

#### Discovery of the HS Zone, La Trinidad Mine, Sinaloa



Matthew D Gray 5 April 2017







# Exploration geology is fraught with uncertainty and the future is unknowable, so don't bet the farm.

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#### Conclusions

- The HS Zone is an enigmatic gold mineralized zone whose existence would not have been inferred from surface or pit exposures
- The discovery of the HS Zone resulted from systematic exploration of an epithermal system and recognition that only a portion of the system had been explored







#### Conclusions

- Required innovative drilling and sampling techniques
- Discovery resulted from willingness to test concepts
- Demonstrates what should be a commonly accepted truth: "there is no geologic reason that the highest grade or most significantly mineralized portion of the system crops out"
- Future discoveries likely to come from district







#### What is the HS Zone?









#### What is the HS Zone?

#### **Geologically:**

- A high grade, gold mineralized enigmatic breccia
- Distinct from the orebody mined by Eldorado
- Multi-stage mineralization, multi-stage brecciation
- Intrusive and/or phreatomagmatic breccia? Mineralized debris flow??
- Overprint by hydrothermal breccia







#### What is the HS Zone?

#### **Economically:**

- The resource that makes the modern La Trinidad mine
- High grade gold
- Exceptional leach characteristics quick leaching, high recoveries
- A cash cow







- 1982
  - Core claims acquired/staked by Porfirio Tirado Beltran, small scale artisanal production
- 1984 to 1988 (gold price \$368)
  - Anaconda (Cobre de Hercules) options property, drilled 17 diamond core holes
- 1992 (gold Price \$344)
  - Acquired by Almaden, land position increased







- 1993-1998
  - Optioned then eventually acquired by Eldorado
  - Defined shallow resource of 173,000 oz Au
  - Gold production at Taunus from open pit
- 1998 (gold price \$294)
  - Hurricane causes flooding and pit wall failure
  - Mine does not re-open
  - Total production of 51,692 oz. Au







- 2005 (gold price \$445)
  - Oro Gold Resources Founded by Darren Bahrey & Eric Grill.
- 2006 (gold price \$603)
  - Trinidad concession staked
- 2007 (gold price \$695)
  - Diamond and RC drilling campaigns
  - Drilling complicated by logistical issue of testing targets beneath a flooded pit







- 2008 (gold price \$872)
  - Additional RC drilling
  - 2nd small diamond campaign, to confirm RC results, resource estimate
  - Significantly higher grade in diamond drill holes twins of RC holes including 08TRD12, discovery hole of HS Zone
- 2009 (gold price \$972)
  - Diamond drilling to confirm higher grade of HS Zone
- 2012 (gold price \$1,667)
  - Major equity position taken by Wexford Capital
  - Company renamed Marlin Gold.







- 2013 (gold price \$ 1,411)
  - PEA completed and commencement of mine construction
- 2014 (gold price \$1,266)
  - Commercial production declared in November
  - 8,212 oz. Au produced
- 2015 (gold price \$1,251)
  - 14,602 ounces Au produced
- 2016 (gold price \$1,251)
  - Pit reaches high grade HS Zone
  - 22,369 ounces Au produced
- 2017 (gold price \$1,217)
  - Mining the HS zone, 10,121 ounces produced in January.







In 2005 Oro Gold recognized an opportunity at La Trinidad

- gold price increase after mine shut down made the unmined resource defined by Eldorado potentially economic
- could be the nucleus of an economic deposit if additional resources could be added
- previous explorers had only drill tested the near surface portions of the system thus potential remained to find additional resources along strike and at depth







- Oro Gold program designed to define the unmined resource left behind by Eldorado and to discover additional resources along a regional structural belt
- first drill programs were:
  - in or immediately adjacent to the area of historically mined resource, hereafter referred to as the Eldorado zone.
  - large step outs along a controlling structure and tests of down dip projections
  - logistically complicated due to the target lying beneath a flooded pit















Early results demonstrated the potential for a deep continuation of the Eldorado Zone, but results were not spectacular

- 0.70m @ 5.15 gpt Au
- 0.85m @ 2.82 gpt Au















- Results like those of 07TR001 were not "economic intercepts" but demonstrated that the system continued at depth
- These results were sufficient to justify deeper drilling along the strike of the known mineralized trend







- RC hole 08TRRC023 drilled to test the deep potential indicated by results like those of 07TR001
- 08TRRC023 returned 78m @ 1.45 gpt Au
- Diamond core hole 08TRD12 was drilled to twin 08TRR02
- 08TRD12 returned 61.1m@ 8.5 gpt Au and was the discovery hole of the HS Zone









- Oro Gold initially thought they had found a down dip extension of the Eldorado Zone or a high grade feeder
- Further work demonstrated that the high grade HS Zone is a separate mineralized body





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## HS Zone – How and why was it discovered Drilling Challenges

- RC hole: 78.0m @ 1.45 gpt Au
- Core hole: 61.1m @ 8.5 gpt
- Mining has proved that the high grade core intercept is the accurate result for the HS Zone
- Significant discrepancy caused by sampling problem of unconsolidated breccia





# HS Zone – How and why was it discovered Drilling Challenges



15TRD05 HS Zone intercept, >8.5 gpt Au Resource Geosciences Inc.





