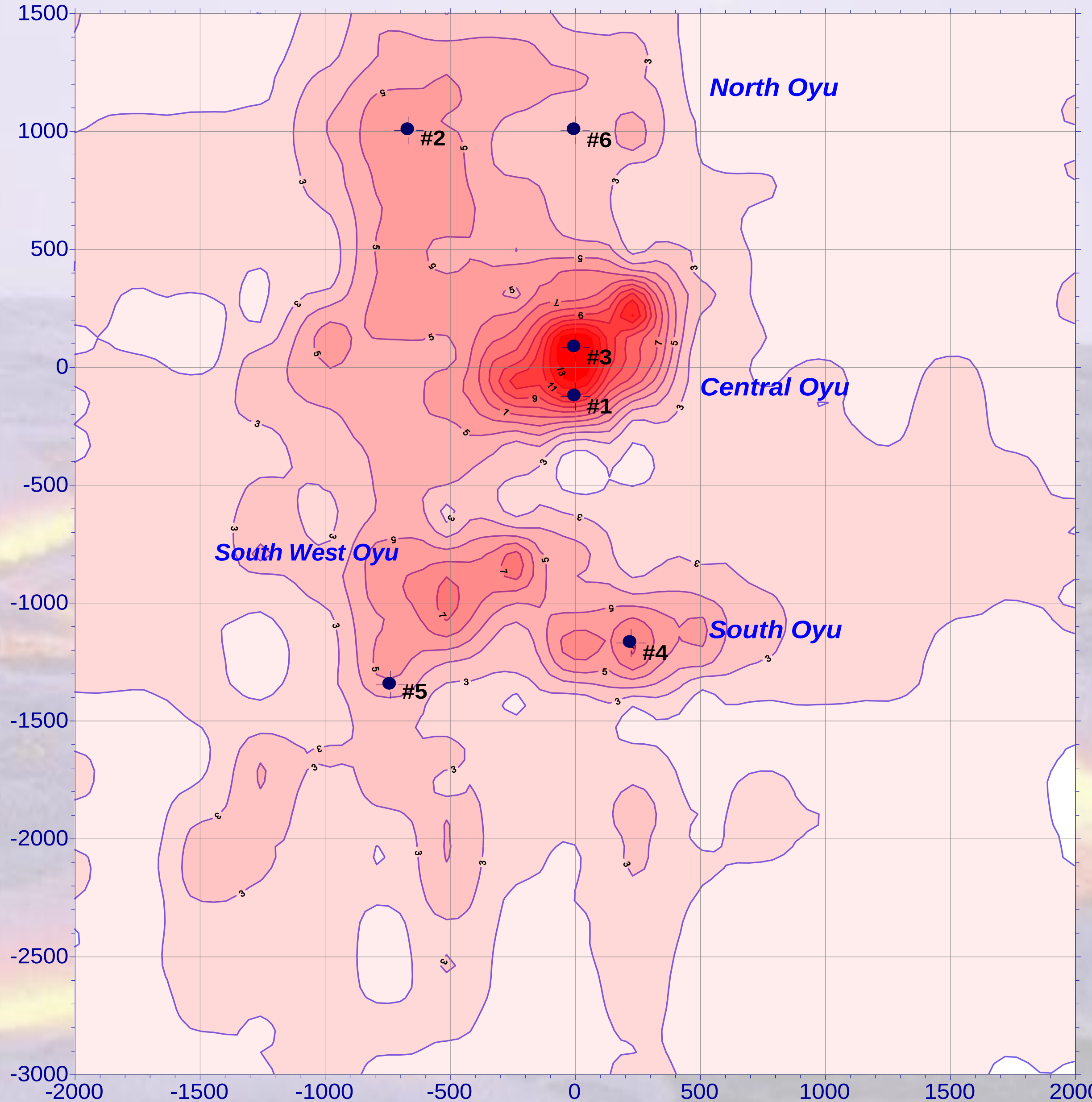


Oyu Tolgoi Camp 1997

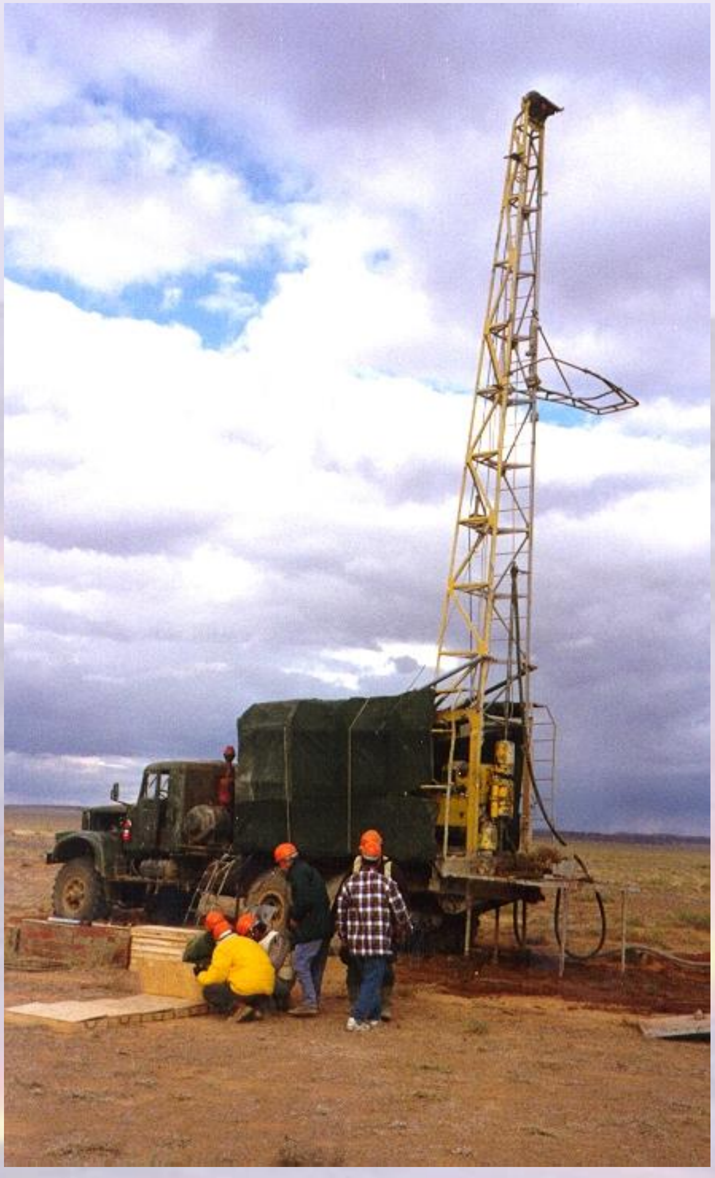
Oyu Tolgoi Geology Map

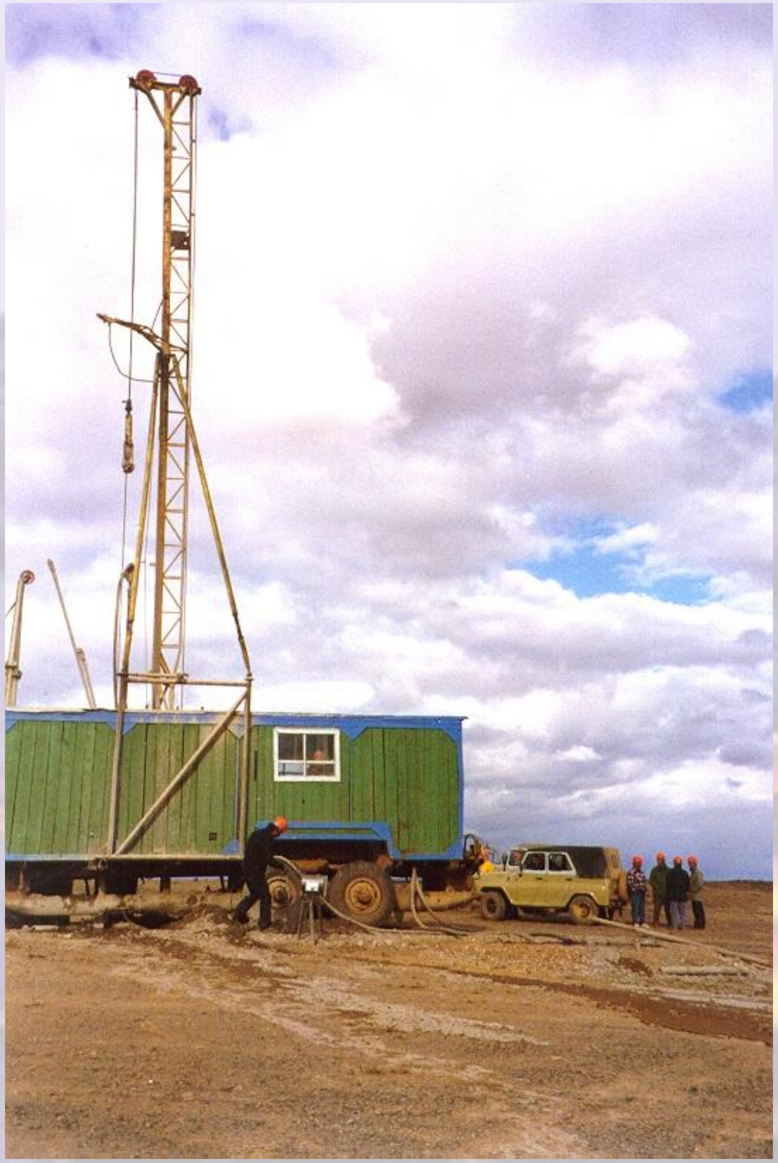


OT Induced Polarization Survey Results

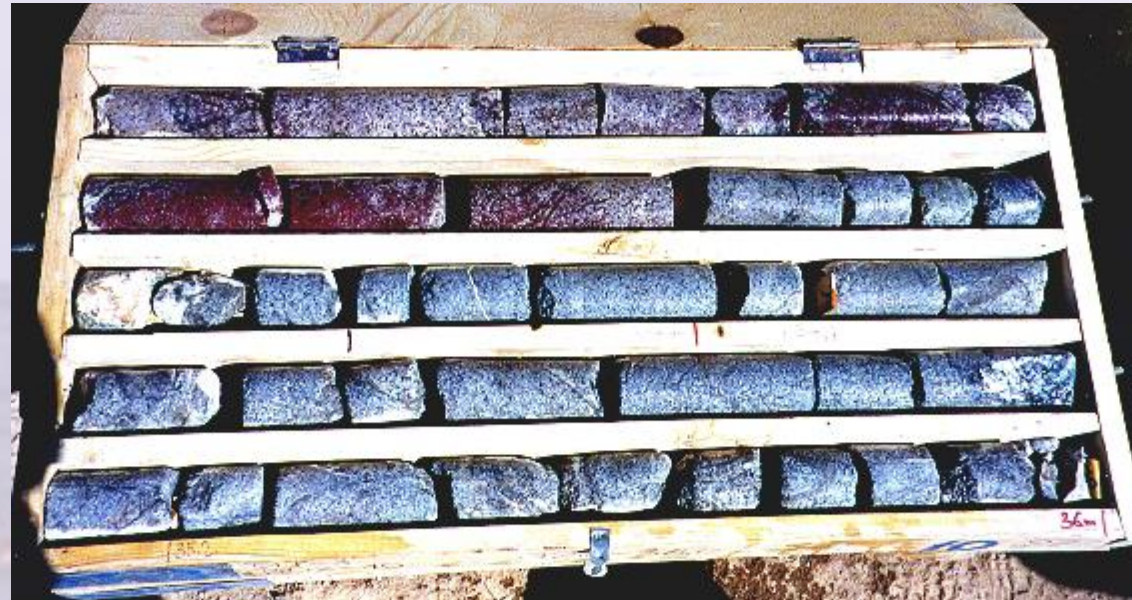


Drilling of Central and South Oyu Tolgoi

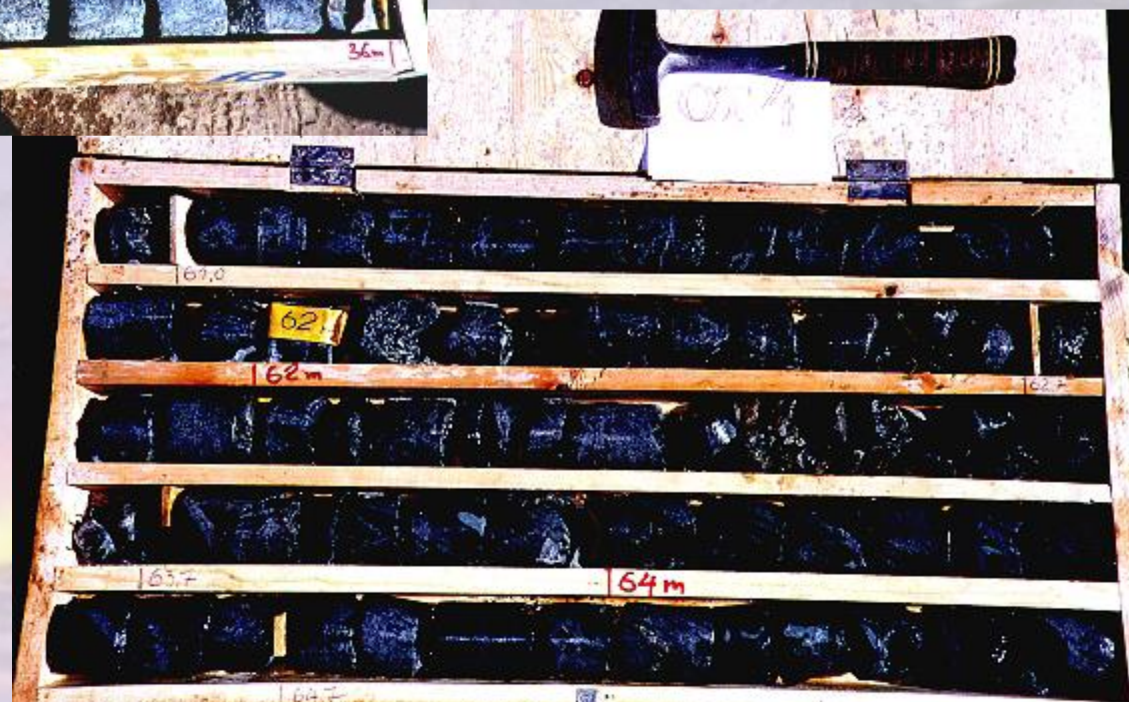




Discovery Drill holes OT-3 & OT-4

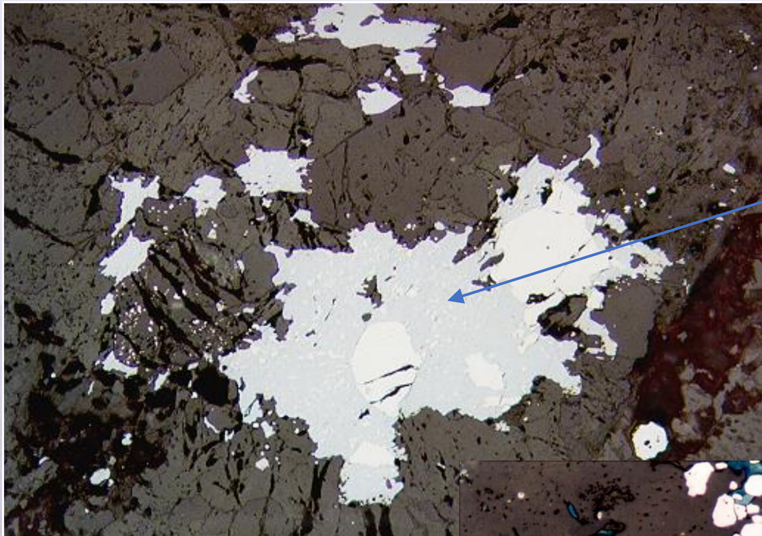


OT-3. Grey-blue - disseminated chalcocite mineralization, red color - hematite

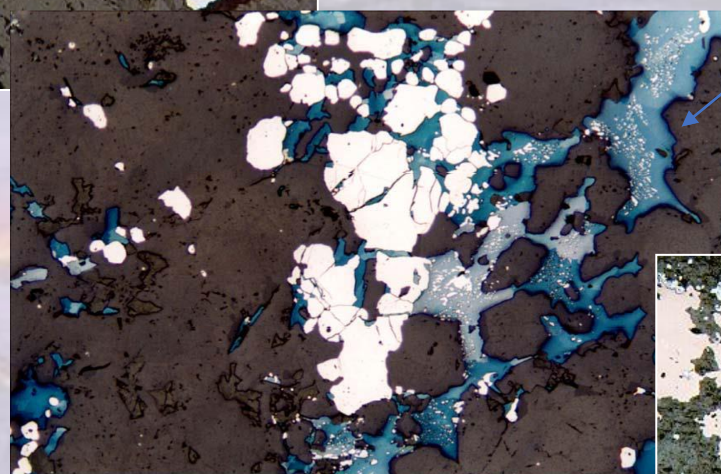


OT-4 . Quartz-magnetite mineralization with quartz-magnetite-bornite stockwork

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 started. Hole OT-3 at Central Oyu intersected **30 m @ + 2.0% Cu** – confirmation of chalcocite blanket presence
- Oct 1997 – Hole OT-4 at South Oyu intersected **73 m** @ **1.65% Cu** & **0.15 g/t Au** – confirmation of Grasberg model
- 1998 – additional ground magnetics. 13 drill hole program. Hole 10 intersects 32 m @ 0.8% Cu and 1.1 g/t Au
- 1999 – airborne magnetics. Additional 4-hole drilling program to confirm giant chalcocite blanket without much success.
- 1999 – BHP reduces its global exploration program. Oyu Tolgoi was recognized as Tier 2 Cu porphyry deposit and was put for JV investment
- Search for suitable partners (>20 copper companies approached, WMC interested but declined, Ivanhoe sole interested party)
- May 2000 – BHP farms out Oyu Tolgoi to Ivanhoe Mines

