UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Element dispersion in alluvium covering gold deposits east of the Osgood Mountains, Getchell Trend, Humboldt County, Nevada; Slides and text of a talk given at the Association of Exploration Geochemists' 15th International Geochemical Exploration Symposium, Reno, Nevada

By

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PREFACE

This report is a release of the slides and oral presentation that was given at the Association of Exploration Geochemists' 15th International Geochemical Exploration Symposium in Reno, Nevada, April 29 - May 1, 1991. The abstract for this talk (Smith and others, 1991) is published in the Symposium's Abstracts with Program volume. The interpretations and models given in this talk are preliminary since the data is incomplete. The authors reserve the right to change these models and interpretations based upon a completed data set of drill hole analyses.

The written text of the talk is divided into sections that are based upon the slides used to illustrate the point. The slides are numbered 1 - 19 (Table 1) and are identified at the beginning of the corresponding section. Since the talk was presented using two slide projectors, several of the sections have two separate slides showing the model from a different perspective (labeled on the slide as a and b). Text displayed in *italics* refers to features that were identified on the slides during the talk.

REFERENCES CITED

Smith, S.M., Detra, D.E., Theobald, P.K., and Theodorakos, P.M., 1991, Element dispersion in alluvium covering gold deposits east of the Osgood Mountains, Getchell Trend, Humboldt County, Nevada: Abstracts with Program, Association of Exploration Geochemists, 15th International Geochemical Exploration Symposium, Reno, Nevada, April 29, 30, May 1, 1991, p. 30.

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INTRODUCTION

The current trend in mineral exploration is to search for covered deposits. In the Great Basin, this translates into searching for ore bodies buried by alluvial cover. The exploration techniques used range from random drilling to the use of new and exciting geochemical sampling media and analytical methods. But we have a problem. Many of our geochemical techniques lack a conceptual basis (We tried it and it worked) or the original conceptual basis is now suspect (The method also works when it shouldn't). What we need is a basic understanding of what is going on in the alluvium -- the third dimension.

The discovery and development of the alluvium-covered, disseminated gold deposits at Rabbit Creek, Chimney Creek, and Pinson provides us with an opportunity to gain some knowledge of the dispersion of elements in the third dimension.

The work presented here is one part of a larger multi-disciplinary study of the Kelly Creek Valley by the U.S. Geological Survey in cooperation with FirstMiss Gold, Inc., Gold Fields Mining Corporation, Pinson Mining Company, and Santa Fe Pacific Mining, Inc.

STUDY AREA

SLIDE 1: Location Map - Getchell District **SLIDE 1: Location Map - Getchell District**

The Rabbit Creek, Chimney Creek and Pinson deposits are situated in North Central Nevada (about 200 miles or 320 kilometers northeast of Reno) within an area known as the Getchell Trend. The alluvium-filled valley of Kelly Creek is bounded on the west by the Osgood Mountains and on the northeast by the Snowstorm Range.

SLIDE 2: Location Map - Kelly Creek Valley **SLIDE 2: Location Map - Kelly Creek Valley**

Our study area consists of about 70 square kilometers of the Kelly Creek valley along the east flank of the Osgood Mountains and the Dry Hills. Note the *township and range lines as well as the numbered, 1 mile square sections* for scale. The *Chimney Creek South Pit, the Rabbit Creek pit, the Getchell pits and the Pinson "A" pit* are also shown for reference.

SAMPLE COLLECTION

SLIDE 3: Drill hole site map **SLIDE 3: Drill hole site map**

All four of the mining companies with mineral property in the Kelly Creek valley have been engaged in exploration drilling through the alluvium and into the bedrock below. Each of these companies has allowed us to take representative samples of drill cuttings in the alluvial section for this study. A 2 kg representative split of the cuttings was collected at intervals of 20' (6 m) down 60 holes in the basin. *(The distribution of drill holes is shown here).*

The samples were sieved to -20/+100 mesh and one-half was ground to < -100 mesh for analysis.