- RC drilling shown to consistently negatively bias grade estimate of HS Zone
  - Blowing out fines ahead of bit?
- Core drilling yielded higher grade samples but drilling was slow, expensive, and yielded low recoveries





### HS Zone – How and why was it discovered Drilling Challenges

Innovative drilling and sampling methods required to test the HS Zone

 Sonic drilling methods, originally designed for drilling of unconsolidated soils, colluvium, and gravels, was tested as a possible solution





### HS Zone – How and why was it discovered Drilling Challenges

Sonic drilling uses intense vertical vibration and lesser rotation force to concentrate energy at the bit face while causing minimal displacement of loose fragments



Sonic core sample, extruded as unconsolidated material held together by plastic wrap, i.e. a core sausage! (Photo from Boart Longyear website)



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- Sonic drilling yielded ~100% recovery through the HS Zone
- Sample produced was of unconsolidated material held together only by the plastic casing in which it was wrapped

How does one collect a representative ½ split of this unconsolidated material?





# HS Zone – How and why was it discovered Drilling Challenges

Innovative sampling method required

- In order to split and sample this unconsolidated material, the solution devised by Frank Powell was:
  - to build a walk-in freezer on site
  - \_ freeze the moist, unconsolidated material
  - use a diamond disk saw set up within the walk-in freezer to split the core

Work all day in parka, hat, and gloves, then go to dinner in tee shirt and flip flops!







# HS Zone – What is it geologically?

#### The HS does not stand for high sulfidation!







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## HS Zone – What is it geologically?

- mineralized breccia
- variably cemented, weakly consolidated
- generally clast supported
- clasts vary from grit to boulder size, and from subangular to rounded
- clasts include:
  - quartz and feldspar porphyries (altered QFP)
  - BQP (brecciated quartz porphyry, intrusive breccia)
  - hydrothermal breccia
  - silicified and quartz veined gossanous material
  - \_ fragments of banded and multistage quartz veinlets
- matrix comprised of siliceous indurated gossanous material and porous, earthy, weakly siliceous and friable dark brown and black oxides







#### **HS Zone breccia**



HS Zone breccia exposed on -26 bench, Taunas pit. Note boulder sized clast above hammer. This is a mine production face so some of the chaotic nature of the rock is due to blasting effects.

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#### **HS Zone breccia**



HS Zone breccia exposed on -26 bench, Taunas pit. Note dark earthy matrix, which is typical of higher grade portions of the HBX.








Large rounded clast of breccia that forms a clast within the hydrothermal breccia. Breccia clast comprised of dark angular clasts of silicified rock in dark brown Fe-oxide rich silicified matrix. This large breccia clast, and smaller similar fragments, are in a lighter colored silica+Fe-oxide matrix. Resource Geosciences Inc.





HS Zone breccia, intrusive breccia clasts in matrix of dark brown Fe-oxide and silica









Intrusive breccia clasts outlined in yellow

QFP clasts within igneous matrix of intrusive breccia outlined in white.







Clasts of QFP and intrusive breccia

At least four stages of fracturing and veining











Clasts of QFP and intrusive breccia outlined in white.

1) banded silica veinlet oldest (yellow outline)

2) siliceous or juvenile material veinlet (orange outline)

3) crosscut by dark brown Fe-oxide and silica breccia matrix

4) later brecciation event with slight rotation creating open spaces, with a late drusy quartz veining event that coats clasts and vugs (red outline).







At least 8 stages of brecciation, fracturing, and quartz veining or deposition.









Each of the 6 colors highlights a different quartz deposition event

7<sup>th</sup> and 8<sup>th</sup> events are represented by the brecciated then silica healed white quartz vein in the upper half of the hand specimen









quartz veined porous vuggy gossanous silica clast

vugs formed by postsilicification dissolution of fragments and/or phenocrysts?







Crosscutting quartz veinlet highlighted in red

Drusy quartz coated siliceous gossan fragment highlighted in white





fault bounded on footwall

## What is the HS Zone?



View looking NE on -20 bench. NA 030 40 E dipping fault that forms footwall contact between HZ Zone breccia and BQP to the west (left side of photo) is exposed behind Gildardo Vejar (blue vest) and David Lujan (red vest).