BHP Exploration Criteria

- Size and quality - porphyries >500Mt @>1% Cu eq.
- Porphyry exploration programs driven by Escondida model
- Concentric alteration zones (potassic core with phyllic zone around). Footprint of 1 to 2 km in diameter
- Presence of leach caps with Cu mineral box works, hematitic iron oxides
- Significant enhancer for grade by secondary enrichment to form a sizable chalcocite blanket
- Open pittable ore body - relatively shallow <400m deep drilling targets

OT Estimated Resource 2000

- **South Oyu**

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

- **Central and North**

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** 438 Mt @ 0.52 % Cu, 0.25g/t Au

Prospect Potential: 1 Bt @ 0.55Cu, 0.25 g/t Au

Oyu Tolgoi Discovery Team

- D. Garamjav
- Dennis Cox
- S. Sanjdorj
- Sergei Diakov
- D. Munkhbat
- Sam Carter

Learnings from BHP Discovery at OT

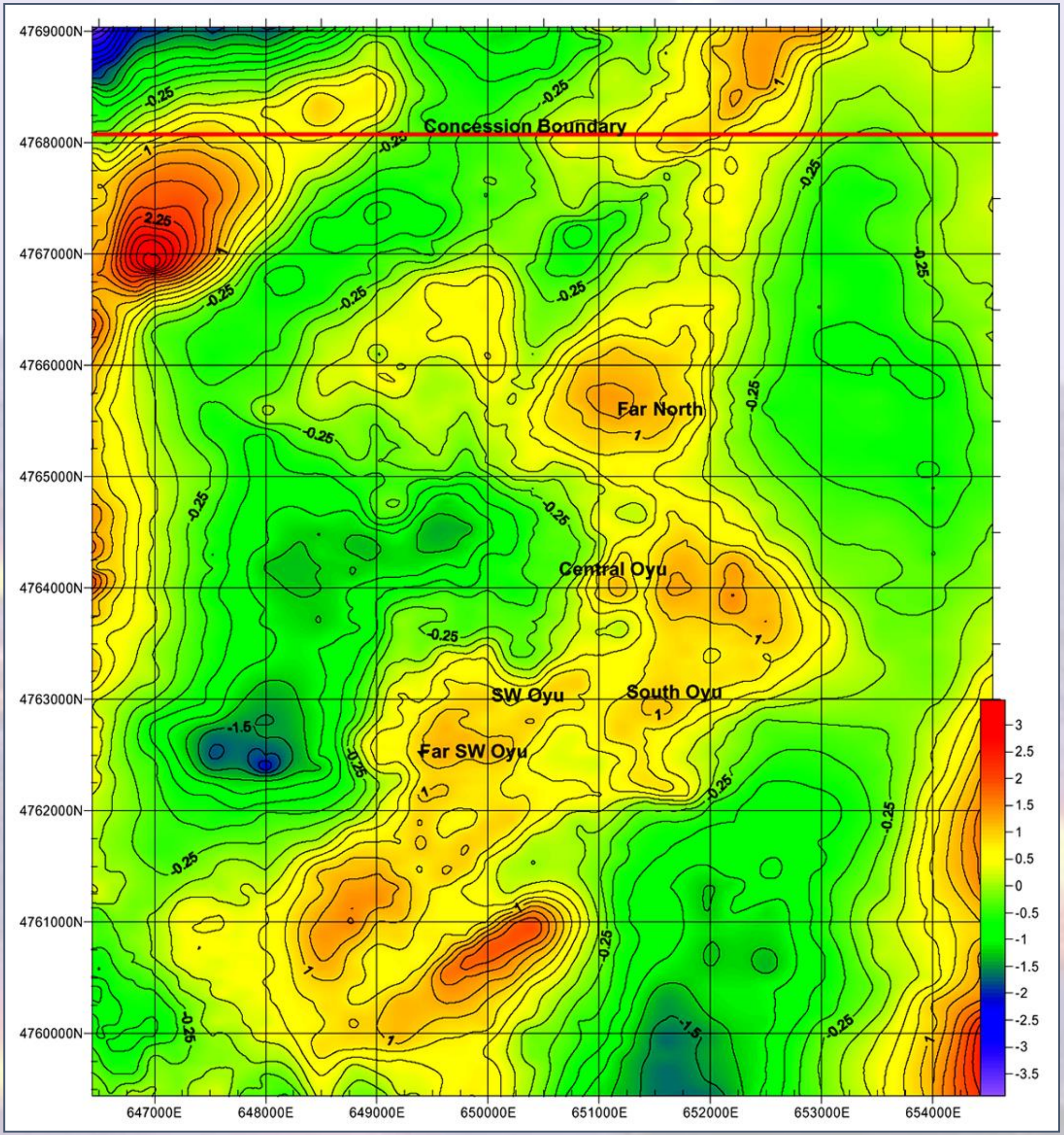
- Innovative approach – targeting silica clay alterations with no obvious presence of copper
- Carefully checking subtle features. Semi-covered targets are the most realistic case scenario for present day exploration
- Landsat TM anomalies conspicuous and small hence may not be adequately recognized, carefully check their manifestation on the ground in outcrops
- Surface exposure of OT – flat topography with rolling hill slopes covered by scree. Hardly noticeable when driving around. Only traversing and cracking of the rocks will reveal their true nature
- “Passive” cover. Geophysics picks up direct signals from sub-surface targets
- Stream sediment and soil sampling – no spectacular results. Within 5 km from Central Oyu the Geochem signal for major elements indicators falls below detection limit. Far North is a covered “blind” target.
- Multidisciplinary approach (remote sensing, geology, geochemistry, and geophysics)
- PICT culture in exploration teams

Successful Discovery Culture

P I C T

- **P** persistence
- **I** innovation
- **C** courage
- **T** teamwork

Oyu Tolgoi District Gravity



OT Summary – what did not fit the model?

- OT – cluster of porphyry centers occurring along the main structural trend
- Presence of zones with high hypogene Cu grades (primary chalcocite and bornite)
- Hugo Dummett ore body is fully "blind" under the post mineral sediment "passive" cover. Mineralization below 200m depth
- Porphyry mineralization is related to Devonian volcanism. Pz porphyry systems in Altaids volcanic belts could remain preserved
- Mineralization is constrained to a major tectonic structure constrains mineralization with stock works being elongated in shape
- Subtle manifestation of outcropping mineralization on the surface
- "What you see is what you get" approach can be deceptive