ANALYTICAL METHODS

SLIDE 4: List of Analyses **SLIDE 4: List of Analyses**

The ground split was analyzed for 35 elements by direct-current-arc Atomic Emission Spectroscopy. The unground split was subjected to an oxalic acid leach and the resultant leachate was also analyzed by the same method. Additional analyses were requested for low level Au (at 2 ppb-lower detection limit by a graphite furnace technique) and thallium (by a flame atomic absorption spectrometry method).

Although both the total and partial analyses generally give similar results, the oxalic acid partial leach method gives a much better contrast in element ranges. The remaining discussion will be limited to the results of the oxalic acid leach analysis. Unfortunately, at this time, the Au analyses are only one third completed and we have even less Tl data.

3-D DISPLAY FORMAT

SLIDE 5a: Bedrock Surface **SLIDE 5b: Bedrock Surface with Drill holes**

In order to model the dispersion of elements, we needed to produce 3-dimensional views of the valley. These slides show a 3-dimensional representation of the bedrock surface in the Kelly Creek Valley as it would appear if the alluvium was removed. *[Note the valley between Osgood Mountains and the Dry Hills and the paleovalley below Rabbit Creek Mine.]*

In all of these slides - *the box* is the field area shown in a previous slide (Slide 3); *the top* is north unless otherwise stated; and the Z dimension (depth) is exaggerated about 8 times. The *yellow lines* that you will see in some of the slides are drill holes.

A 3-dimensional grid of the entire box was created from our drill hole data using the Interactive Volume Modeling software from Dynamic Graphics, Inc. The bottom of that grid was then truncated by this bedrock surface.

As MODEL OF KELLY CREEK BASIN

SLIDE 6: As model (All shells, bedrock surface) **SLIDE 6: As model (All shells, bedrock surface)**

We also truncated the top of the grid with a representation of the actual ground surface of the valley and constrained our display to that part of the basin where we have sufficient data.

The model which I have displayed here is As. Our raw data for As (from oxalic acid leach analyses) ranged from not detected at 500 ppm to >2% As. Since this As data was gridded in 3-dimensions, *each contour level* is actually represented by a shell of similar As values. We can then peel these shells off like the skin of an onion to see what is happening inside our model.

SLIDE 7a: As model (>500 ppm with Bedrock surface) **SLIDE 7b: As model (>500 ppm)**

If we remove all of the As that is less than 500 ppm, we get this result. This model allows us to make some observations about the source and distribution of As in the basin. At shallow levels, we see As associated with the exposed *Chimney Creek* and *Pinson deposits* as well as *the region along the Osgood Mountains* near the recently developed Summer Camp Deposit.

Even more striking is the *large plume of As enrichment in the alluvium that is moving down gradient from the valley separating the Dry Hills from the Osgood Mountains*. The As-rich *Getchell deposits* are located marginal to this valley. This As body swings north up the Kelly Creek Valley in the vicinity *of Rabbit Creek* and we also see additional As at depth near *Pinson.*

SLIDE 8a: As model (>2000 ppm with Bedrock surface) **SLIDE 8b: As model (>2000 ppm, plan view)**

If we peel off more As shells, we see the >2000 ppm As body. At this level, the shape suggests that sources for enriched As can be found just south of *Rabbit Creek* and at depth below *Pinson.* If we would continue to peel away As shells, the highest values are centered *in a paleovalley south of and below the level of the Rabbit Creek deposit.*

The next slide will be a north-south cross-section *over the Chimney Creek South Pit and the Rabbit Creek deposits.*

SLIDE 9a: As cross section with bedrock **SLIDE 9b: As cross section**

The view is to the west with north to the right. Our model shows a bedrock source for As below Rabbit Creek at a depth of about 300 feet in the alluvium. *Note that the As anomaly extends laterally and down gradient from this source.*

W MODEL OF KELLY CREEK BASIN

SLIDE 10a: W model (>100 ppm) **SLIDE 10b: W model (>100 ppm, plan view)**

If we look at W, we see that its distribution has a similar pattern to that of As. There appears to be a W source from the *valley between the Osgood Mountains and the Dry Hills*, another near *Rabbit Creek* and a third source near *Pinson*. This latter is not surprising considering that there are several W-bearing skarns exposed in the Osgood Mountains.

