Mineral exploration campaigns: an overview

by
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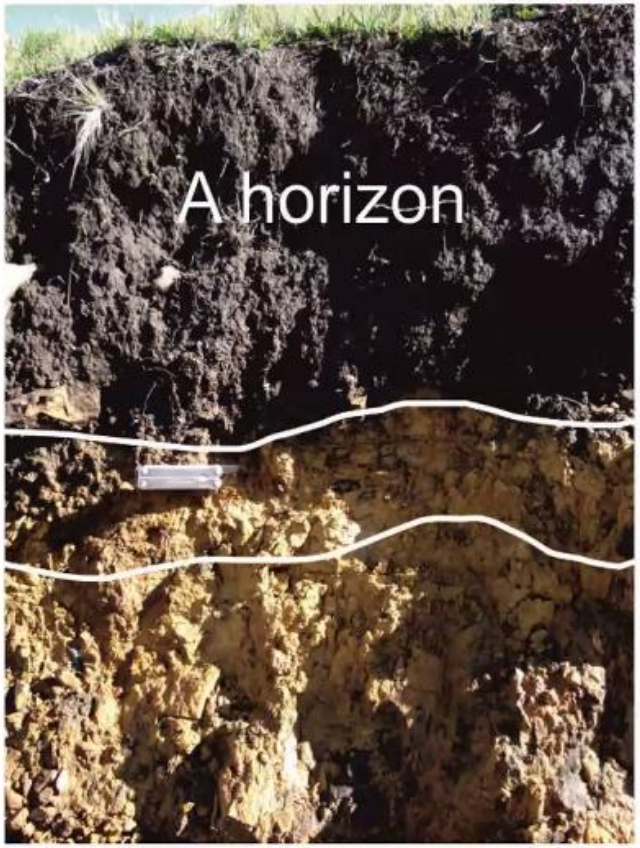
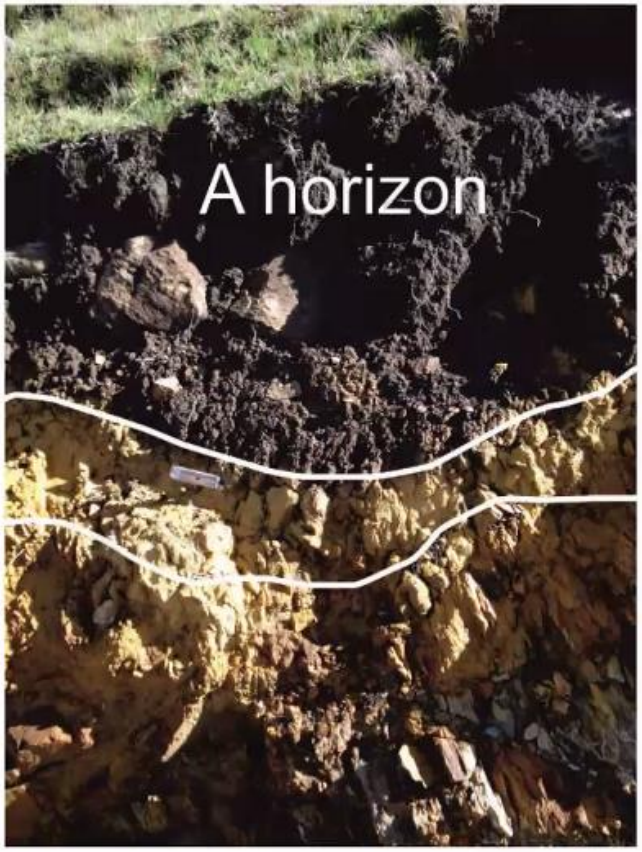
Specialised Geological Mapping Ltd.