Ivanhoe OT Exploration Milestones

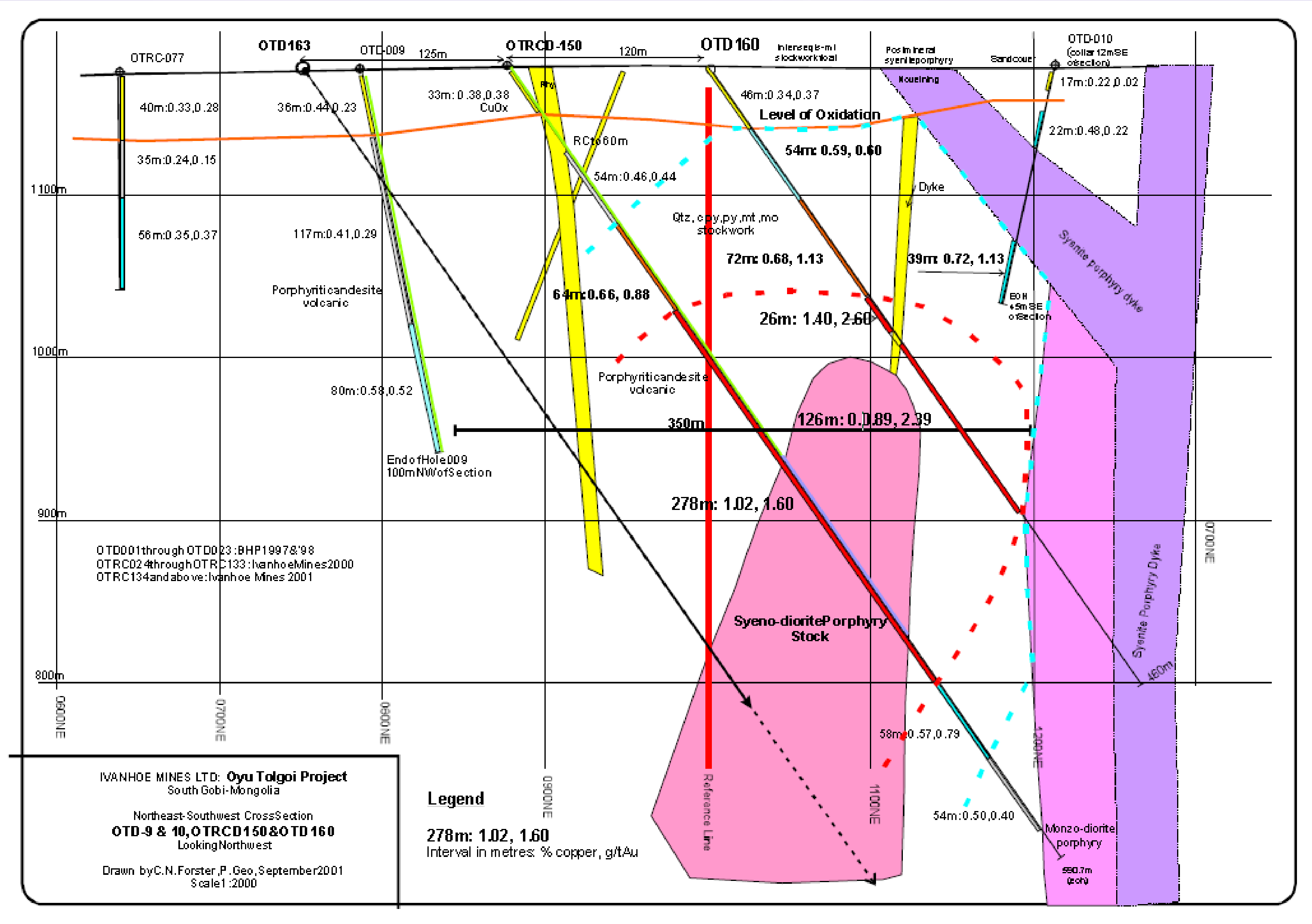
- Summer 2000 – Initial drilling program targeted secondary enrichment following BHP footsteps (shallow RC drill holes, areal coverage). Only a small chalcocite blanket present
- March 2001 – Ivanhoe reduces OT tenement into 4 smaller areas and is immediately surrounded by a local junior
- June 2001 - Change in exploration methodology from chalcocite blanket to hypogene mineralization (deeper drilling, inclined diamond drill holes)
- July 2001 – drill hole OTD 150 (under BHP OT-10) at SW Oyu proved copper-gold hypogene mineralization - **508 m @ 1.17 g/t Au** and **0.81% Cu** intercept
- 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

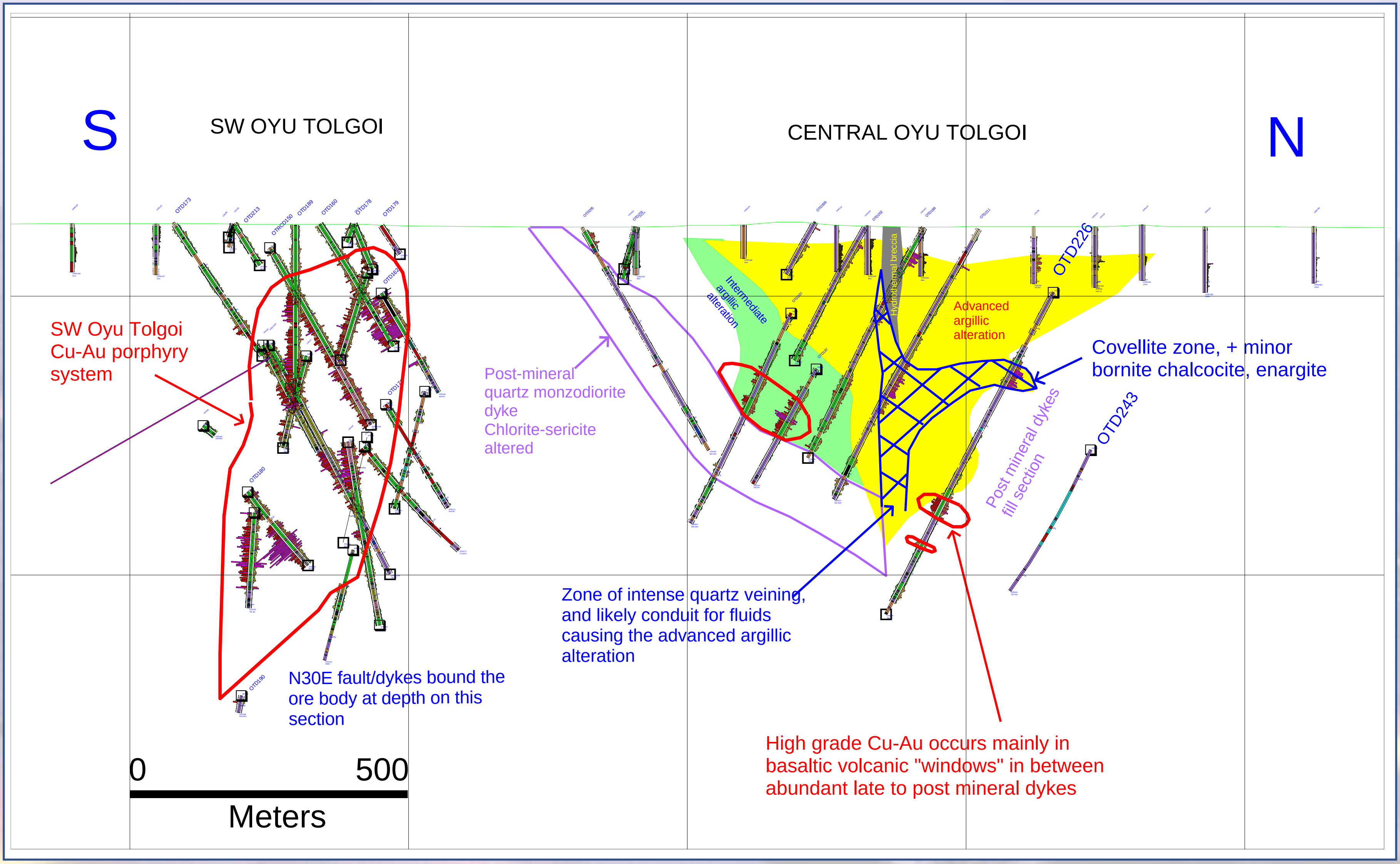
Central Oyu leached capping with Q stockwork