SLIDE 11a: W model (>300 ppm) **SLIDE 11b: W model (>300 ppm, plan view)**

At higher levels of W, the anomaly again shows the *Rabbit Creek and Pinson areas*. And like As, the highest values of W are found *in the paleovalley below Rabbit Creek.*

Ge MODEL OF KELLY CREEK BASIN

SLIDE 12a: Ge model (>20 ppm) **SLIDE 12b: Ge model (>20 ppm, plan view)**

One unexpected element emerged from this study. Here we see the distribution of low level Ge that mimics the As and W distribution down valley from the Getchell area.

SLIDE 13a: Ge model (>60 ppm) **Slide 13b: Ge model (>60 ppm, plan view)**

And at higher levels, we see the same pattern as before near the Rabbit Creek deposit.

Sb MODEL OF KELLY CREEK BASIN

SLIDE 14a: Sb model (>300 ppm) **SLIDE 14b: Sb model (>300 ppm, plan view)**

The Sb model also behaves like As and should be included in this suite of elements.

Since the oxalic acid leach primarily attacks Fe and Mn oxide coatings within the alluvium, we should also look at the distribution Mn and Fe.

Mn MODEL OF KELLY CREEK BASIN

SLIDE 15: Mn model (<4000 ppm) **SLIDE 15: Mn model (<4000 ppm)**

Note that in this slide, we have reversed our display. Whereas before, the displays showed a body of enriched concentration, *here we are emphasizing the depleted end of the scale*. This body represents the area in the basin with a value of <4000 ppm Mn.

Again, note the similar distribution pattern. Where we had high As, W, Ge, and Sb values, we have low Mn. The highest Mn values (not shown) were found primarily at shallow depths within the alluvium.

Fe MODEL OF KELLY CREEK BASIN

SLIDE 16: Fe model (>20 %) **SLIDE 16: Fe model (>20 %)**

If we look at Fe, we see the inverse of Mn and a close spatial correlation with the As, W, Ge, Sb suite. We call this distribution pattern, the Fe "blanket".

This series of 3-D models suggests that the Fe "blanket" represents an environment within the alluvium that was favorable for the precipitation of Fe oxide. As, W, Ge, and Sb were co-deposited within the same environment forming a body of alluvium with higher background levels of these elements than in the surrounding alluvium.

SLIDE 17a: W model cross section (Rabbit Cr.) **SLIDE 17b: Ge cross section (Rabbit Cr.)**

Within this favorable environment, local sources or processes then produced anomalous metal concentrations in the alluvium as shown here in these north-south cross sections for *W and Ge* over the Rabbit Creek and Chimney Creek deposits.

DISCUSSION

SLIDE 18: General Discussion **SLIDE 18: General Discussion**

Au - As I mentioned earlier, we do not have enough data to produce a model of Au dispersion in the alluvium of the basin. Our "early returns" suggests that the gold is extremely fine-grained and disseminated in the alluvium with values ranging from < 2 ppb to 30 ppb. There appears to be no coherent distribution or migration patterns for Au in the alluvium.

Fossil Anomaly vs. Equilibrium State - At the moment, we don't know if the Fe blanket is a static fossil anomaly, created sometime earlier in the basin's history or if it is in equilibrium with the present ground water of the basin. Some comparisons with water data suggest the possibility of an equilibrium with a present-day stratified ground water system. However, the existence of normal faults in the alluvium that apparently offsets the "blanket", suggests that it is a fossil anomaly that is unrelated to the current ground water regime.

ACKNOWLEDGMENTS

SLIDE 19: Company Acknowledgment List **SLIDE 19: Company Acknowledgment List**

In closing, I would like to thank the following companies for drill cuttings and other sample media, for mine tours, and for access to the respective properties. Specifically, I would like to thank...