Lecture notes of SEG-RWTH AACHEN web seminar
11/3/2021

Gossan with free gold in Tz

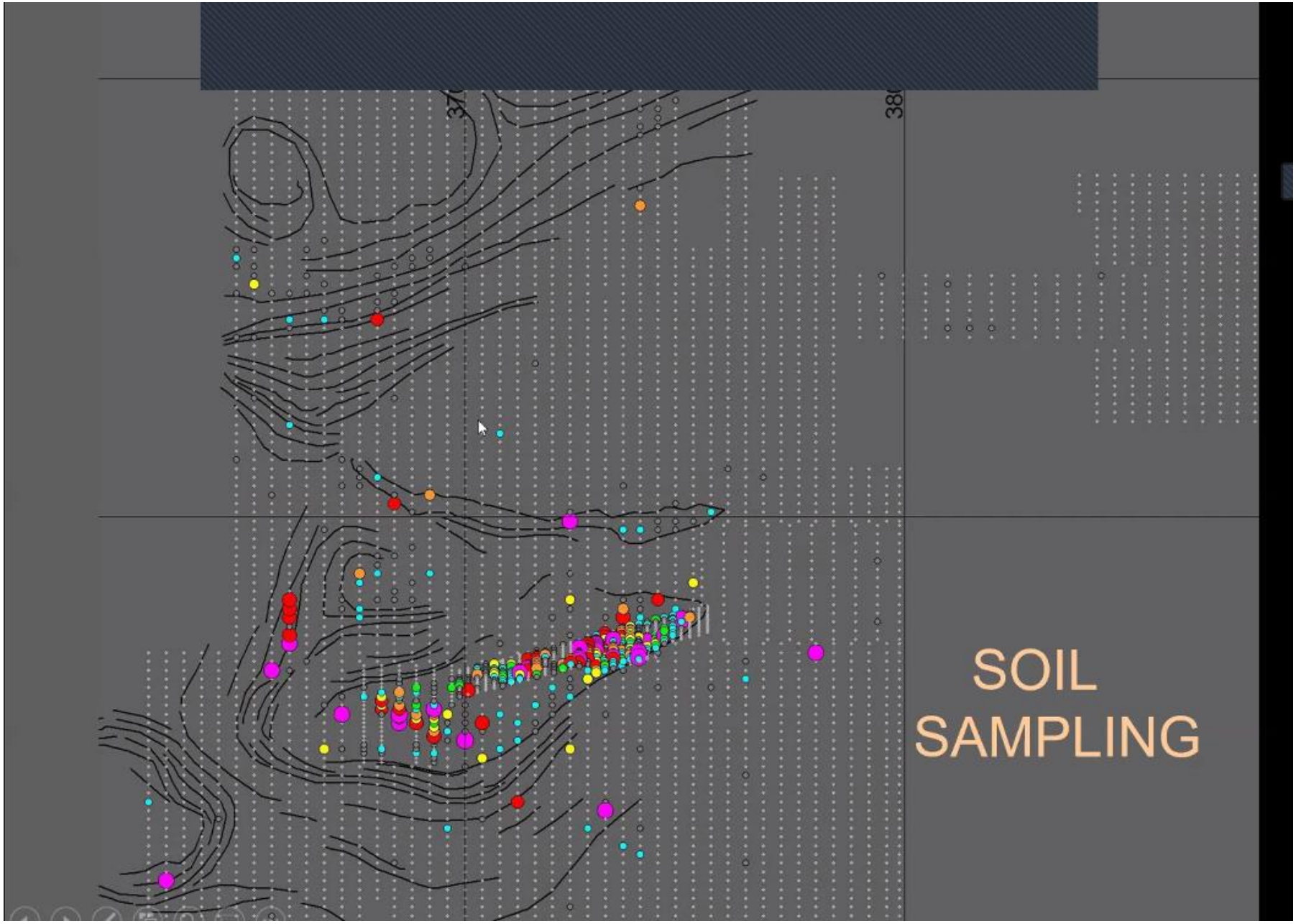
Soil sampling orientation study

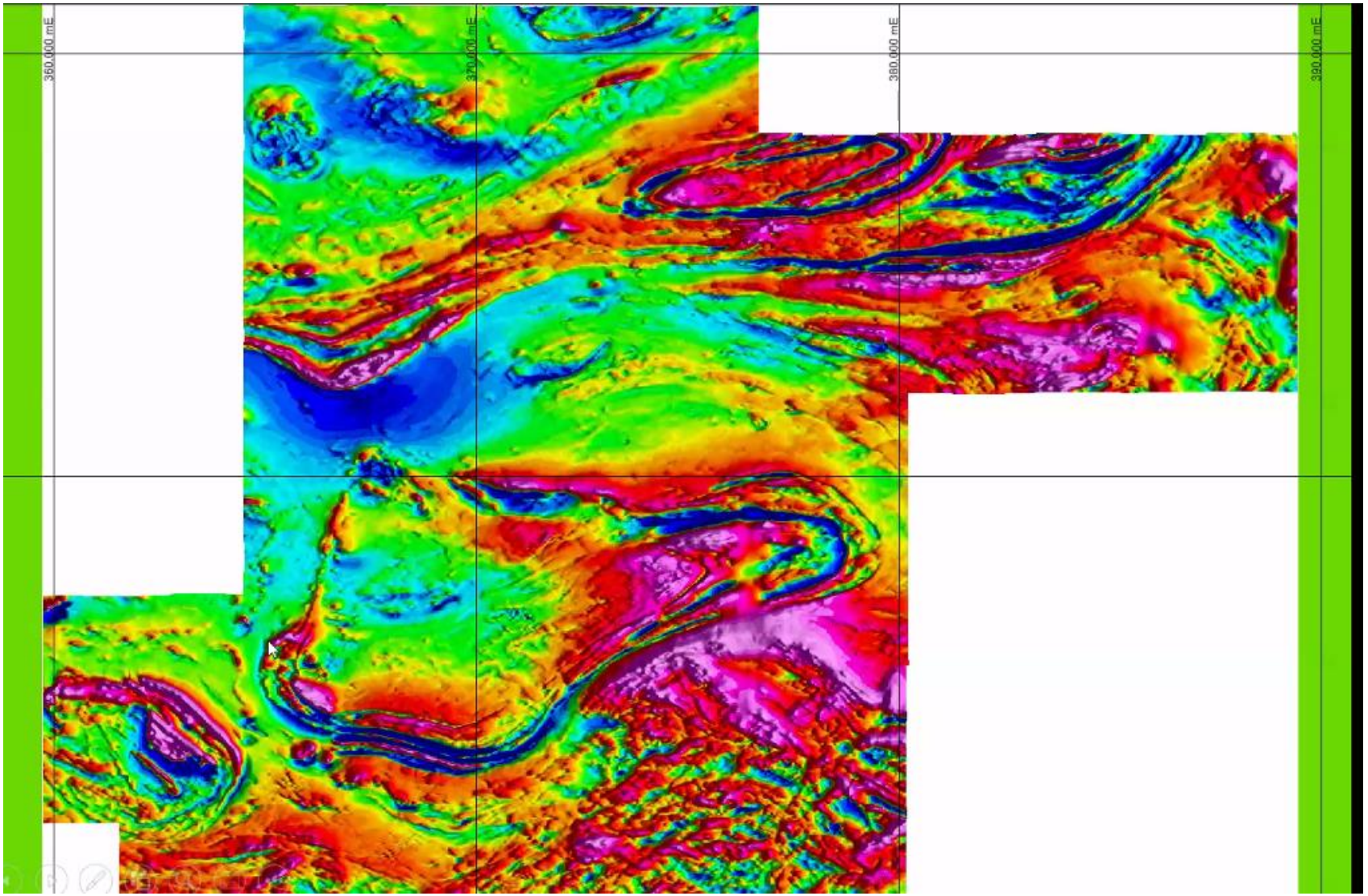


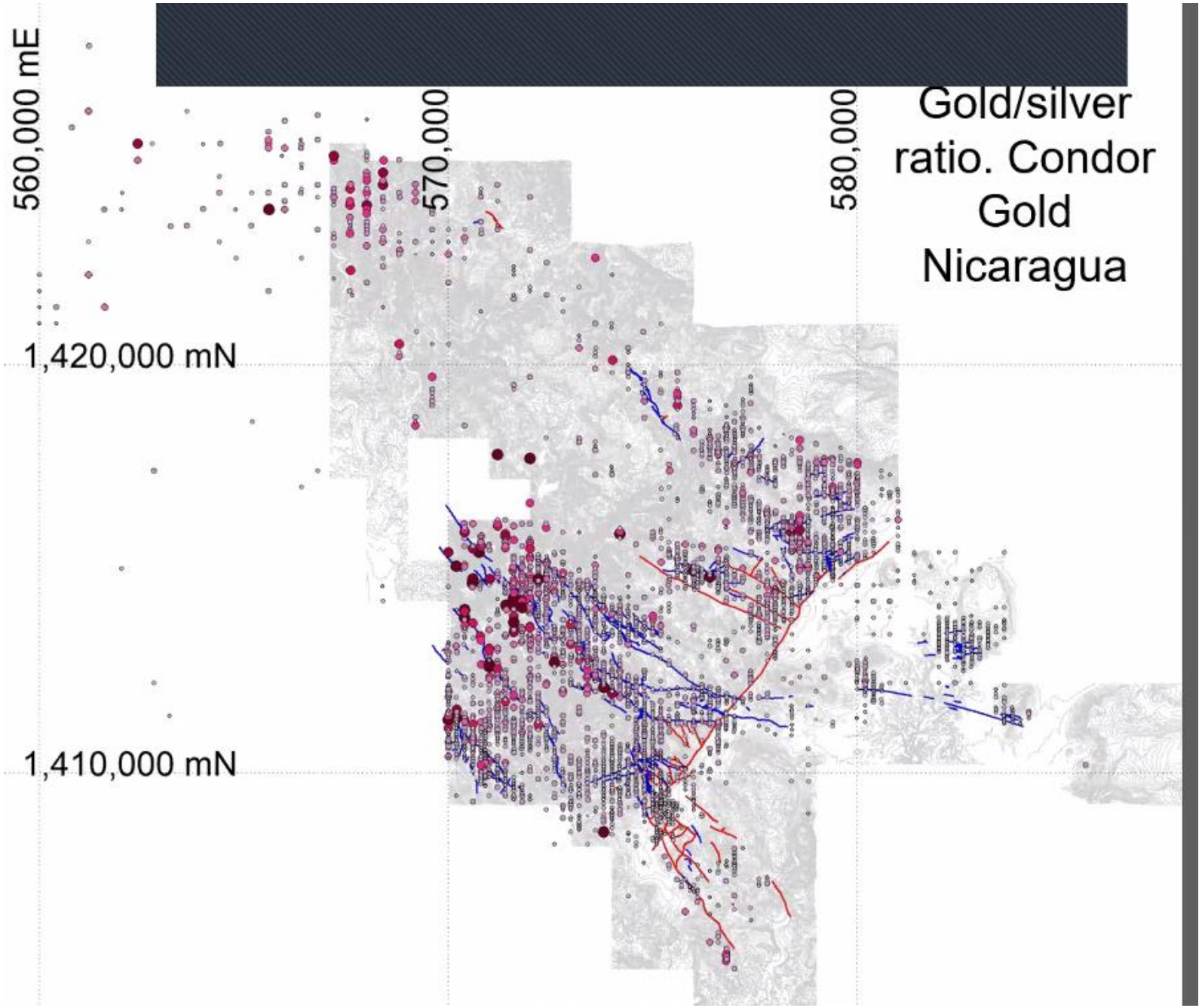


B horizon

C horizon
(weathered friable rock)


SOIL
SAMPLING


360,000 mE
370,000 mE
380,000 mE
390,000 mE

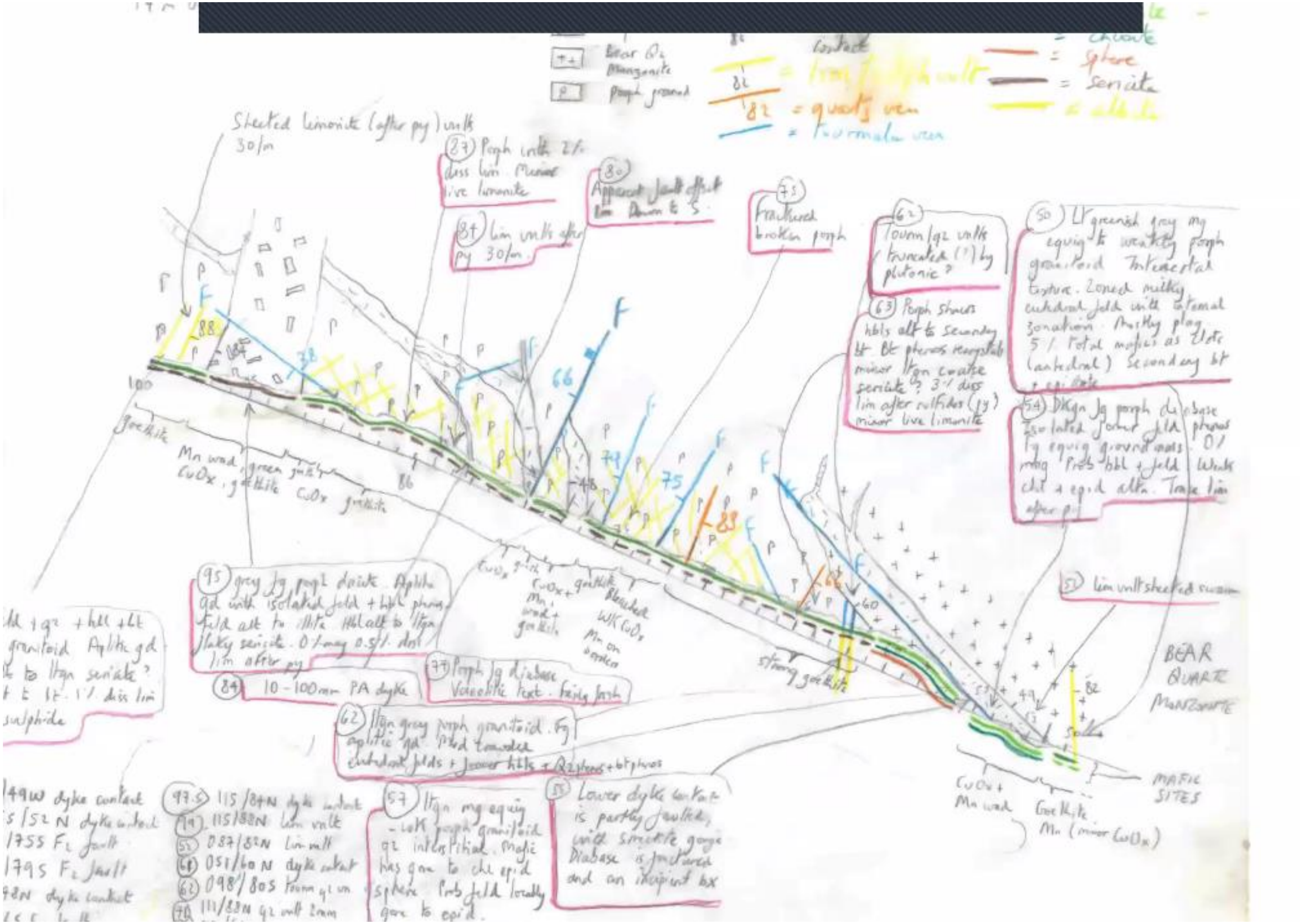

560,000 mE
570,000
580,000
1,420,000 mN
1,410,000 mN
Gold/silver ratio. Condor Gold Nicaragua

CAÑICAPA - ECUADOR

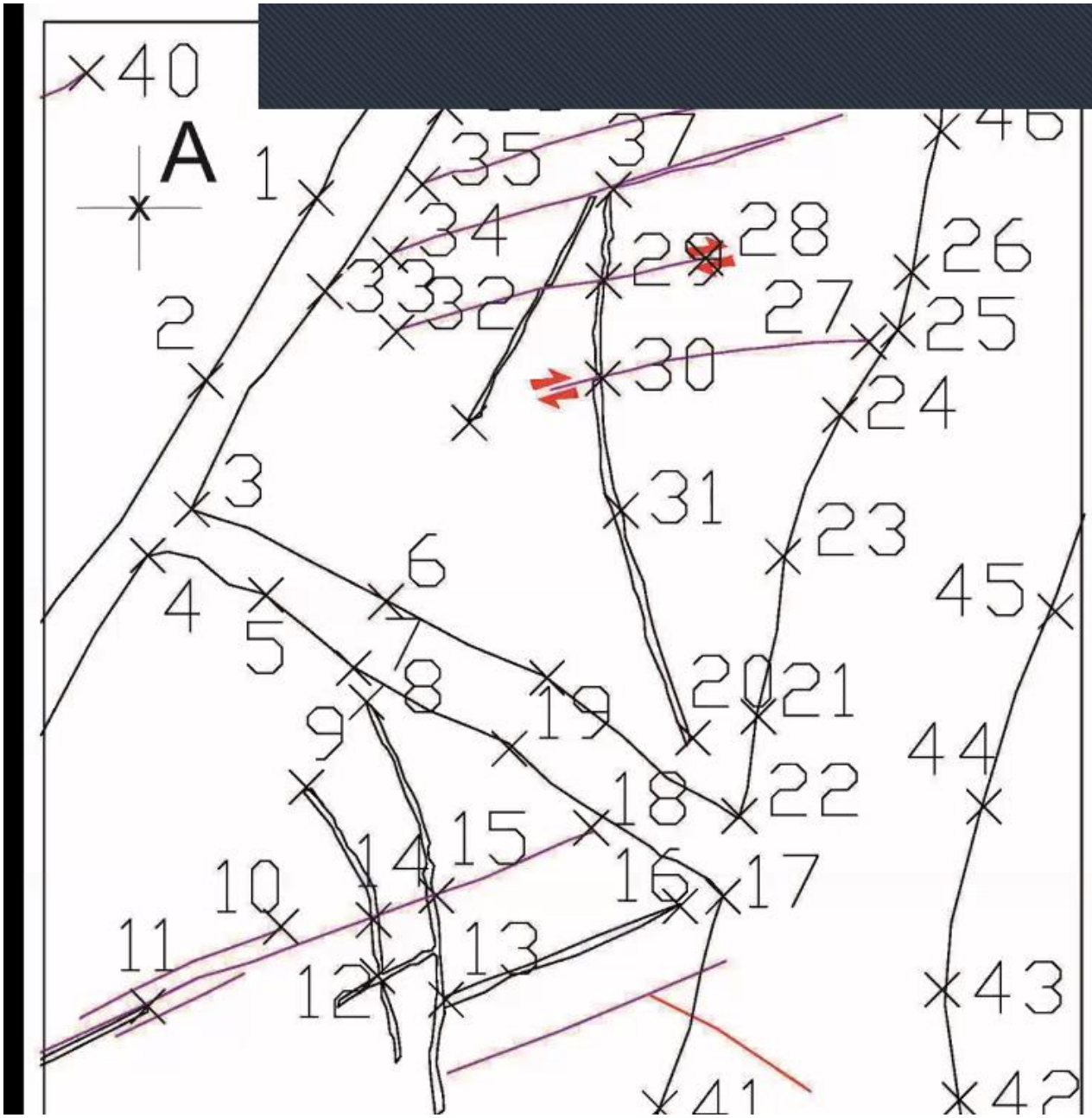
High sulphidation epithermal gold.

More than 3 km of trenches dug by 40 indigenous Saraguro

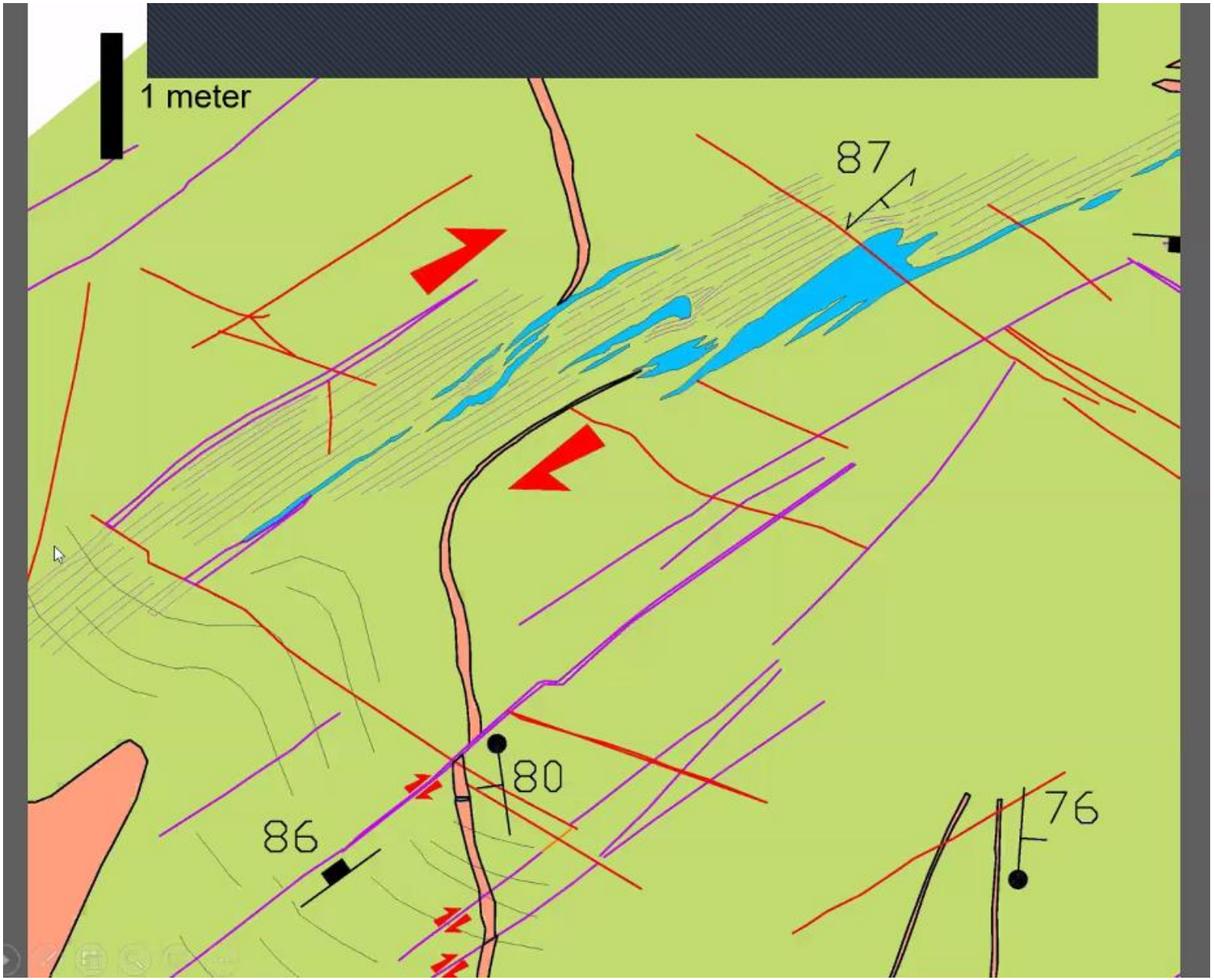

DEAKIN
EQUIPMENT
www.deakin.com
1-800-663-3735
3
Outfitting for over
30 YEARS
NO BLANCO
PERU
FEB-MAR 2004
All-Weather
LEVEL NOTEBOOK