South West Oyu Tolgoi



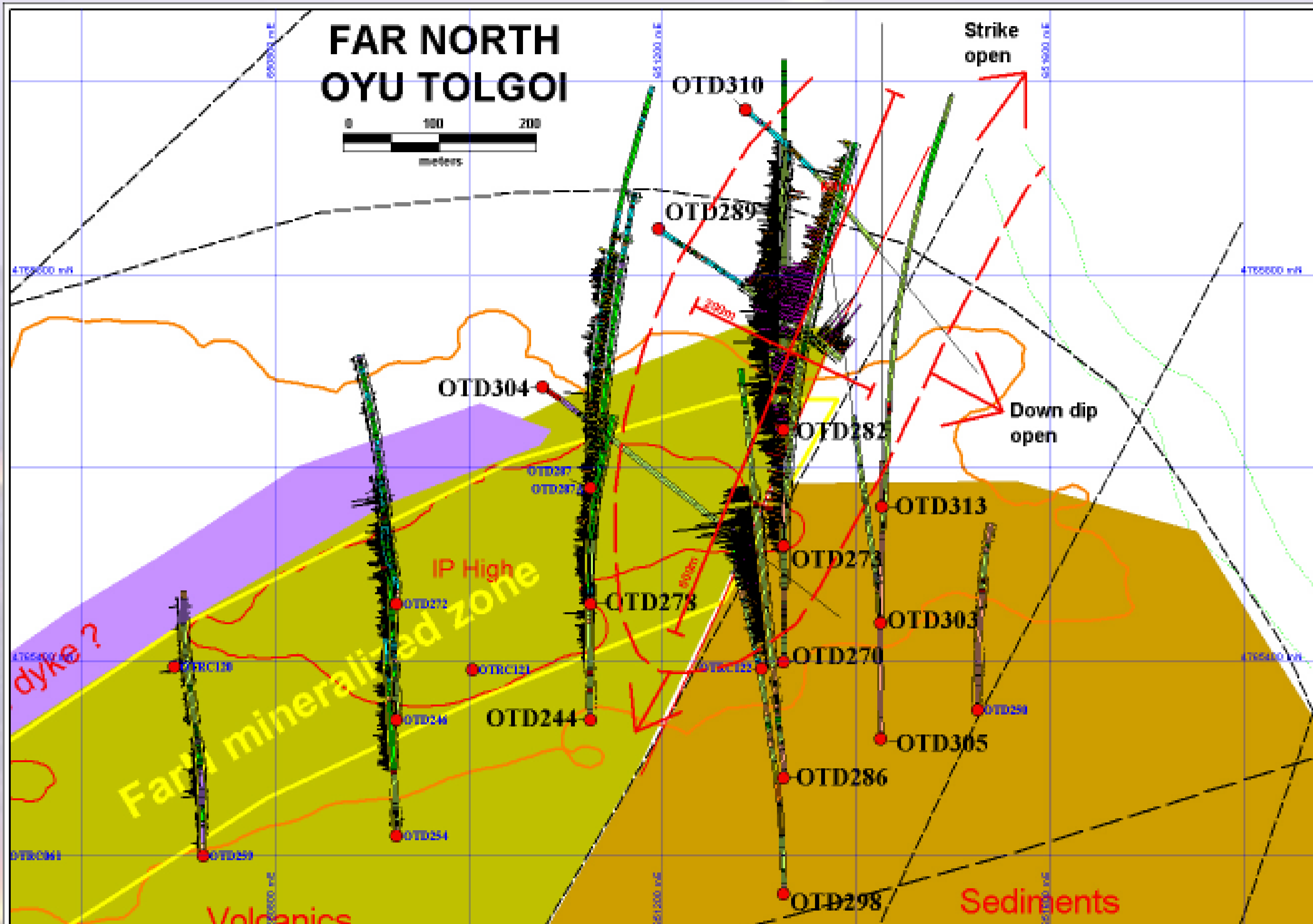
Ivanhoe Mines, 2002

South West Oyu Tolgoi



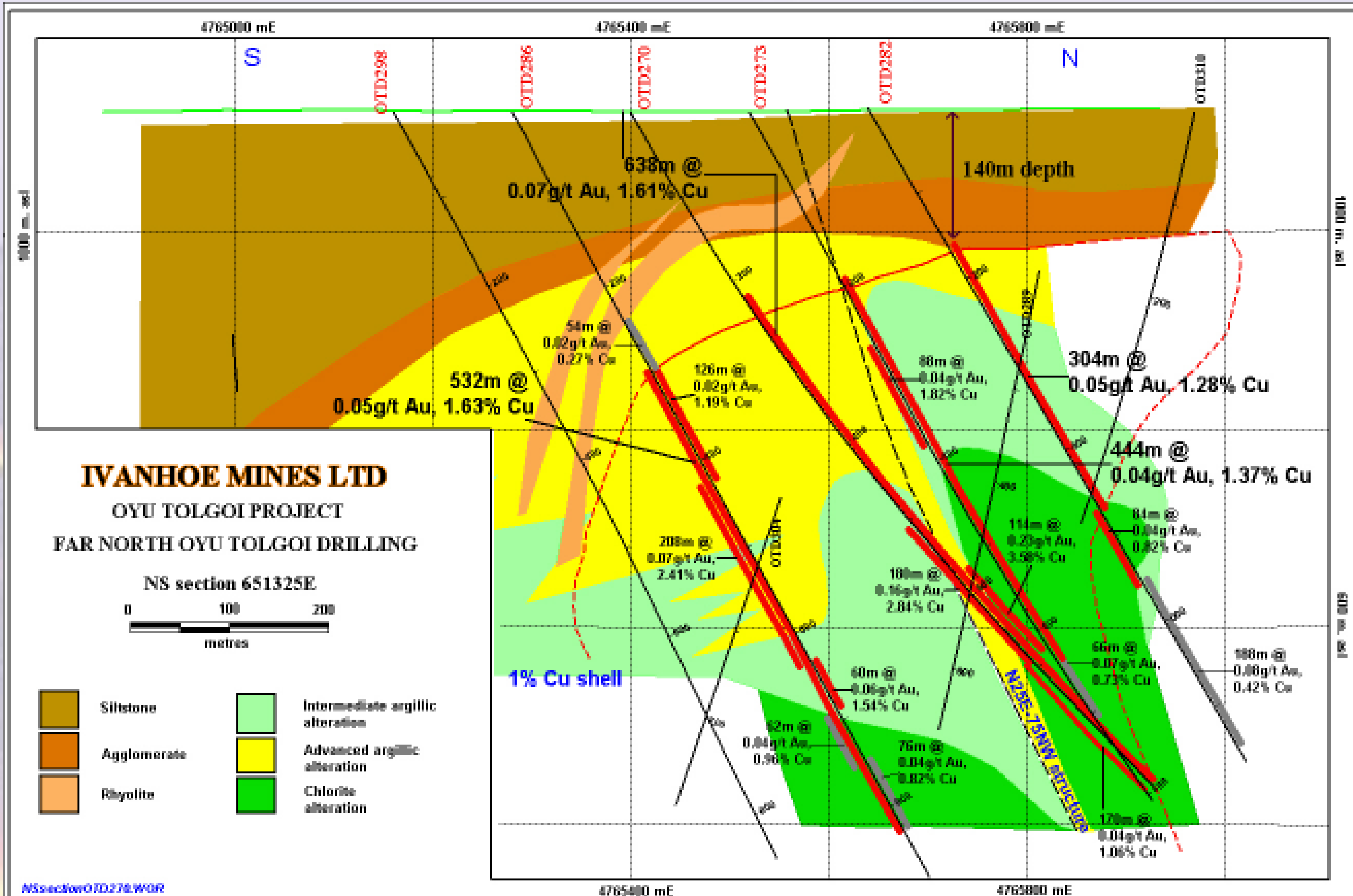
Ivanhoe Mines, 2002

Far North - Hugo Dummett Drilling



Ivanhoe Mines 2003

Far North - Hugo Dummett Drilling



Ivanhoe Mines 2003

Ivanhoe Milestones at OT

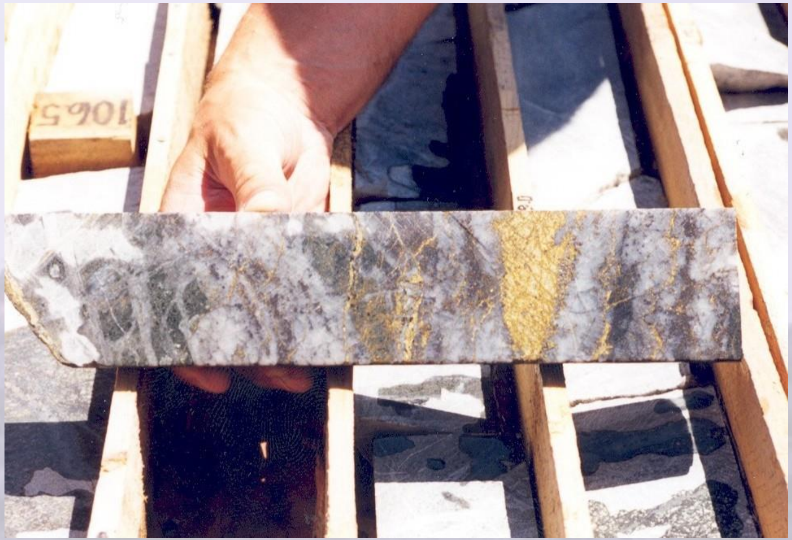
- Sept 2002 - fence drilling at Far North
- Significant hypogene mineralization intercept **608m @ 1.6% Cu** and **0.07 g/t Au** including 114m @ 3.58% Cu and **0.23 g/t Au -** OTD 270 drill hole
- Step up in drilling with powerful drill rigs capable of reaching >1,000 m
- Nov 2003 – Ivanhoe buys 2% royalty from BHP Billiton, establishes full ownership of Oyu Tolgoi project
- Feb 2004 – independent scoping study confirms OT has a potential to become a world class copper-gold mine
- 2005 – Falcon airborne gravity regional survey – JV with BHP