... Dick Nanna, Mark Gingrich and Eric Berentsen of FirstMiss Gold, Inc.;

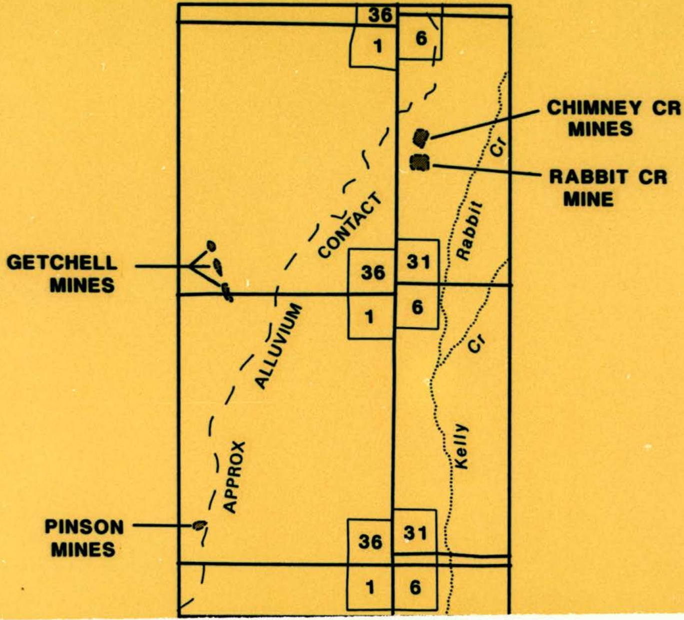
... Alan Wright, Ron Deichman, and Bill Feyerabend of Gold Fields Mining Corporation;

... Ed Kretschmer and Rob Dennison of the Pinson Mining Company; and

... Dean Peltonen and Roy Owens of Santa Fe Pacific Mining, Inc.

HOT SPRINGS RANGE
SNOWSTORM MOUNTAINS
DRY HILLS
Chimney Creek
Rabbit Creek
Getchell
Pinson
OSGOOD MTNS
Preble
Kelly Creek
Humboldt River
0 5MI
0 5KM

4P



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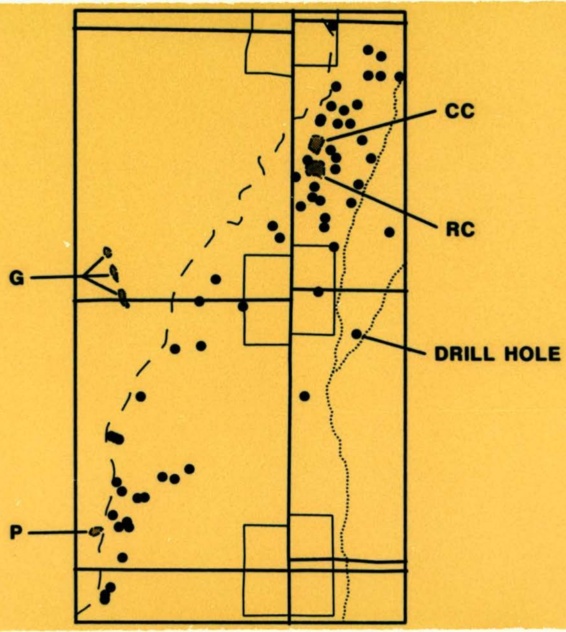

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TOTAL ANALYSES

DC-Arc Atomic Emission Spectrography - 35 elements

Ag As Au B Ba Be Bi Ca Cd Co Cu Fe Ga Ge La Mg Mn
Mo Na Nb Ni P Pb Sb Sc Sn Sr Th Ti V W Y Zn Zr