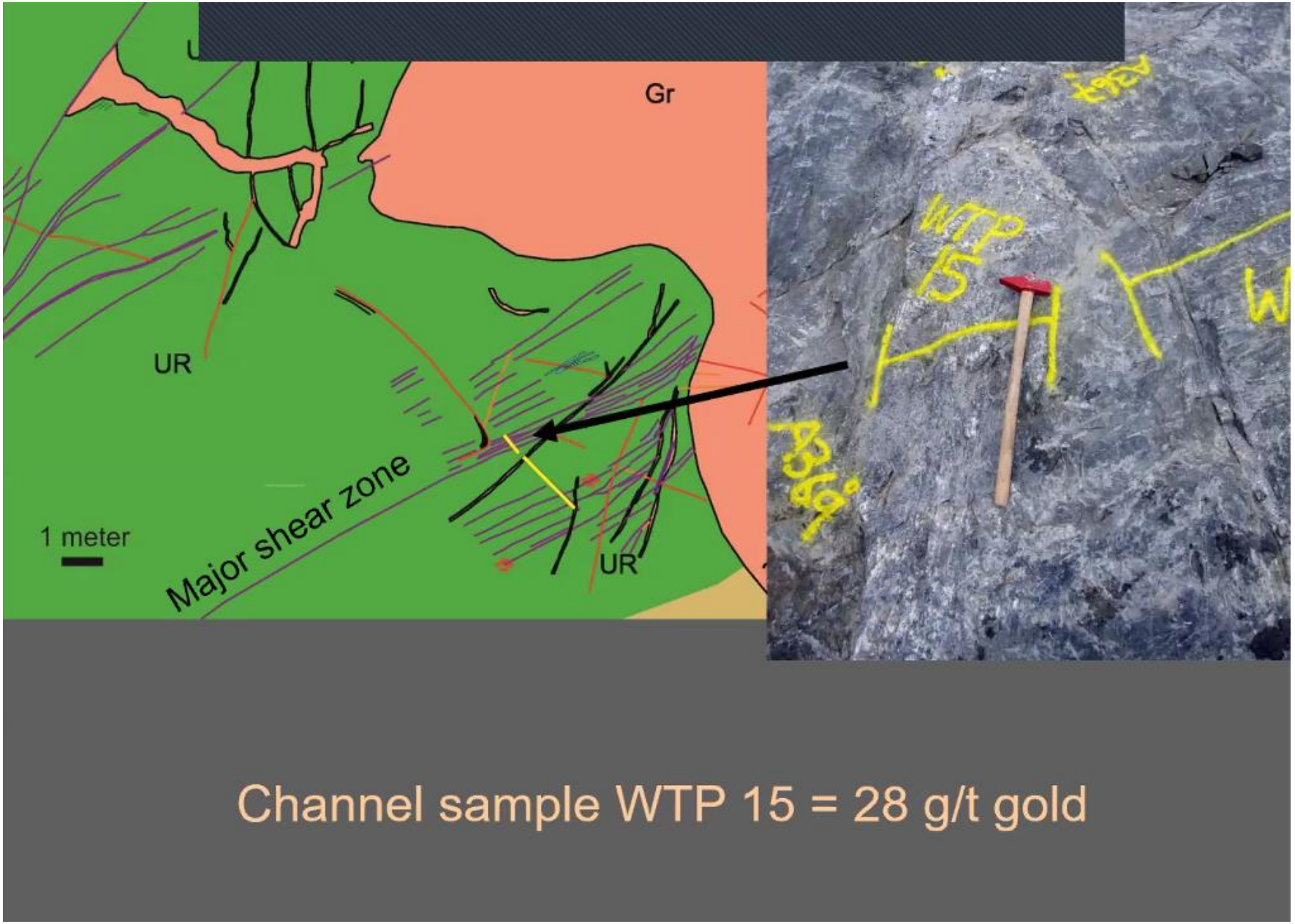


[redacted]
Bear Qz Monzonite
Porph ground
Contact
= quartz vein
= Tourmaline vein
= chlorite
= Sphene
= Sericite
= albite
Sheeted limonite (after py) veinlets 30/m
(87) Porph with 2% diss lim. Minor live limonite
(80) Apparent fault offset
(84) Lim veinlets after py 30/m
(75) Fractured broken porph
(62) Tourm/qz veinlets truncated (?) by plutonic?
(63) Porph shows hbls alt to secondary bt. Bt phenos recrystal. Minor ltgn coarse sericite? 3% diss lim after sulfides (py) minor live limonite
(50) Lt greenish grey mg equig to weakly porph granitoid. Interstitial texture. Zoned milky euhedral feld with internal zonation. Mostly plag. 5% total mafics as clots (anhedral). Secondary bt
(54) Dkgn fg porph diabase. Isolated former feld phenos. Fg equig groundmass. 0% mag. Prob hbl + feld. Weak chl + epid alt. Trace lim after py
(51) lim veinlet sheeted swarm
100
goethite
Mn wad, green goethite, CuOx, goethite, CuOx, goethite
86
66
71
75
83
66
60
88
38
48
82
49
53
CuOx, goethite
CuOx + Mn, wad + goethite
goethite, bleached, wk CuOx, Mn on cracks
strong goethite
BEAR QUARTZ MONZONITE
MAFIC SITES
CuOx + Mn wad
Goethite Mn (minor CuOx)
(95) grey fg porph dike. Aplitic gd with isolated feld + hbl phenos. Feld alt to illite. Hbl alt to ltgn flaky sericite. 0% mag. 0.5% diss lim after py
(84) 10-100mm PA dyke
(77) Porph fg diabase. Variolitic text. Fairly fresh
(62) ltgn grey porph granitoid. Fg aplitic gd. Ptd tomodee euhedral felds + lower hbls + Qz phenos + bt phenos
granitoid. Aplitic gd
to ltgn sericite?
diss lim
sulphide
149W dyke contact
152N dyke contact
175S F fault
179S F fault
48N dyke contact
(97.5) 115/84N dyke contact
(79) 115/88N lim veinlet
(53) 087/82N lim veinlet
(60) 051/60N dyke contact
(62) 098/80S tourm qz vein
(70) 111/88N qz veinlet tourm
(57) ltgn mg equig - weak porph granitoid. Qz interstitial. Mafic has gone to chl epid sphene. Prob feld locally gone to epid.
(55) Lower dyke contact is partly faulted, with smectite gouge. Diabase is fractured and an incipient bx



ART MEETS SCIENCE


1 meter
87
80
86
76



Channel sample WTP 15 = 28 g/t gold

CORE LOGGING lies behind all the 3D models

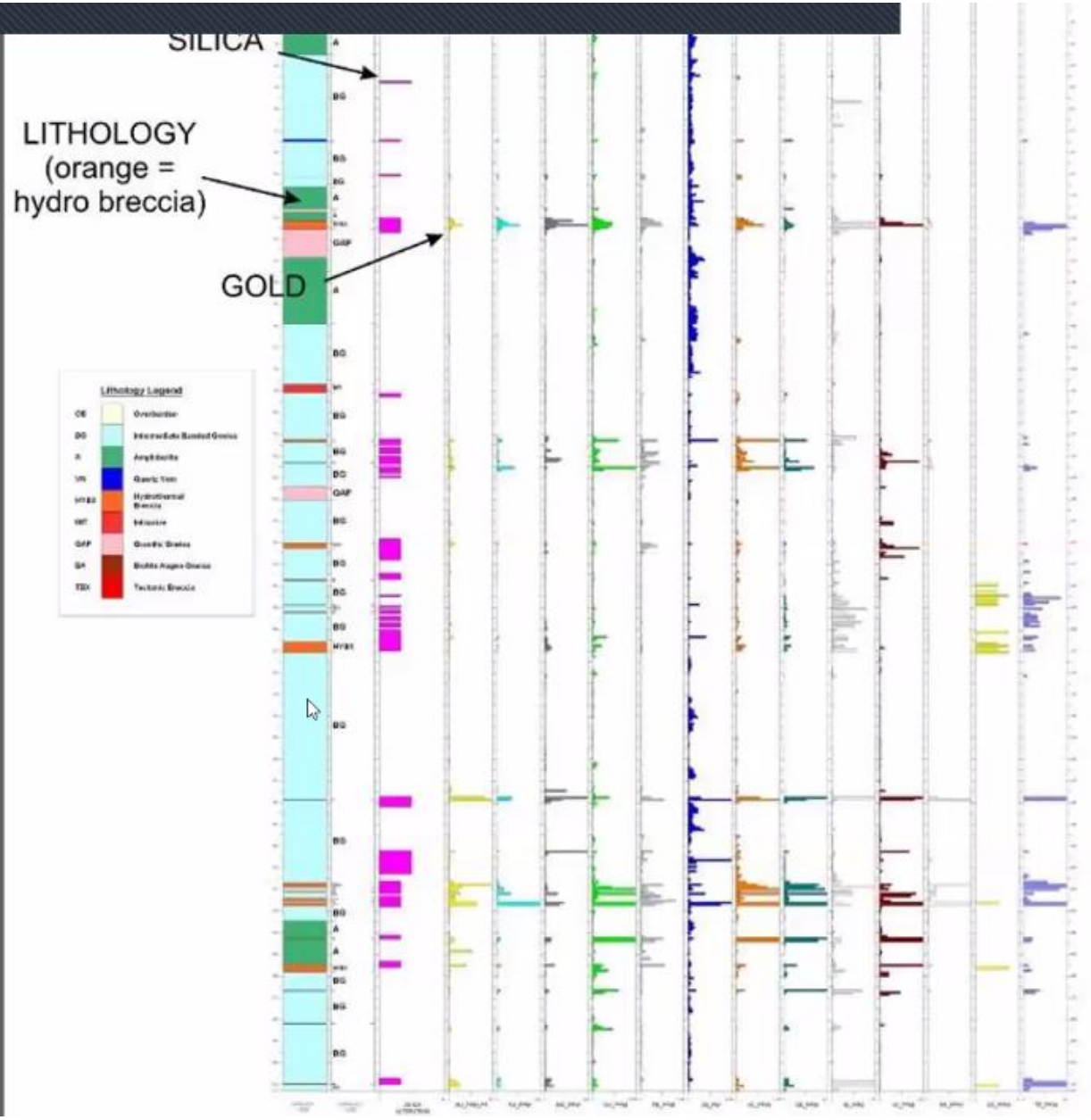
Two things are guaranteed to cause arguments amongst geologists:

1) Breccia textures

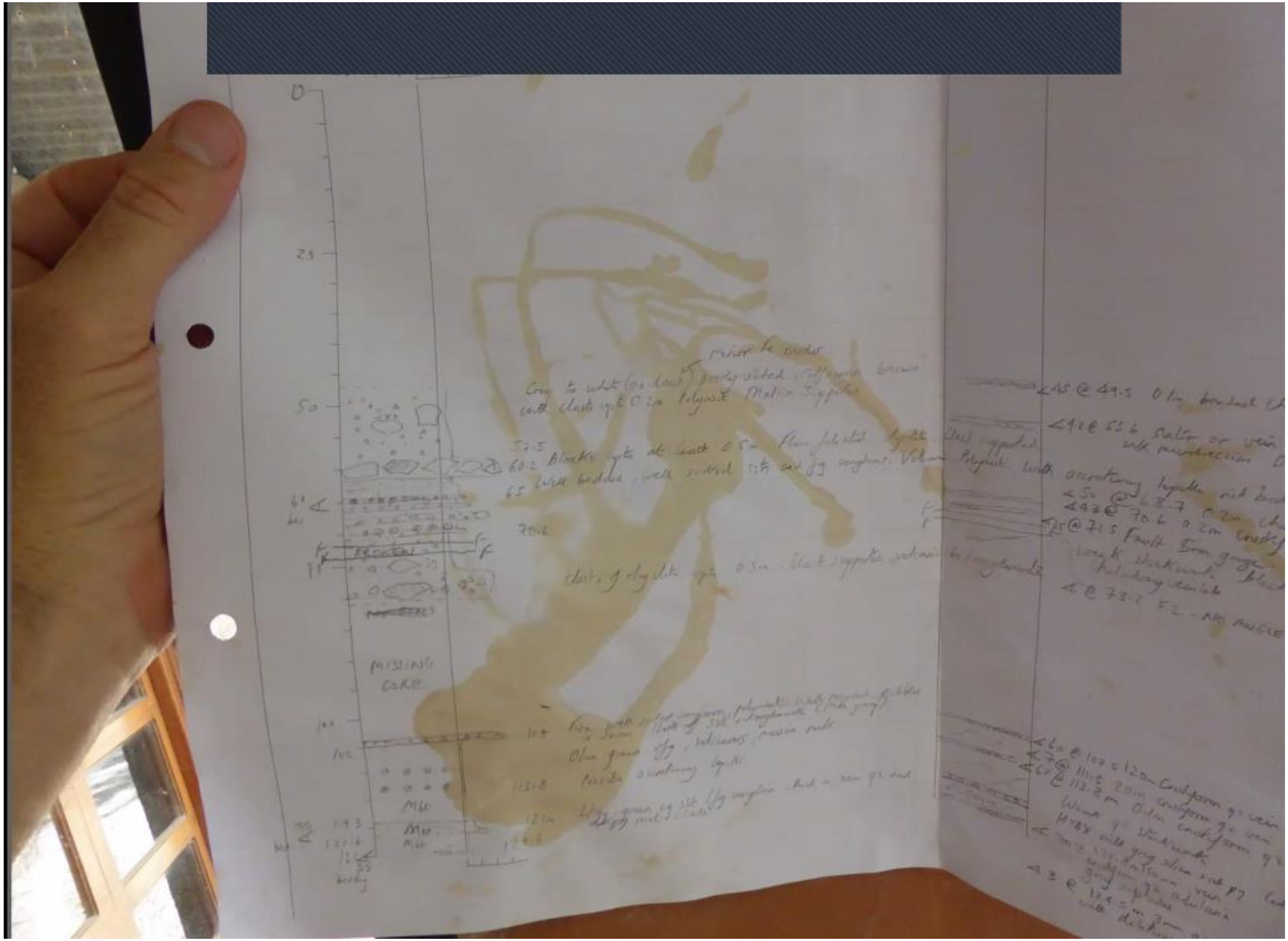
2) Core logging

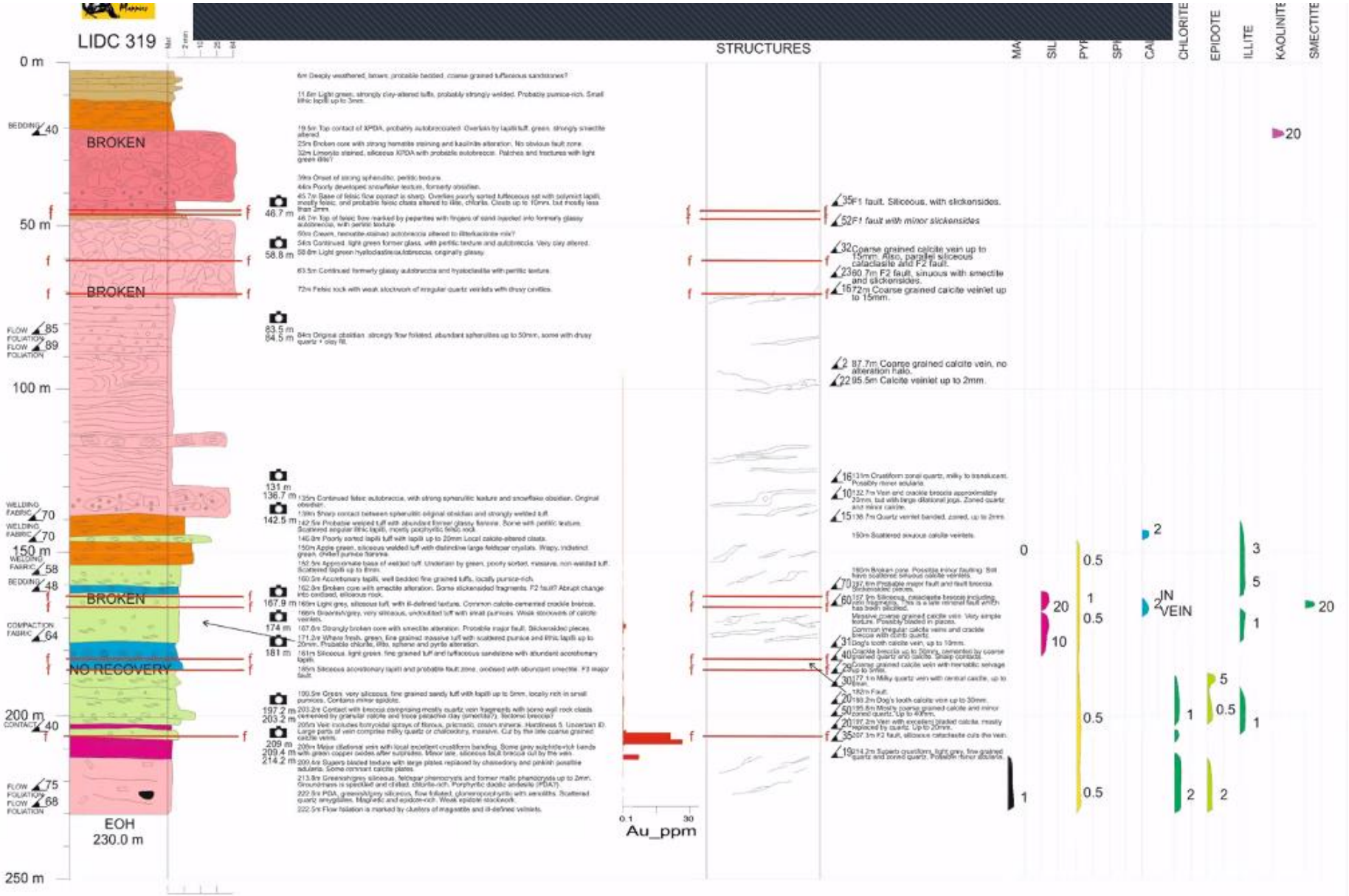
Ventana Gold Colombia

>8 Moz gold?

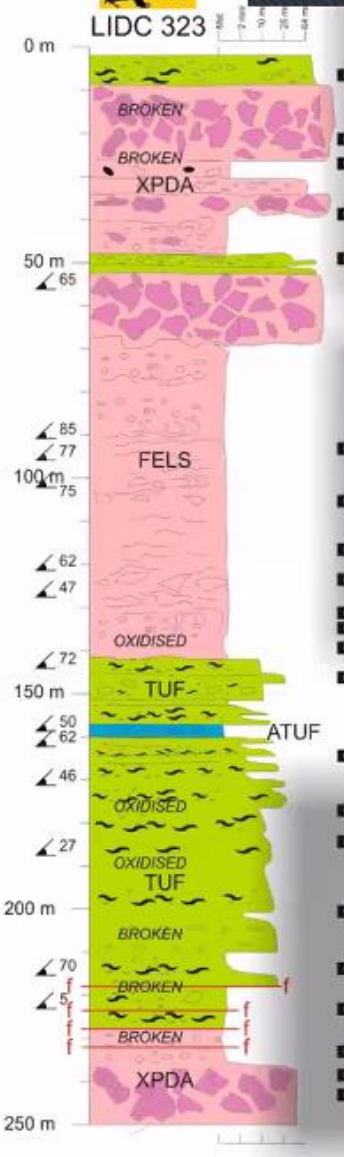


COMPARE AND CONTRAST


0
25
50
MISSING CORE


LIDC 319
STRUCTURES
CHLORITE
EPIDOTE
ILLITE
KAOLINITE
SMECTITE
0 m
50 m
100 m
150 m
200 m
250 m
BROKEN
BROKEN
BROKEN
NO RECOVERY
CONTACT
EOH
230.0 m
BEDDING
FLOW FOLIATION
WELDING FABRIC
COMPACTION FABRIC
46.7 m
58.8 m
83.5 m
84.5 m
131 m
136.7 m
142.5 m
167.9 m
174 m
181 m
197.2 m
203.2 m
209 m
209.4 m
214.2 m
F1 fault. Siliceous, with slickensides.
F1 fault with minor slickensides
Coarse grained calcite vein up to 15mm. Also, parallel siliceous cataclasite and F2 fault.
F2 fault, sinuous with smectite and slickensides.
Coarse grained calcite veinlet up to 15mm.
Coarse grained calcite vein, no alteration halo.
Calcite veinlet up to 2mm.
Dog's tooth calcite vein, up to 10mm.
Milky quartz vein with central calcite, up to 6mm.
Fault.
Dog's tooth calcite vein up to 30mm.
F2 fault, siliceous cataclasite cuts the vein.
IN VEIN
0.1
30
Au_ppm

LIDC 323



8 m

22 m, 23

28 m

39.5 m

49.2 m

ABOVE 94 m Flow banded rhyolite/felsic lava.

94 m

106 m

118 m

123.5 m

132 m

136 m

141 m

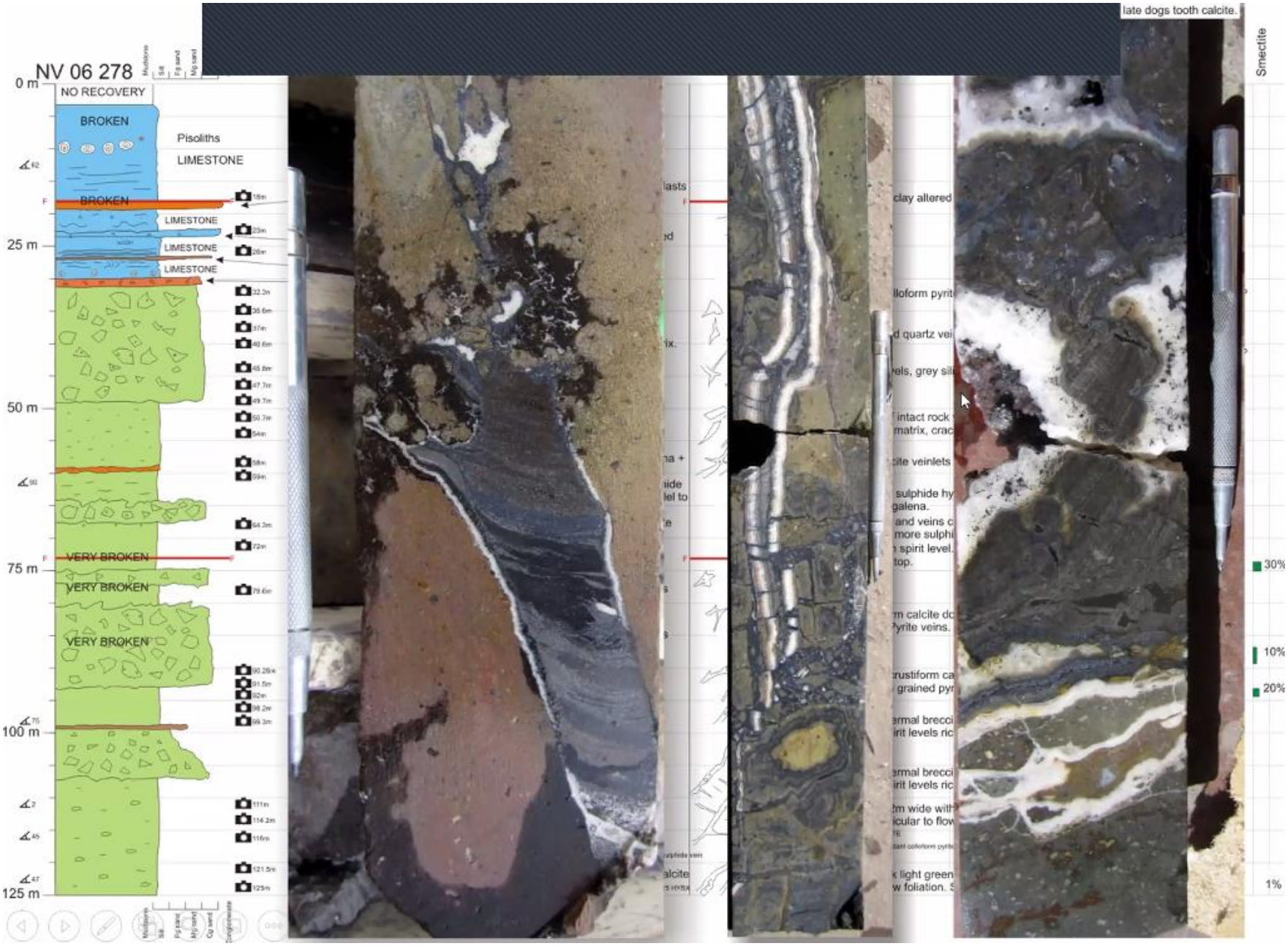
147.5 m ABOVE 132 m Spherulitic rhyolite/felsic lava.