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

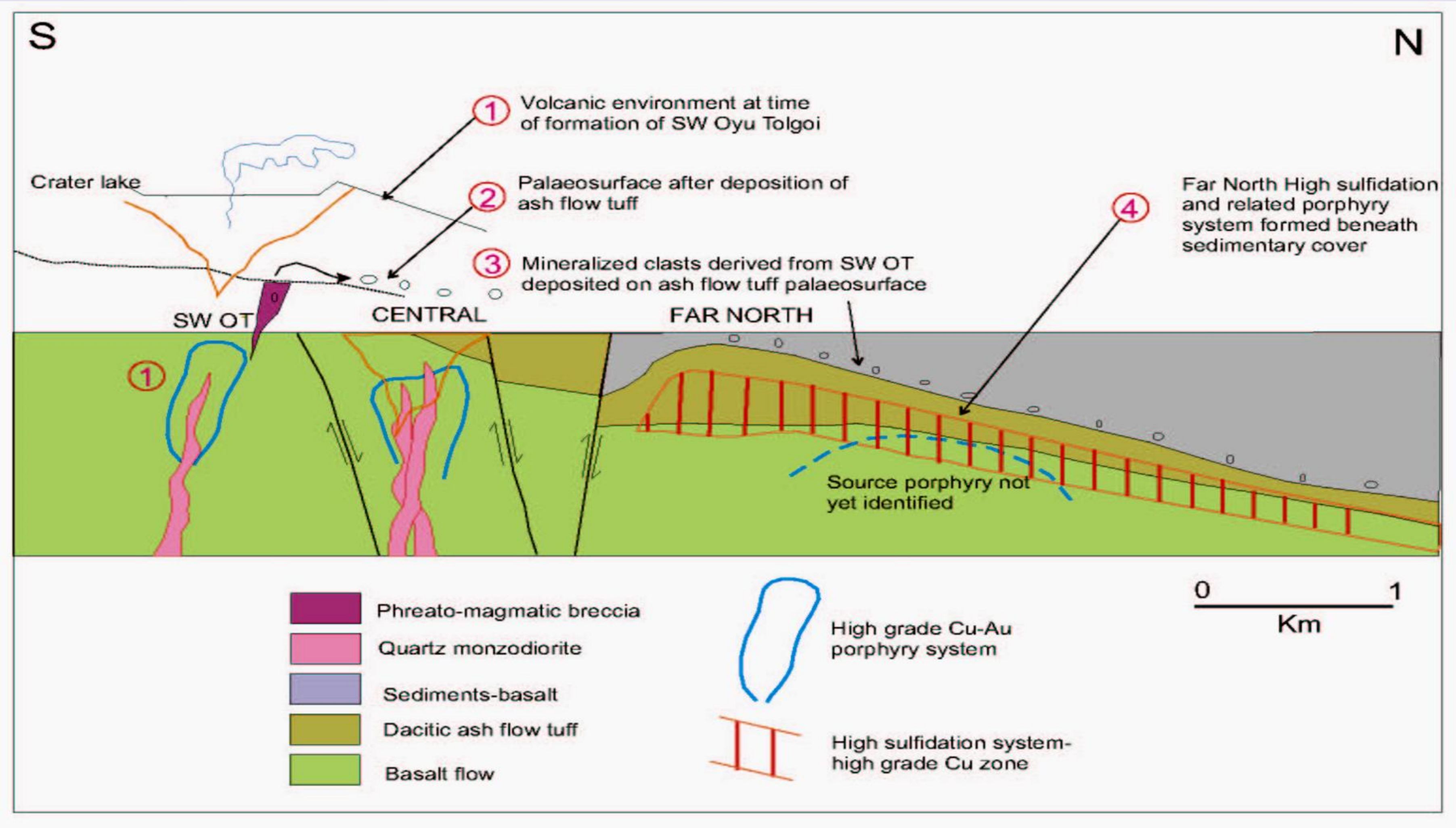


October 2002 – OTD 270 at Far North Oyu 638 m @ 1.61% Cu & 0.07 g/t Au

Far North renamed to Hugo Dummett deposit

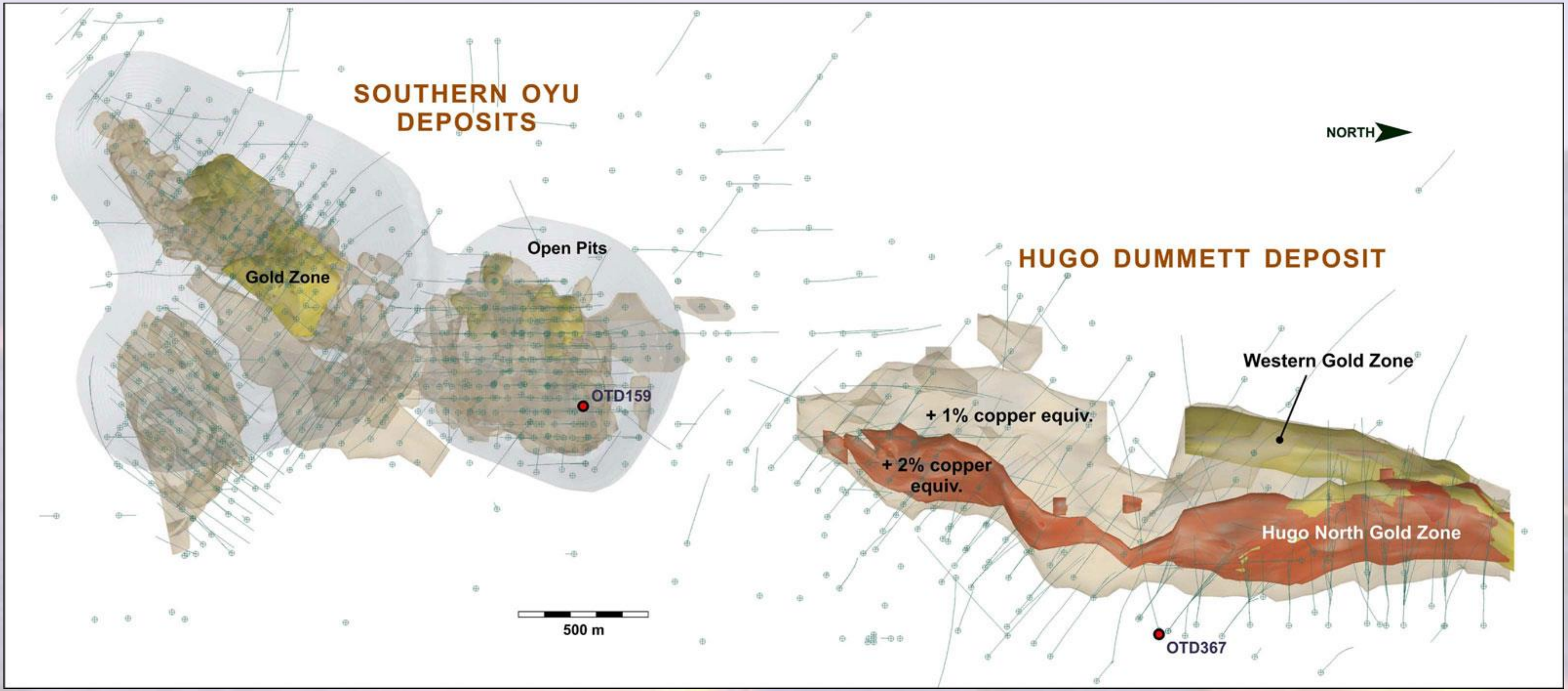
Photo Ivanhoe Mines

OT General Geologic Concept

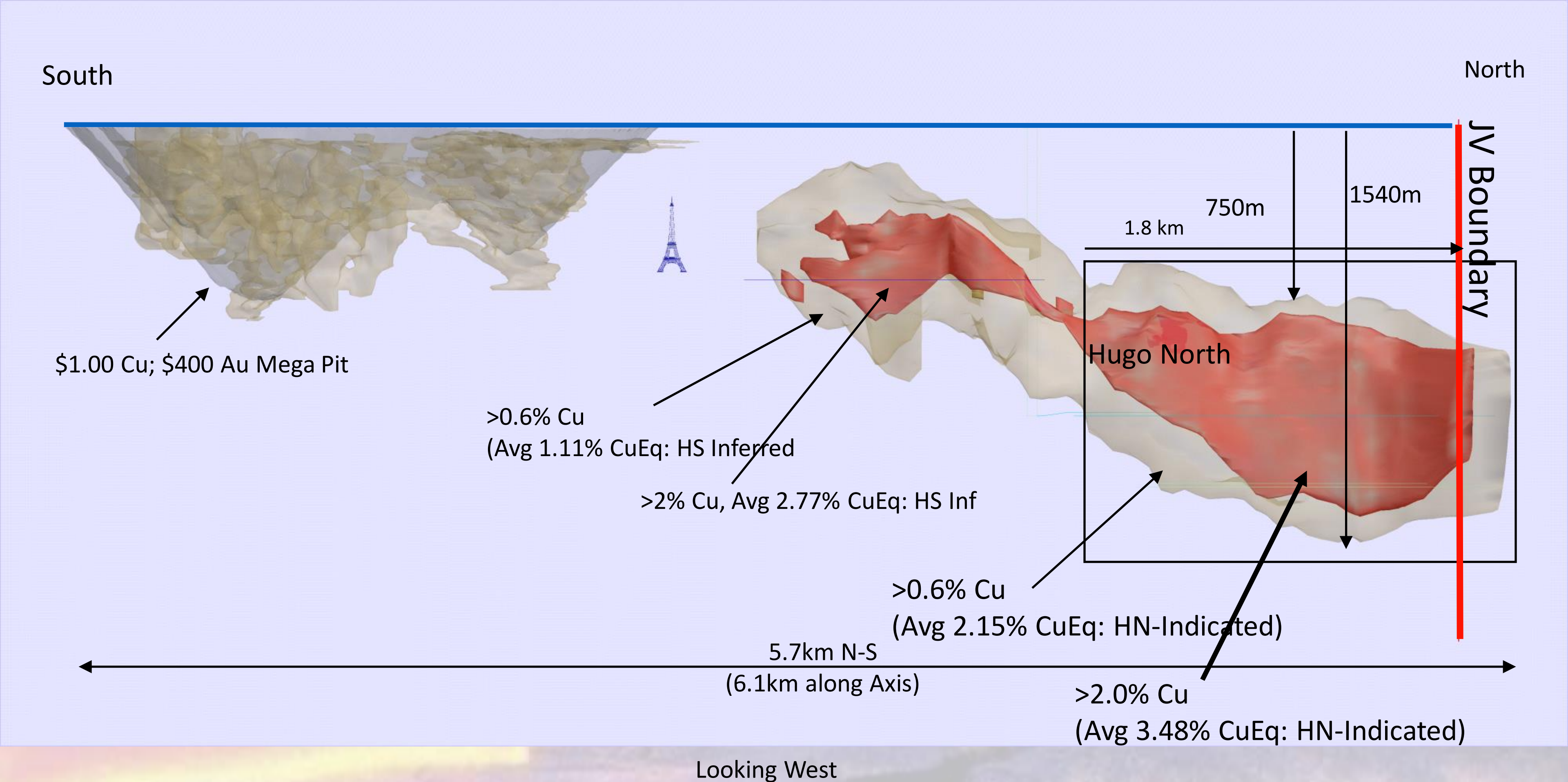


Ivanhoe Mines

Oyu Tolgoi Plan View

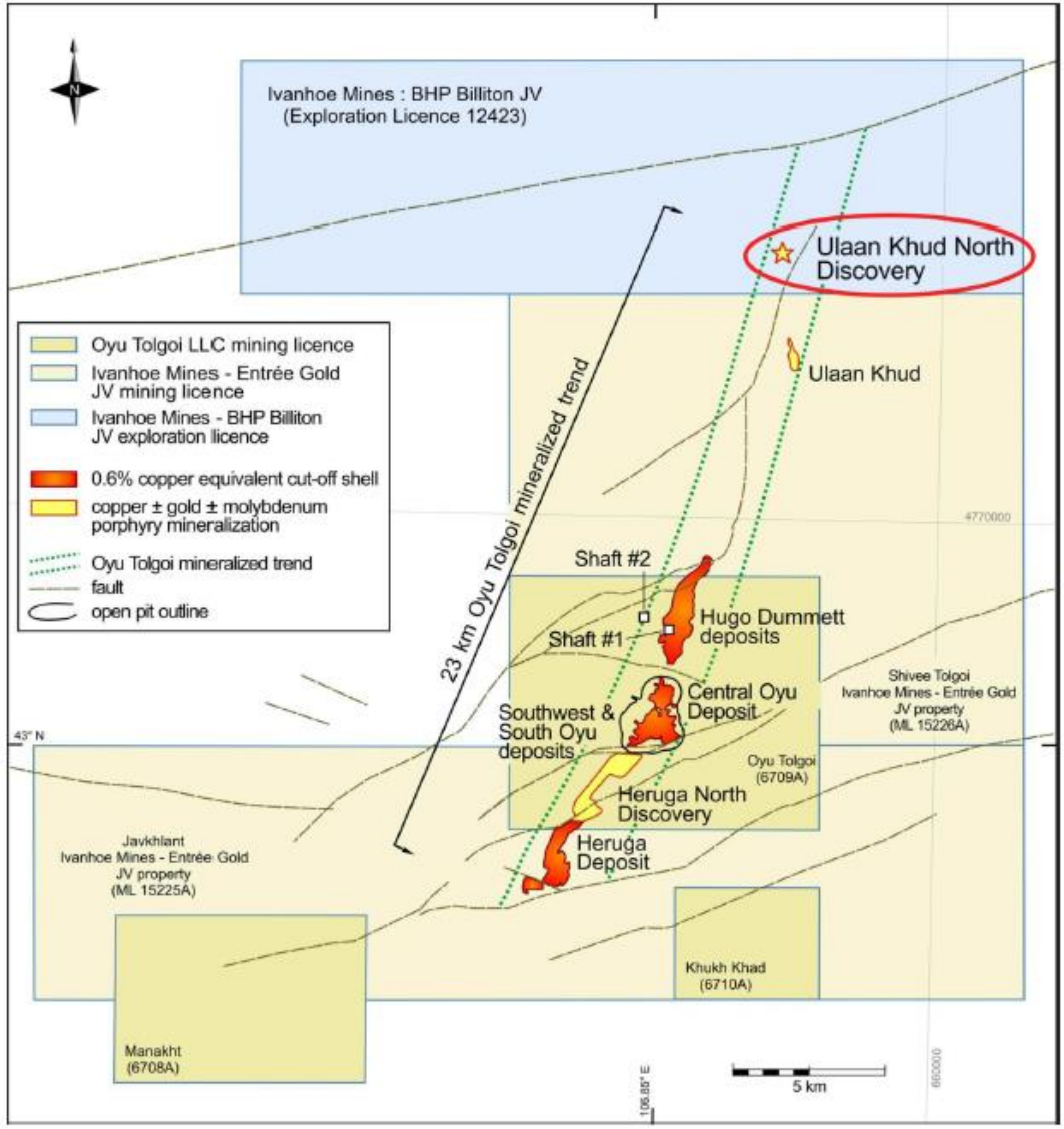


Long Section of Hugo Dummett 2005

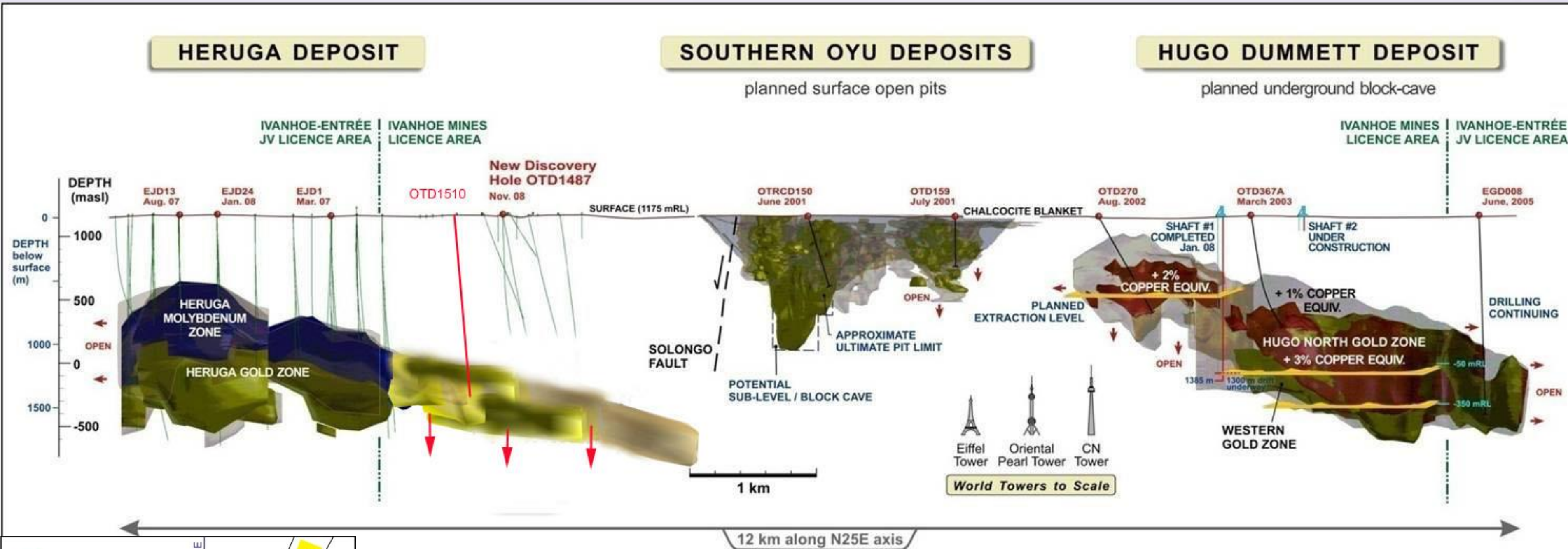


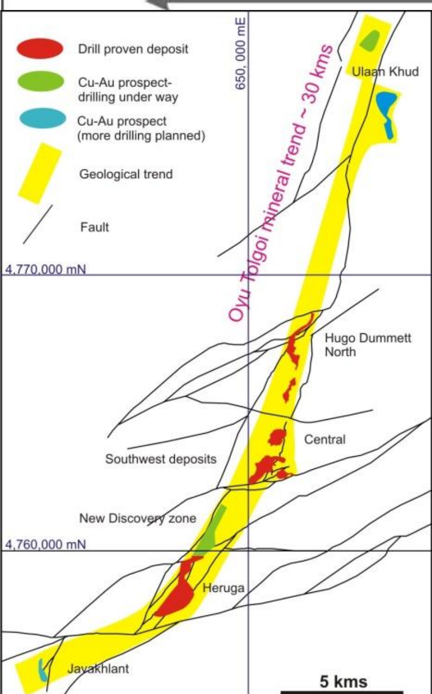
Ivanhoe Oyu Tolgoi Discovery Milestones

- 2001 – Ivanhoe follows BHP exploration for chalcocite blankets - shallow RC drill program with limited success
- 2002 – Ivanhoe switching to an exploration model of exploring for hypogene mineralization
- 2001-2003 – Successful intercepts at OTD-150 and OTD-270. Discovery of Hugo Dummett deposit
- 2006 – Rio Tinto strategic partnership with Ivanhoe Mines
- Oct 2007 – Heruga deposit discovered, Rio Tinto buys 10% of Ivanhoe's Oyu Tolgoi
- Mar 2008 - Ivanhoe estimated OT project copper resources at 35Mt copper and gold resources at 45.2Moz
- Oct 2009 – Ivanhoe and Mongolian Government sign an Investment Agreement to put the OT project into production in 2013 by investing $4B
- 2010 – Rio Tinto establishes control of OT. Full scale construction at OT started
- Mar 2011 – Ivanhoe and BHP discovered new shallow Cu-Mo-Au zone Ulaan Khud 10 km north of OT, mineralized trend >23 km
- 2011 – First copper concentrate production from Oyu Tolgoi

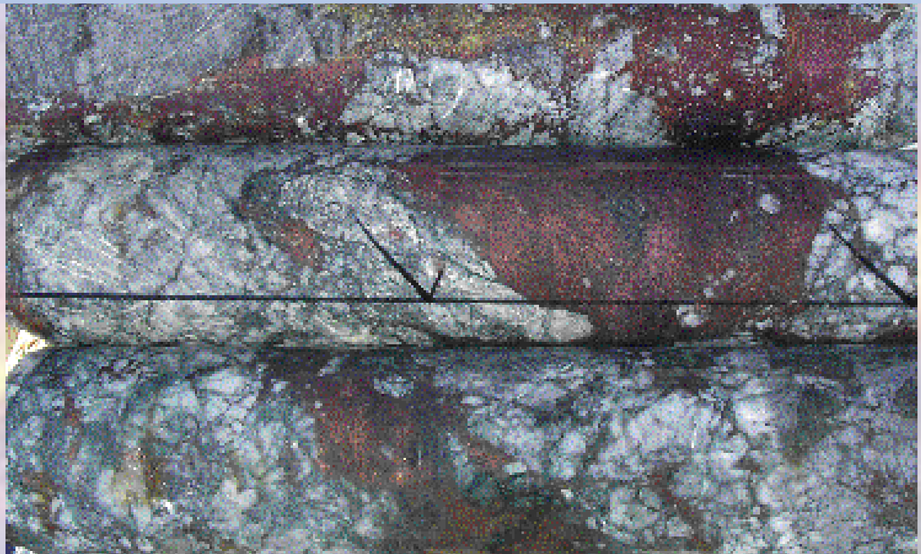


Ivanhoe Mines : BHP Billiton JV
(Exploration Licence 12423)
Ulaan Khud North
Discovery
Ulaan Khud
Oyu Tolgoi LLC mining licence
Ivanhoe Mines - Entrée Gold JV mining licence
Ivanhoe Mines - BHP Billiton JV exploration licence
0.6% copper equivalent cut-off shell
copper ± gold ± molybdenum porphyry mineralization