PARTIAL ANALYSES - Oxalic Acid Leach

DC-Arc Atomic Emission Spectrography - 35 elements

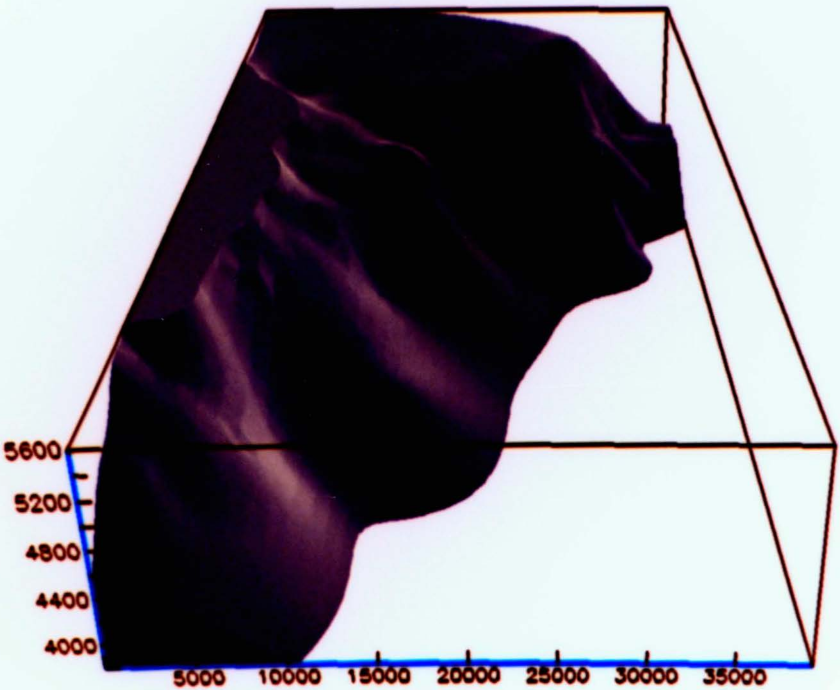
Ag As Au B Ba Be Bi Ca Cd Co Cu Fe Ga Ge La Mg Mn
Mo Na Nb Ni P Pb Sb Sc Sn Sr Th Ti V W Y Zn Zr

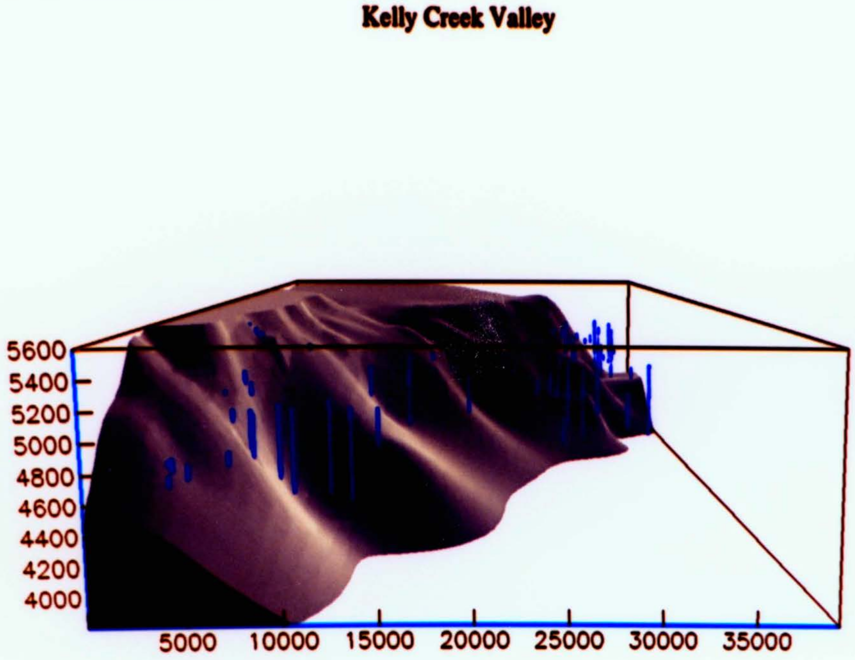
OTHER ANALYTICAL METHODS

Graphite Furnace - low level Au ($\geq$ 2 ppb)