BELOW. 136.4 m Spherulitic rhyolite with spherulites up to > 0.1 m diameter.

166 m

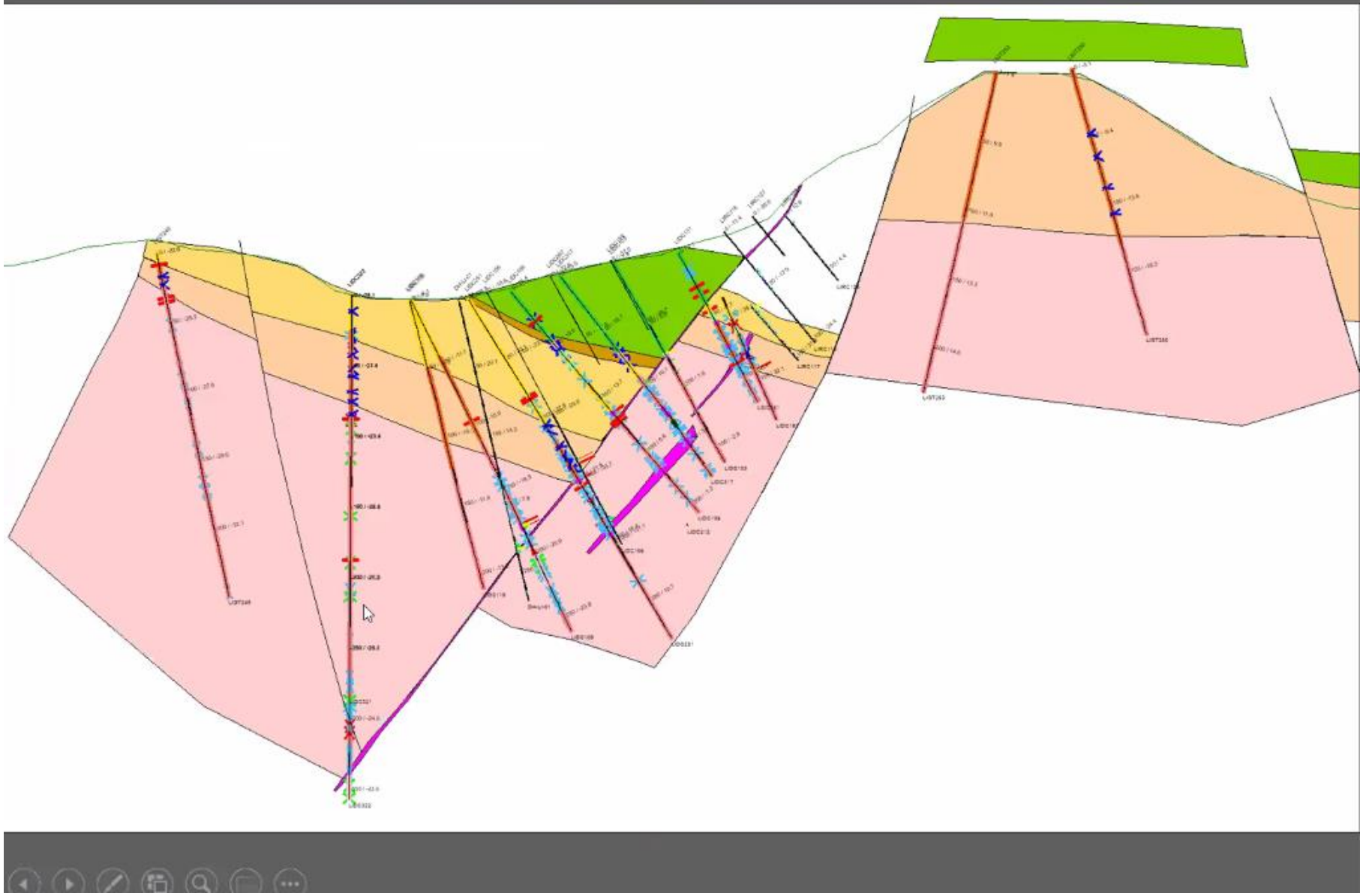
BELOW. 141 m Welded tuff with large pumice fiamme.

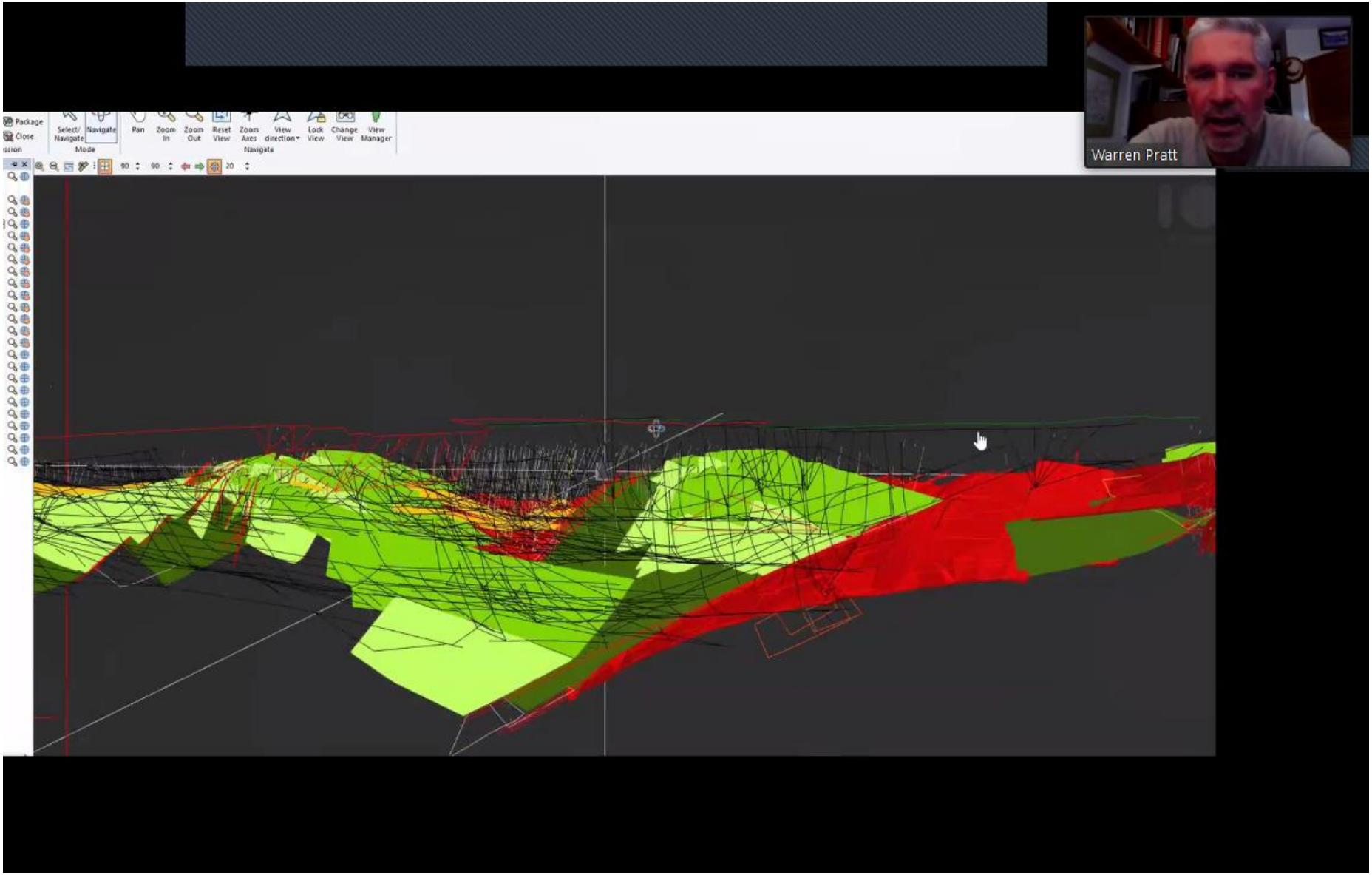
Fine grained lapilli tuff with small pumices.


late dogs tooth calcite.
NV 06 278
0 m
NO RECOVERY
BROKEN
Pisoliths
LIMESTONE
BROKEN
LIMESTONE
LIMESTONE
LIMESTONE
25 m
50 m
VERY BROKEN
75 m
VERY BROKEN
VERY BROKEN
100 m
125 m
clay altered
intact rock
matrix, crac
galena.
top.
Pyrite veins.
grained pyr
Smectite
30%
10%
20%
1%

Hole_ID	mFrom	m				
CCDC020	165.5	16	fault			
CCDC023	105.5	105.6	fault	2	F2 FAULT	15
CCDC023	108.8	108.9	vein		QZ VNLT	42
CCDC023	113	113.1	fault	1	F1 FAULT	34
CCDC023	120	120.1	vein		BX CONTACT	28
CCDC023	131	131.1	flow foliation			64
CCDC023	141	141.1	flow foliation			69
CCDC023	141.5	141.6	vein		CALCITE VN	18
CCDC023	157.4	157.5	vein		QZ VN CONTACT	40
CCDC023	160.2	160.3	fault	1	F1 FAULT	45
CCDC023	170.5	170.6	fault	1	F1 FAULT	35
CCDC024	205.2	205.3	vein			50
CCDC025	38.8	38.9	fault	2	F2 FAULT	45
CCDC025	46	46.1	flow foliation			55
CCDC025	47	47.1	vein			25
CCDC025	47.6	47.7	vein			30
CCDC025	50	50.1	vein			40
CCDC025	50.5	50.6	flow foliation			50
CCDC025	53	53.1	fault	3	F3 MAJOR FAULT	40
CCDC025	65	65.1	flow foliation			60
CCDC025	100	100.1	spirit level			62

Hole_ID	mFrom	mTo	check	LITH CODE
CCDC020	62	127	0	PA
CCDC020	127	128.5	0	TUF
CCDC020	128.5	149.5	0	PA
CCDC020	149.5	153	0	VN
CCDC020	153	159	0	HYBX
CCDC020	159	162	0	PA
CCDC020	162	165.5	0	VN
CCDC020	165.5	165.6	0	FLT
CCDC020	165.6	170	0	VN
CCDC020	170	174	0	PA
CCDC020	174	174.1	0	FLT
CCDC020	174.1	185	79.5	PA
CCDC023	105.5	105.6	0	FLT
CCDC023	105.6	120	0	PABx
CCDC023	120	124	0	HYBX

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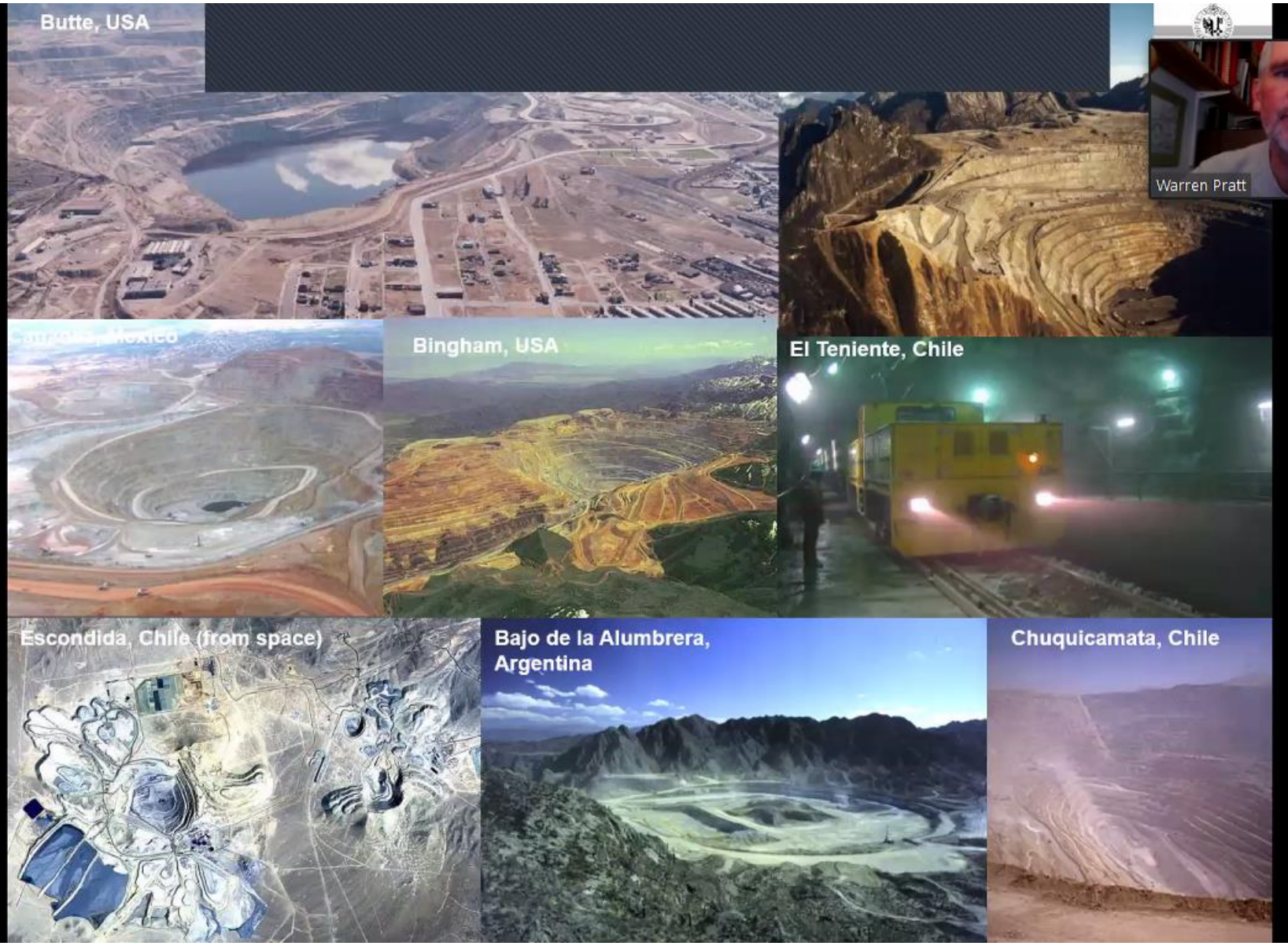
Package
Close
Select/ Navigate
Navigate
Mode
Pan
Zoom In
Zoom Out
Reset View
Zoom Axes
View direction
Lock View
Change View
View Manager
Navigate