Oyu Tolgoi mineralized trend
fault
open pit outline
23 km Oyu Tolgoi mineralized trend
Shaft #2
Shaft #1
Hugo Dummett deposits
Central Oyu Deposit
Southwest & South Oyu deposits
Shivee Tolgoi
Ivanhoe Mines - Entrée Gold
JV property
(ML 15226A)
Oyu Tolgoi
(6709A)
Heruga North Discovery
Heruga Deposit
Javkhlant
Ivanhoe Mines - Entrée Gold
JV property
(ML 15225A)
Khukh Khad
(6710A)
Manakht
(6708A)
43° N
4770000
106.85° E
660000
5 km





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 equiv. cut-off)



Oyu Tolgoi Geological Summary

- Early to mid Paleozoic island arc within Altaids
- Typical calc-alkaline, 'island arc-type' Cu-Au porphyry mineralization
- Lower to mid Paleozoic metasediments and island arc basalts resting on lower Paleozoic ophiolite complex
- Stratigraphy: andesite volcanicalstics, augite basalts, dacite pyroclastics, sediment units, basalt tuffs and flows, dacite flows
- Post mineral dykes: basalt, rhyolite, hornblende-biotite andesite, and biotite granodiorite intrusives and variety of altered and mineralized porphyritic quartz monzodiorite dykes
- Style of mineralization from porphyry (SW Oyu) representing root zone of high sulphidation (HS) systems, eroded away at S and SW Oyu, but still present in Central Oyu and Hugo Dummett deposits
- HS system partly telescoped onto underlying porphyry systems at Central and Hugo
- High grade copper mineralization at Hugo Dummett as bornite, chalcocite and chalcopyrite
- Pyrite, enargite, tetrahedrite-tennantite occur in subordinate amounts at Hugo Dummett South deposit

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

Turquoise Hill 2008

Oyu Tolgoi Production Facility

Hugo Mine Production Facility

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 - 1,5000	Geophysics							Drilling
			Airborne surveys		Ground surveys					
			Magnetics	Gravity	Seismic	EM	AMT	Electric		
								SP	IP	