Flame Atomic Absorption Spectrometry - Tl

Bedrock Surface

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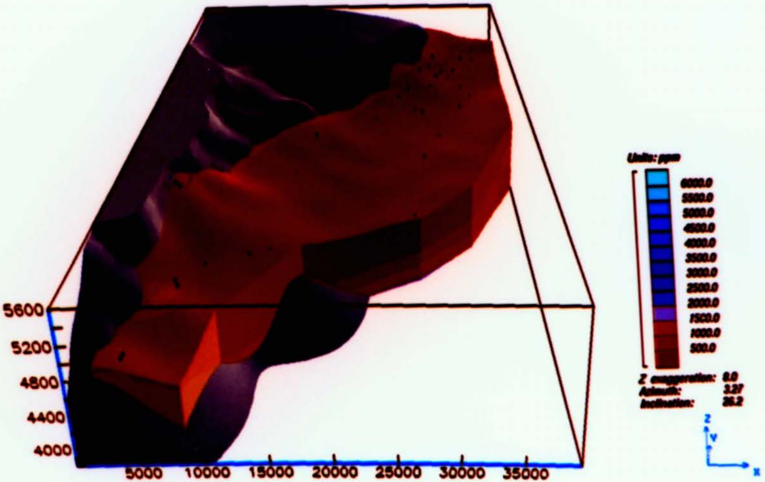
Kelly Creek Valley
As



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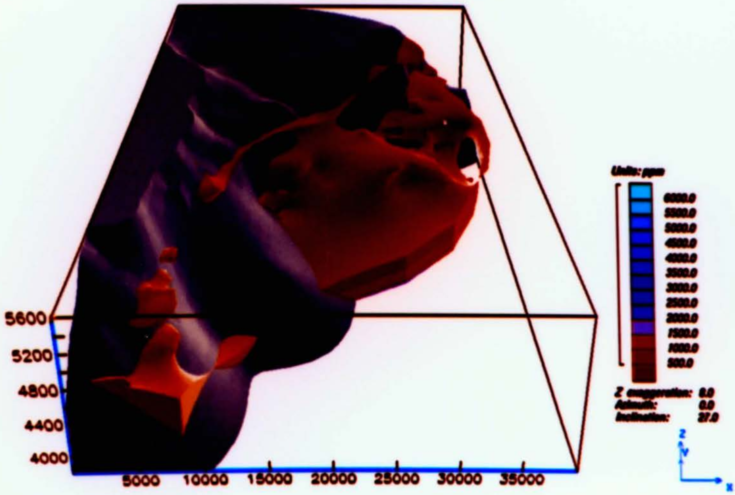

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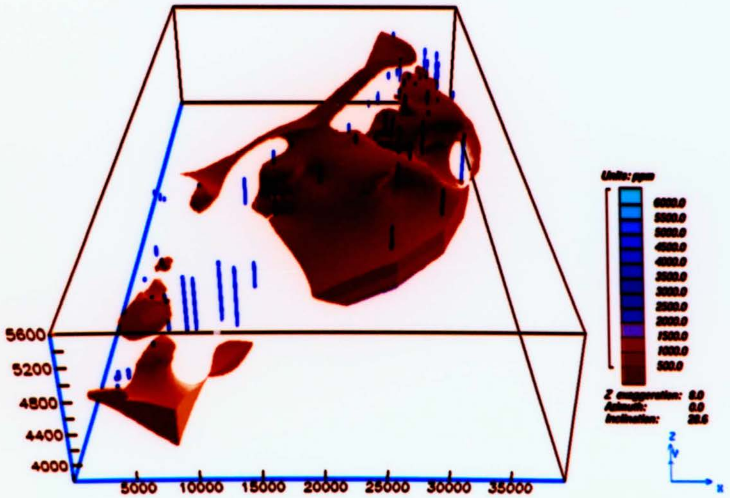