Butte, USA
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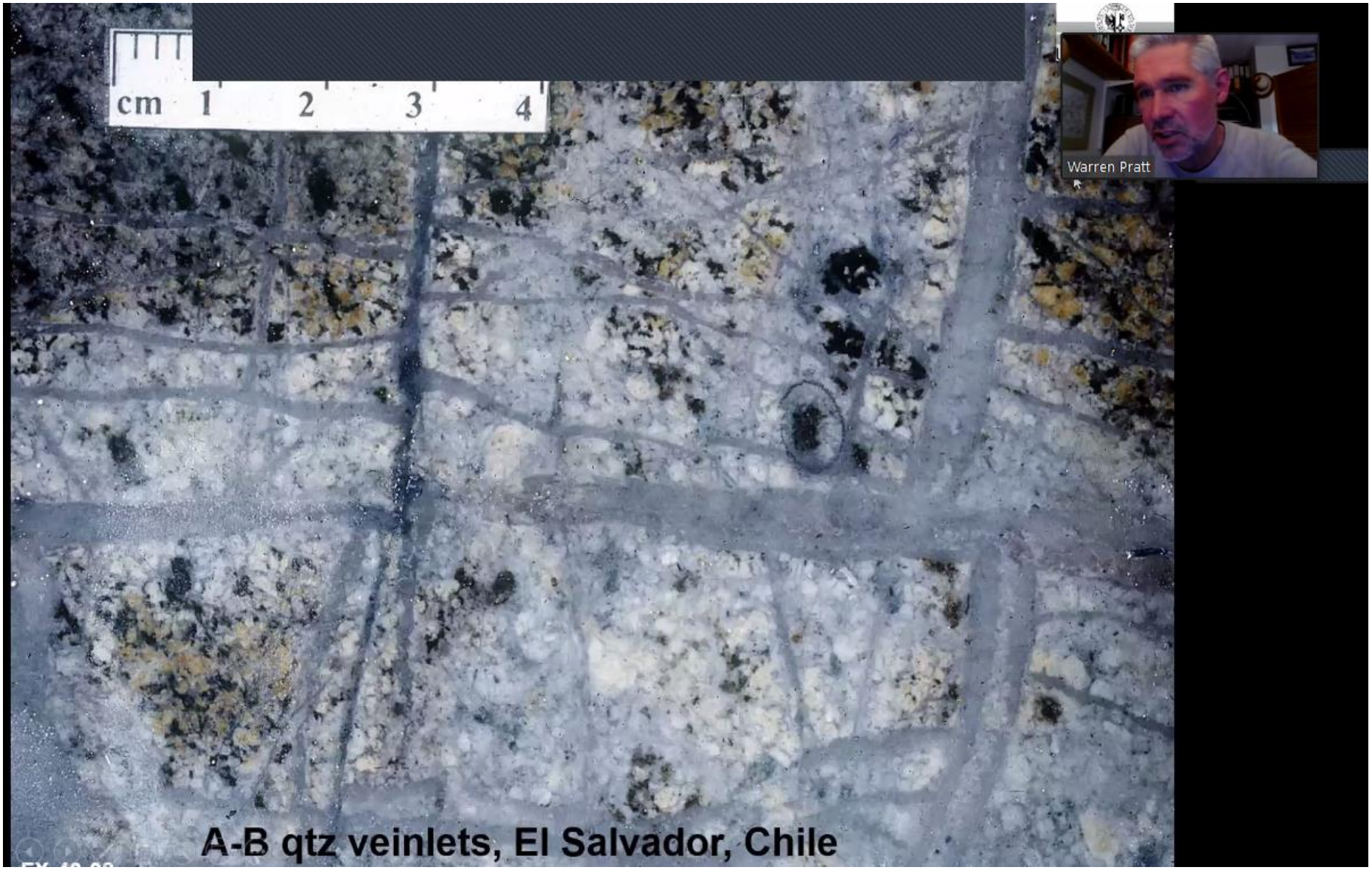
Bingham, USA
El Teniente, Chile
Escondida, Chile (from space)
Bajo de la Alumbrera, Argentina
Chuquicamata, Chile


cm 1 2 3 4
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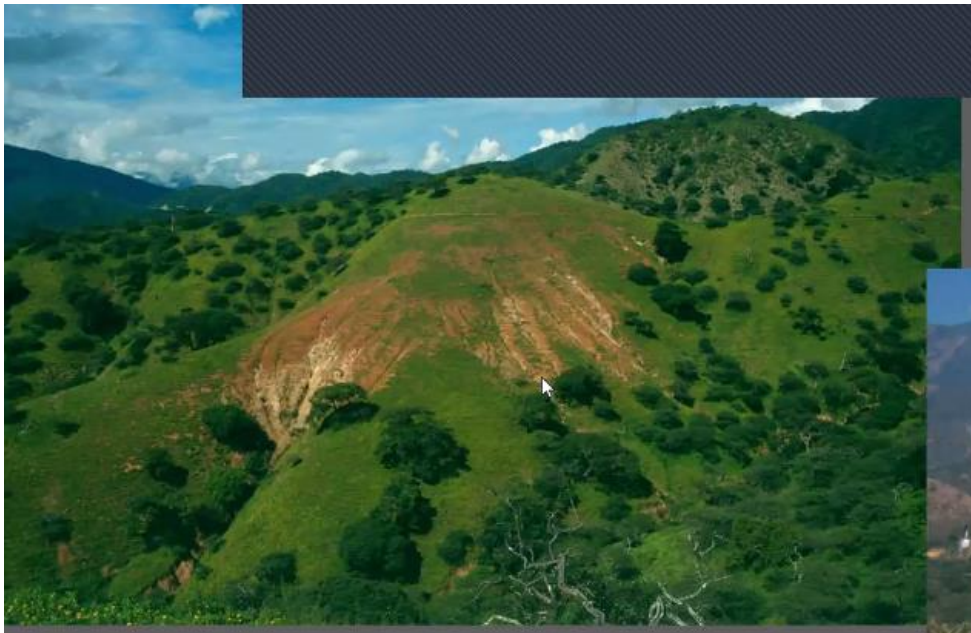
A-B qtz veinlets, El Salvador, Chile

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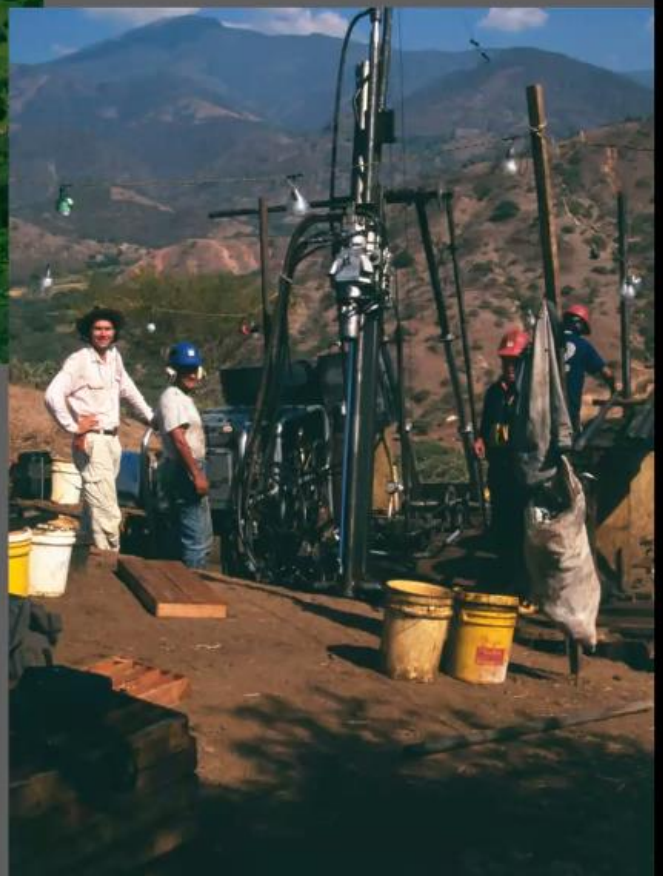


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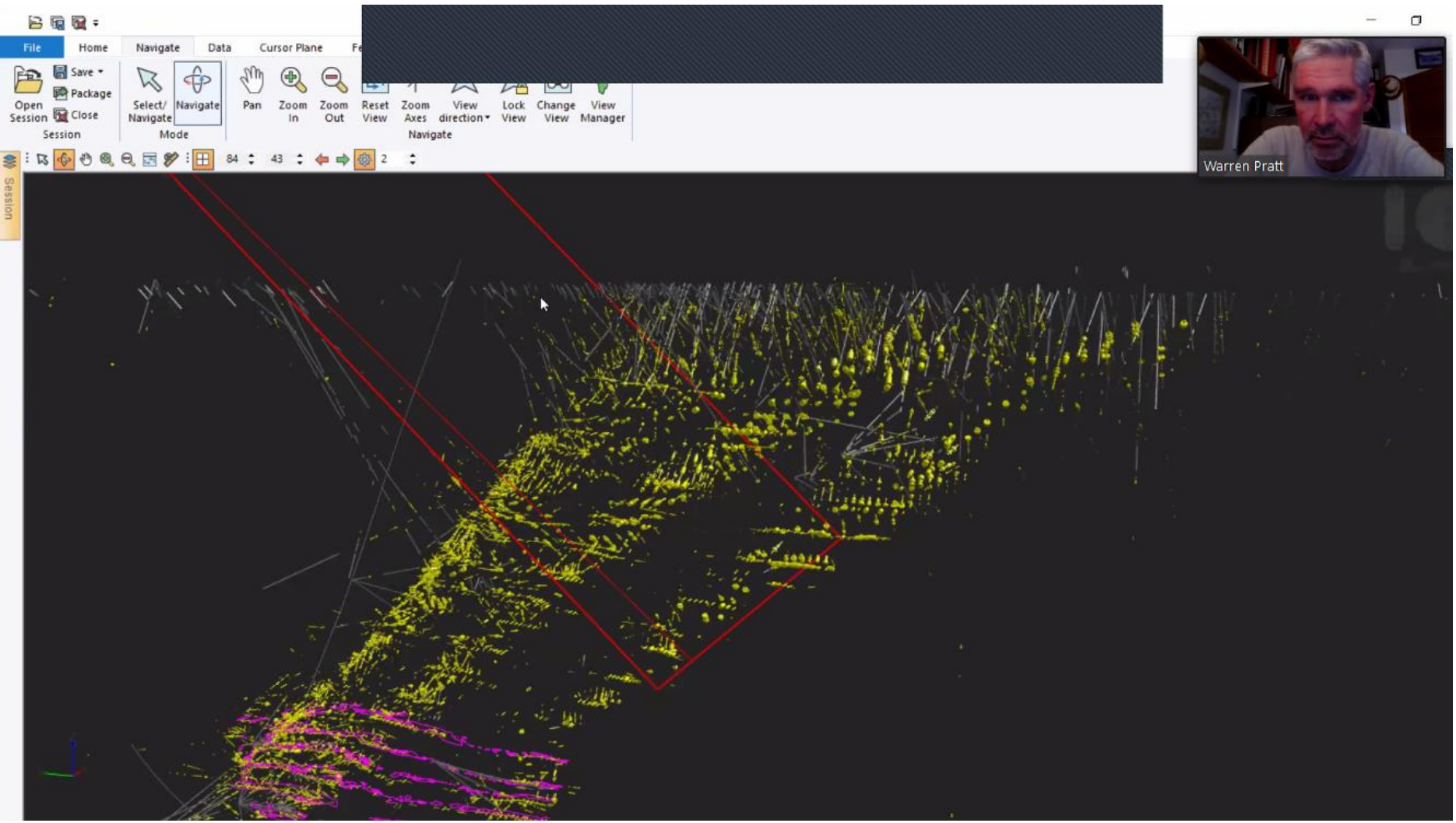
WHEN RESOURCE MODELS GO WRONG