Structures	x	x	x		x					+
Porphyry intrusions	+		+	x						+
Mineralization:										
Outcropping	+	+	+			+	x	x	+	+
Sub-cropping		x	x			x	x		+	+
Deeply buried							x		x	+

Discovery Case Histories

- Mineral exploration - process of finding commercially viable mineral resource. Its objective is to locate an economically viable deposit in the shortest possible time and at the lowest possible cost
- Case histories provide good lessons for discovery of new largest and richest deposits
- Case histories and applications of exploration help conceptualizing possibility of mineral occurrences in new matching environments
- Adoption of right combination of techniques is warranted to conduct exploration in a cost-effective manner to locate concealed ore bodies
- Each mineral deposit is unique in own characteristic, each exploration program needs to be crafted to the local geological conditions
- Case histories focus on application aspects specific exploration concepts crafted to real-life scenarios in the field with 3D modelling for better interpretation and predictive targeting
- Important ingredients of a successful exploration are (1) selection of right geological terrain, (2) optimum level of funding, and (3) keeping pace with the state-of-the-art exploration technology

Conclusions

- Case histories are valuable source of knowledge for explorers
- Consideration of host rocks and factors for generation of highly valuable high-grade mineralization and rich ores
- Types of pre-mineral or post-mineral cover and selection of relevant assemblage of exploration tools
- Dynamics and history of ore formation
- Mineralized system approach
- Postmineral history
- Levels of erosion, depth to targets
- Selection of effective exploration tools
- Drilling has been and remains the ultimate most efficient exploration discovery method

New Discoveries Awaiting Smart Persistent LIPs Explorers