#### Gradational contact with BQP

## What is the HS Zone?



Faulted off by Chandler fault







#### Gradational contact with BQP

## What is the HS Zone?



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Faulted off by Chandler fault



# What is the HS Zone?

Working hypothesis:

- 1. BQP and HS Zone breccia are related, formed during a multi-stage mineralizing event
- 2. BQP is intrusive breccia, formed when magmatic activity brecciated and cemented an earlier formed porphyry phase
- Hydrothermal processes further brecciated the unit and created weak quartz stockwork, with associated low grade gold mineralization
- 4. A later and more intense hydrothermal event caused further brecciation, multistage quartz veining, and deposition of a sulfide rich siliceous matrix with significant gold content
- 5. Post mineral movement along the Chandler Fault and the unnamed fault exposed on -20 Bench further brecciated the HS Zone
- 6. Oxidation of sulfidic matrix converted the breccia cement to a friable mass of oxides and granular silica, resulting in the incompetent nature of the HS Zone.







# What is the HS Zone?

Geologically speaking, we're not quite sure.

Economically speaking, the answer is: The resource that makes the modern La Trinidad mine.

- 1. High grade gold
- 2. Exceptional leach characteristics quick leaching, high recoveries
- 3. A cash cow







## **HS Zone drives production growth**







# Mining the sweet spot – the high grade HS Zone

La Trinidad Gold Mine Statistics – September 2016 to January 2017					
	Sep	Oct	Nov	Dec	Jan
Tonnes Crushed <sup>(1)</sup>	25,690	130,660	127,557	110,943	123,743
Average Crushed Grade <sup>(2)</sup>	1.80	4.30	5.26	5.17	1.87
Gold Stacked <sup>(3)</sup>	1,484	18,052	21,567	18,431	7,447
Average Daily Recovered Gold <sup>(4)</sup>	11	68	283	354	231
Gold Shipped <sup>(5)</sup>	495	447	6,247	9,924	10,121

16,618 ounces Au sold in 4<sup>th</sup> Qtr 2016 18,875 ounces Au sold in 1<sup>st</sup> Qtr 2017







## Au in blastholes, 10 Bench, La Trinidad Mine







## Au in blastholes, 4 Bench, La Trinidad Mine







## Au in blastholes, -2 Bench, La Trinidad Mine









## Au in blastholes, -8 Bench, La Trinidad Mine







## Au in blastholes, -14 Bench, La Trinidad Mine







## Au in blastholes, -20 Bench, La Trinidad Mine







## Au in blastholes, -26 Bench, La Trinidad Mine













Because it was not feasible to drill below the flooded pit, HS Zone limits were not fully defined in resource model, thus potential remains to increase the HS Zone resource











HS Zone limits were not fully defined in resource model – HS Zone extends beyond current planned pit limit.

Drilling of HS Zone adjacent to pit in process





#### TAUNAS PIT (LA TRINIDAD)- LONG SECTION HIGHLIGHTING HIGHER-GRADE HS ZONE



HS Zone continues to south, below current pit floor. South highwall layback in process, in pit drilling will better define limits of HS Zone to south.









HS Zone was a blind ore zone beneath the Eldorado orebody, discovered by deep drilling.

Are there more stacked ore zones below the HS Zone?





**Regional targets** 







# La Trinidad – San Cristobal Area

Oro Gold de Mexico prospected along the NW trending corridor and identified multiple gold anomalies.





# Future discoveries? San Cristobal



Claim boundary for spatial reference only – does not represent current claim holdings, which extend beyond limit of figure to SE





# La Trinidad – San Cristobal Area

- San Cristobal target discovered in 2010, 12 km SE of Taunus pit.
- 6 scout RC drillholes.
  - 30m @ 0.45 gpt Au
  - 14m @ 0.56 gpt Au
- Oro Gold unable to raise funds for exploration, no further work
- 16km<sup>2</sup> target area with significant gold anomalies defined but not evaluated







# La Trinidad – General Exploration









# La Trinidad – San Cristobal Area





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# Conclusions

- Required innovative drilling and sampling techniques
- Discovery resulted from willingness to test concepts
- Demonstrates what should be a commonly accepted truth: "there is no geologic reason that the highest grade or most significantly mineralized portion of the system crops out"
- District has high potential for future discoveries






# Conclusions

1985 drillhole cross section of Taunas zone by Cobre de Hercules (Anaconda)









### Conclusions



2010 drillhole cross section of Taunas and HS Zone by Oro Gold







#### Conclusions



1985 and 2010 cross sections at same scale. The "it gets better at depth" idea sometimes it true!





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