- This can be disastrous
- Mostly due to a poor geological model
- This can reflect the quality of ‘mapping’ (not just conventional 2D mapping, but cross sections, and 3D models)
- The paragenesis may not be understood
- The geology is simply not well enough understood


File
Home
Navigate
Data
Cursor Plane
Open Session
Save
Package
Close
Session
Select/ Navigate
Navigate
Mode
Pan
Zoom In
Zoom Out
Reset View
Zoom Axes
View direction
Lock View
Change View
View Manager
Navigate
84
43
2
Session
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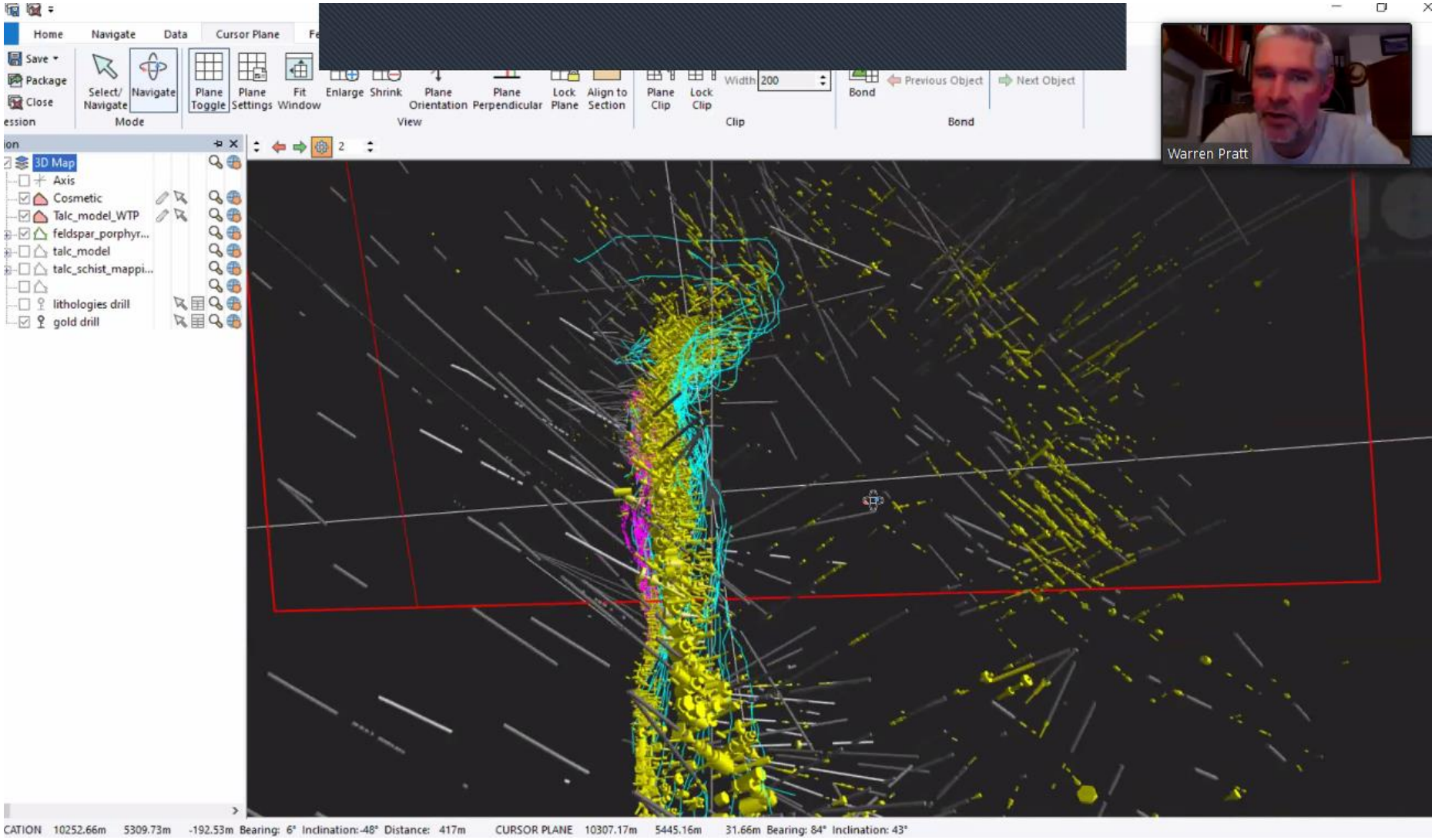
Home
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Mode
Plane Toggle
Plane Settings
Fit Window
Enlarge
Shrink
Plane Orientation
Plane Perpendicular
Lock Plane
Align to Section
View
Plane Clip
Lock Clip
Width 200
Clip
Bond
Previous Object
Next Object
Bond
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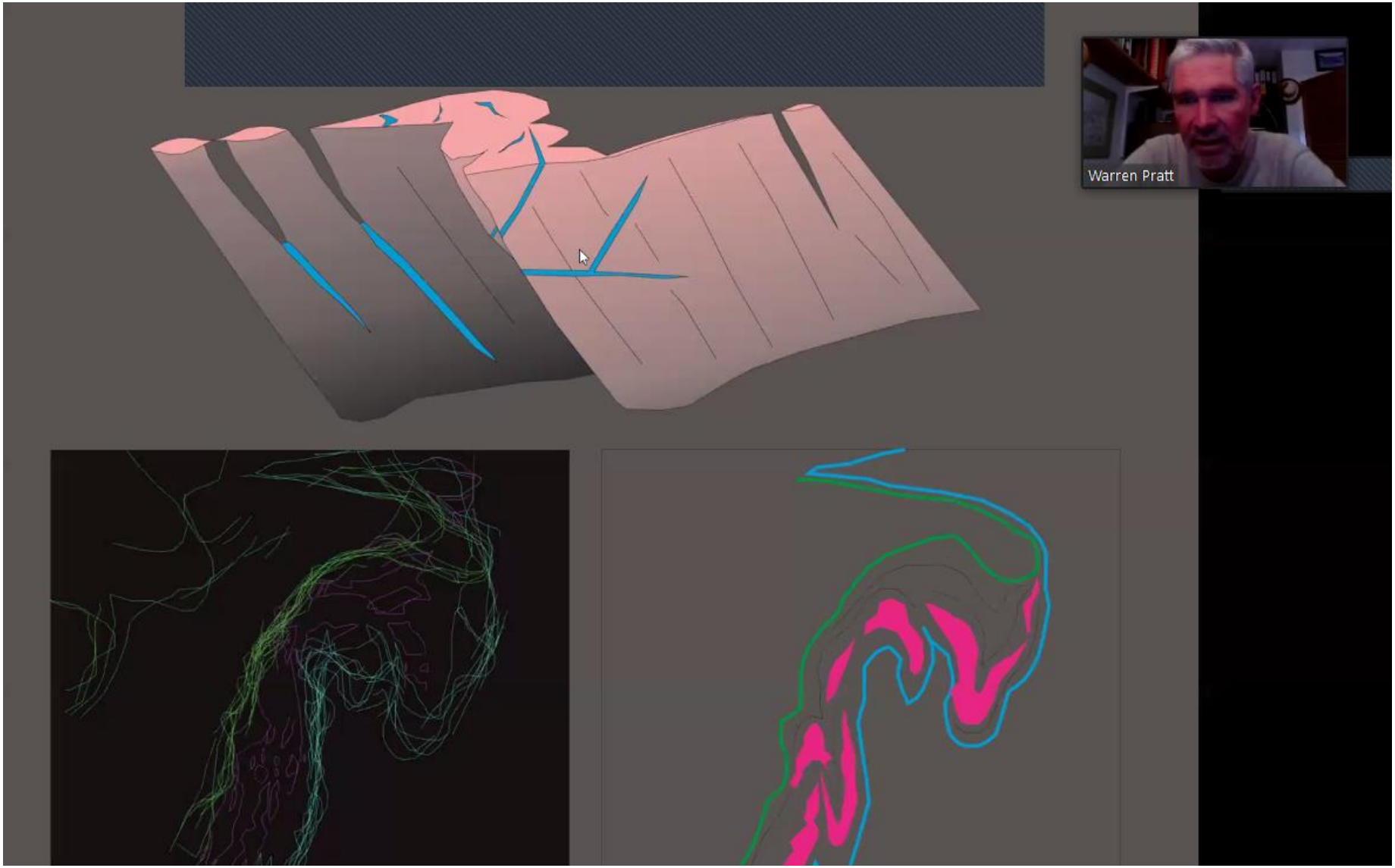
3D Map
Axis
Cosmetic
Talc_model_WTP
feldspar_porphyr...
talc_model
talc_schist_mappi...
lithologies drill
gold drill
CATION 10252.66m 5309.73m -192.53m Bearing: 6° Inclination:-48° Distance: 417m
CURSOR PLANE 10307.17m 5445.16m 31.66m Bearing: 84° Inclination: 43°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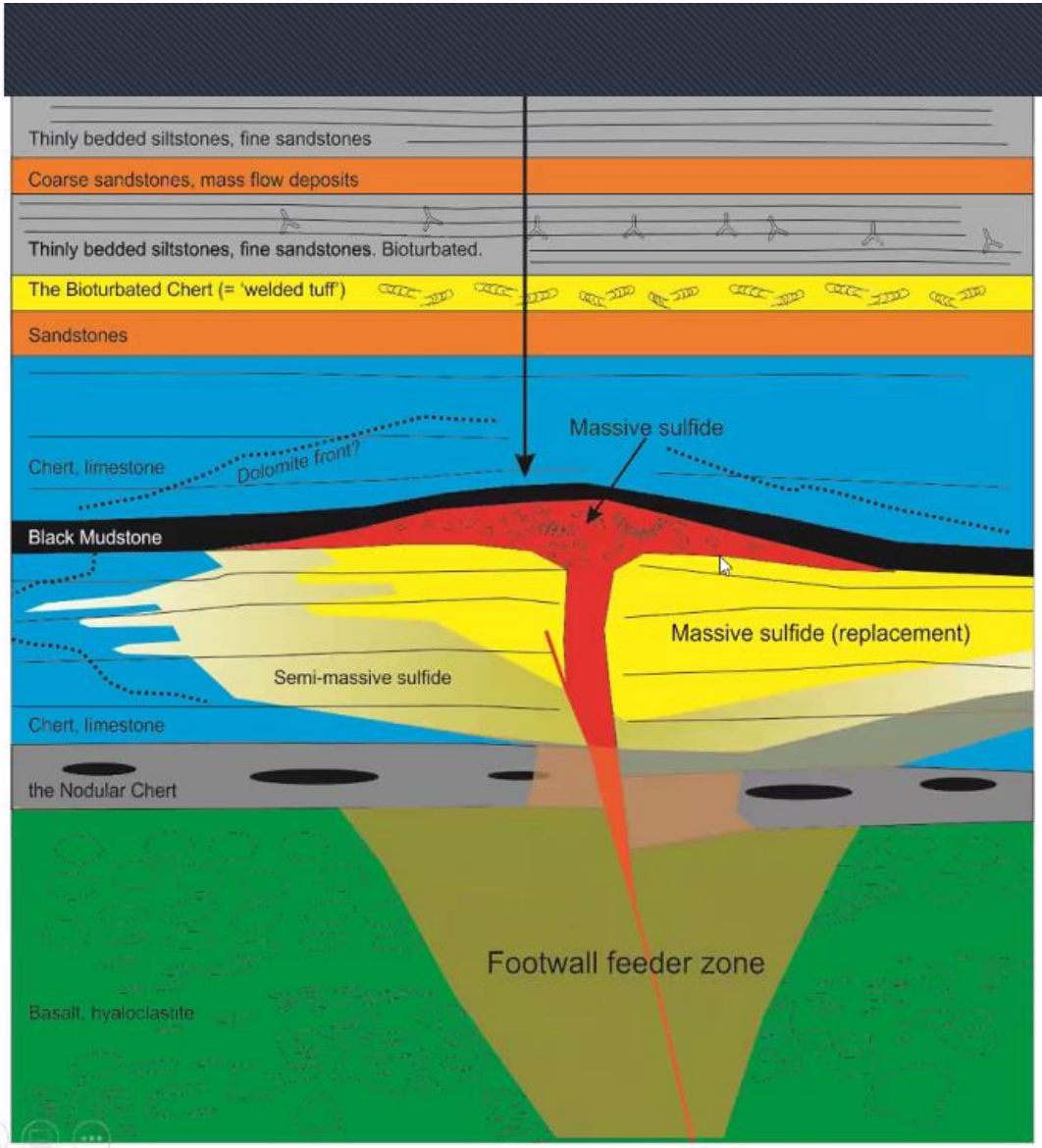
COLOMBIA

Volcanogenic massive sulphide

- Unusually gold-rich Cyprus-type (?) Cu/Zn massive sulphide
- Milling 300 tonnes per day
- Associated with a dolomitised limestone
- Above pillowed basalts and overlain by cherts and sandstones


Thinly bedded siltstones, fine sandstones
Coarse sandstones, mass flow deposits
Thinly bedded siltstones, fine sandstones. Bioturbated.
The Bioturbated Chert (= 'welded tuff')
Sandstones
Chert, limestone
Dolomite front?
Massive sulfide
Black Mudstone
Massive sulfide (replacement)
Semi-massive sulfide
Chert, limestone
the Nodular Chert
Footwall feeder zone
Basalt, hyaloclastite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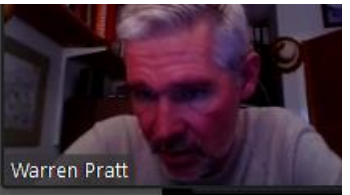
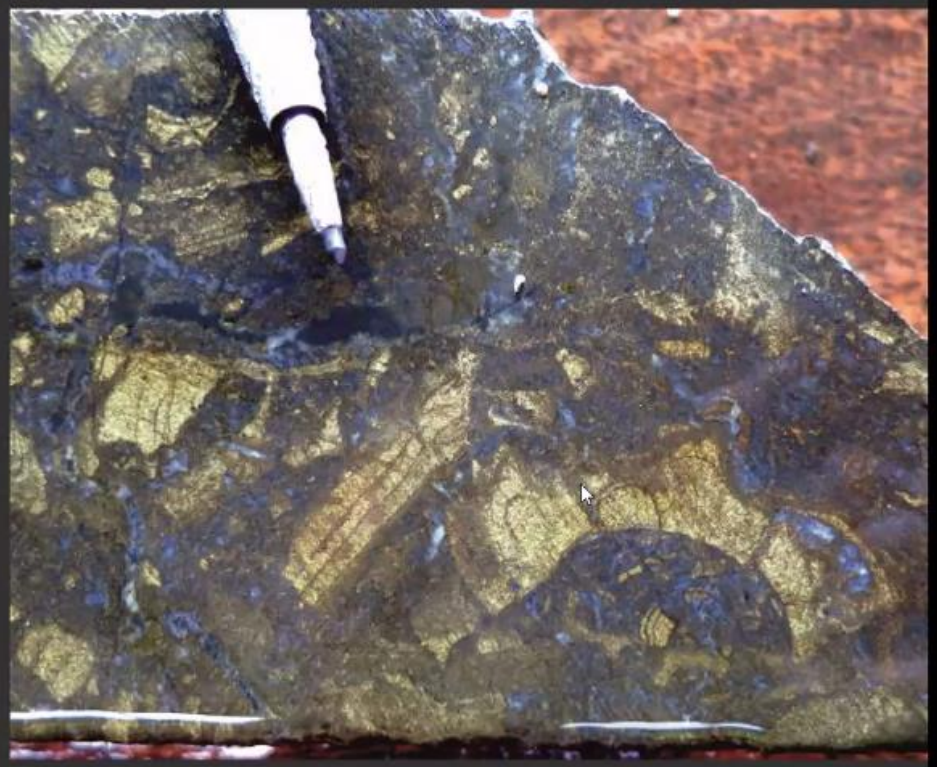
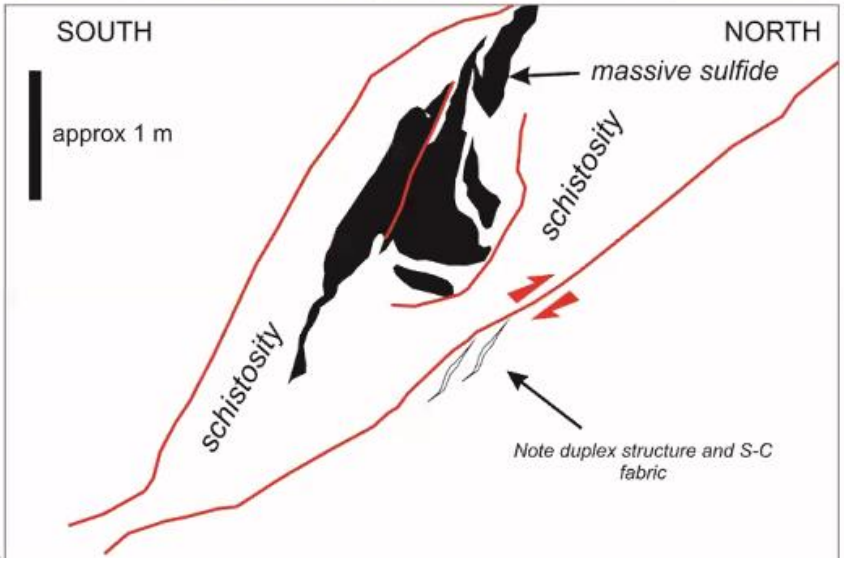
Top of

From Jim Franklin

Tubeworms and chimney fragments






SOUTH
NORTH
massive sulfide
approx 1 m
schistosity
schistosity
Note duplex structure and S-C fabric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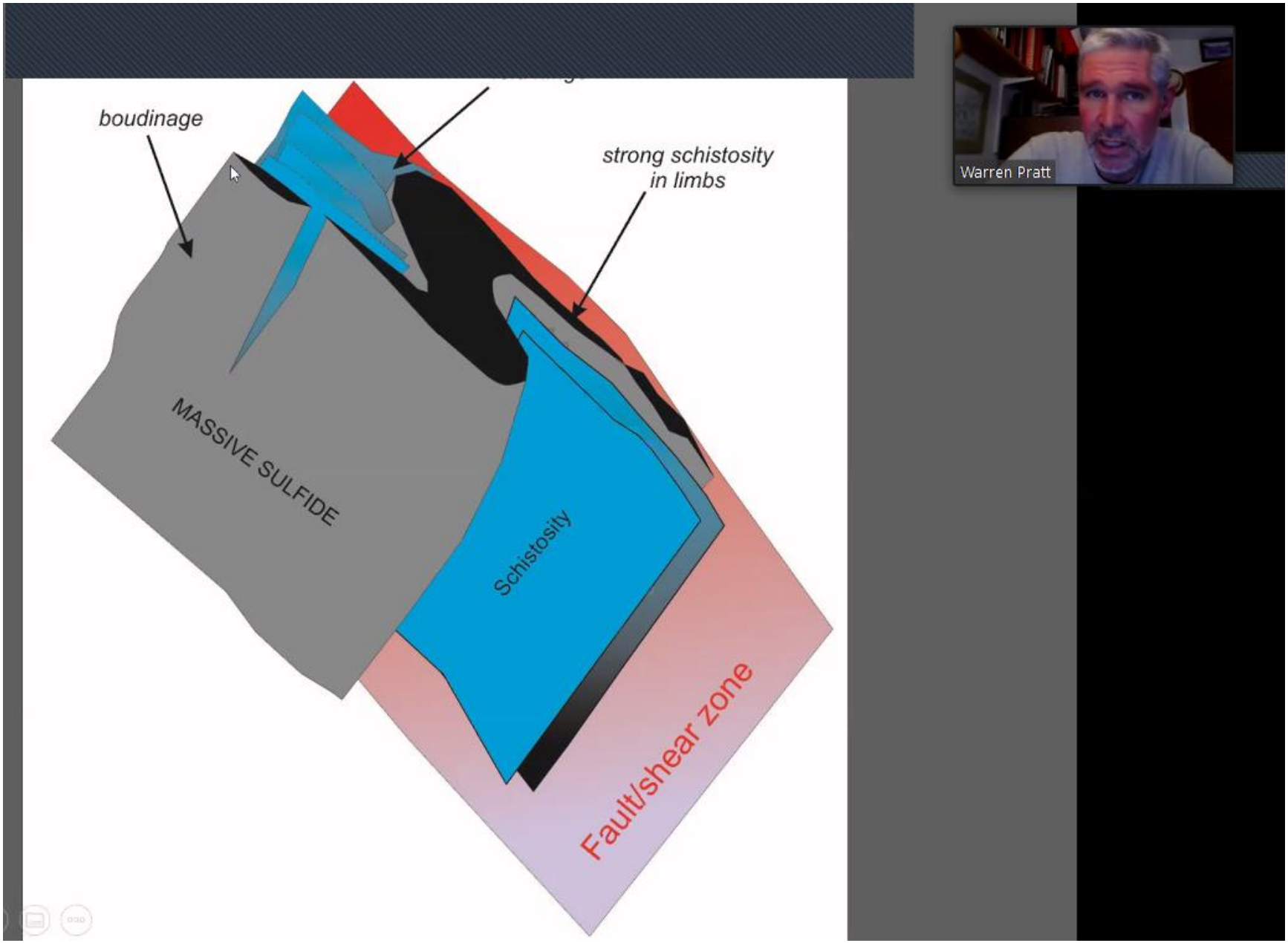
boudinage
strong schistosity
in limbs
MASSIVE SULFIDE
Schistosity
Fault/shear zone
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- Gold can be ‘nuggety’. This can make resource calculations very difficult. These type of mines tend to have little or no ‘reserves’. Hand-to-mouth existence. The mill is always hungry.
- Poor downhole surveys.
- Search directions in the resource model (which feeds back to a bad geological model).


ScanMining
BLAIKENVERKET
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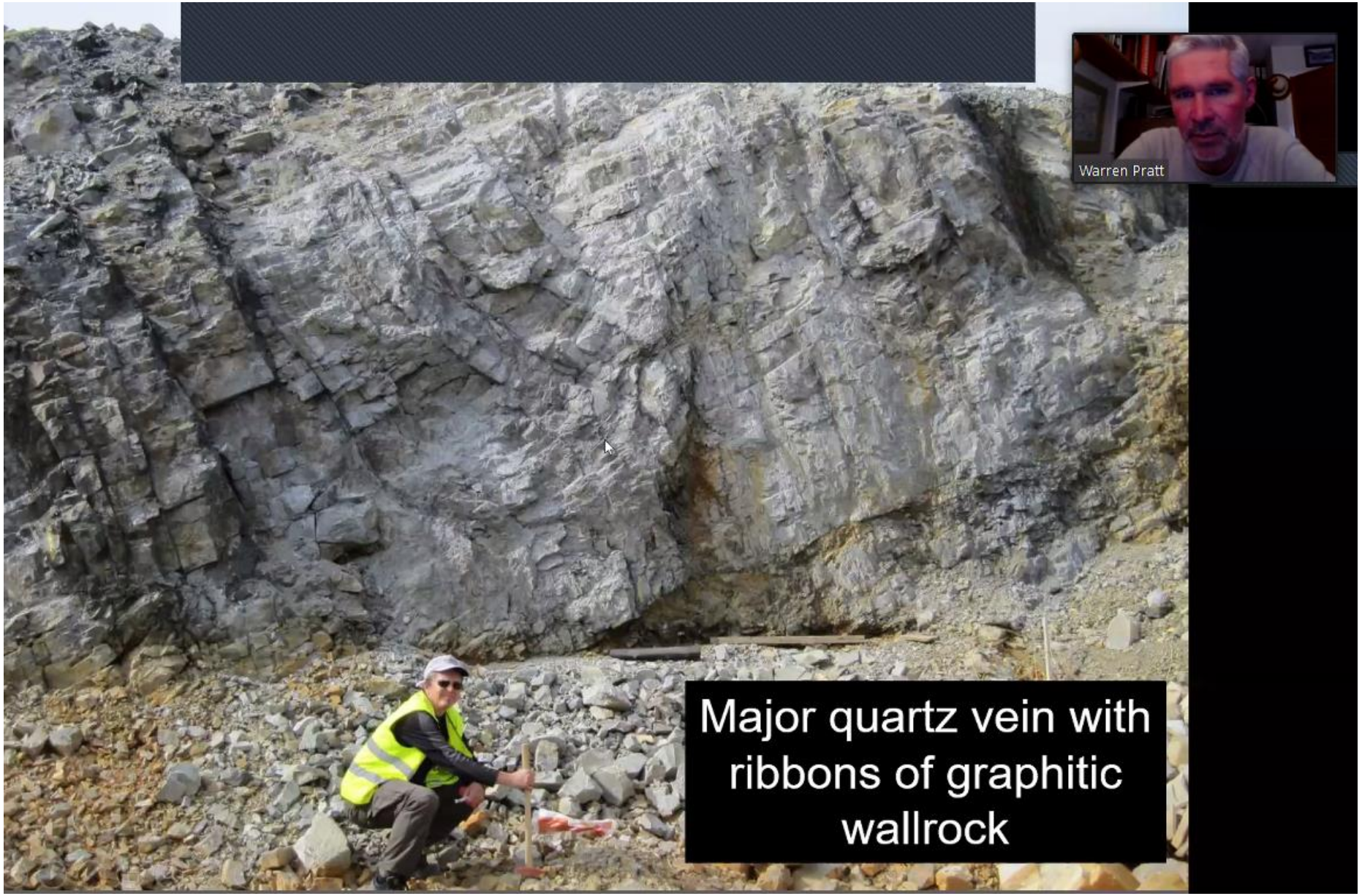
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Major quartz vein with ribbons of graphitic wallrock

CONCLUSIONS

- USE THE TECH/SOFTWARE
- FOCUS ON WHAT IS RELEVANT
- AND NEVER FORGET MAPPING……


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