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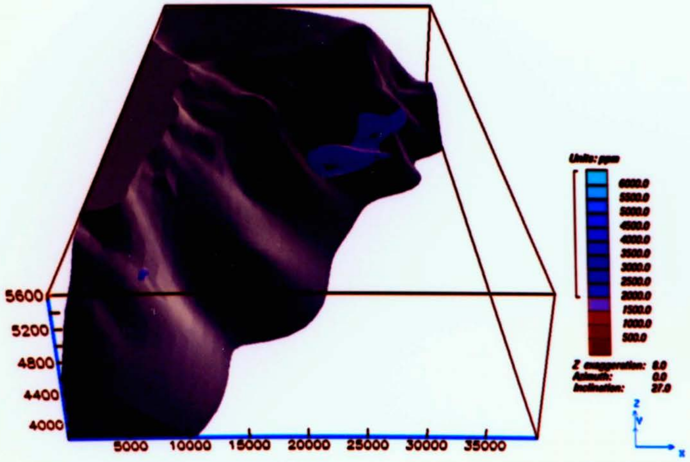

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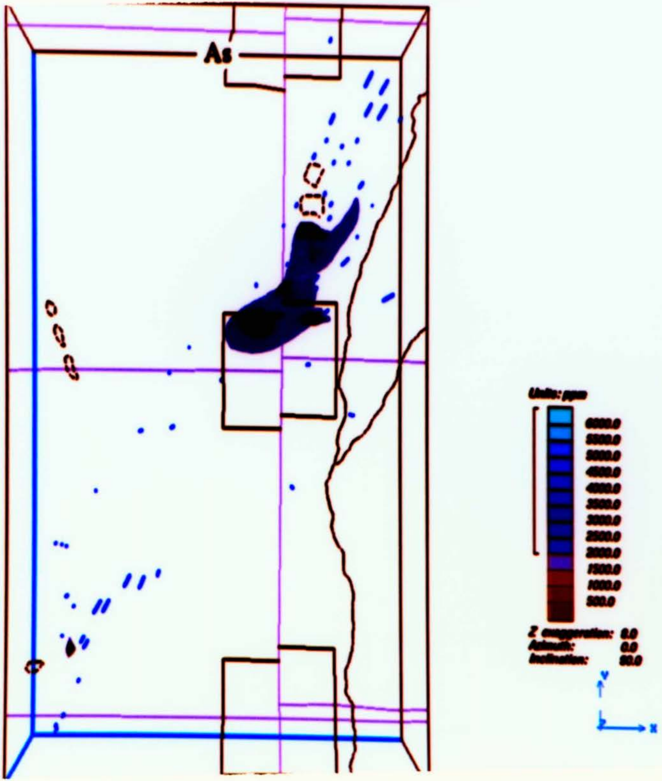
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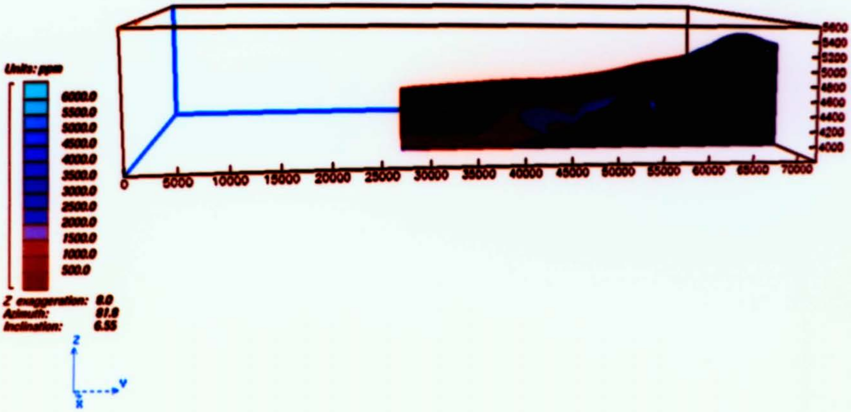
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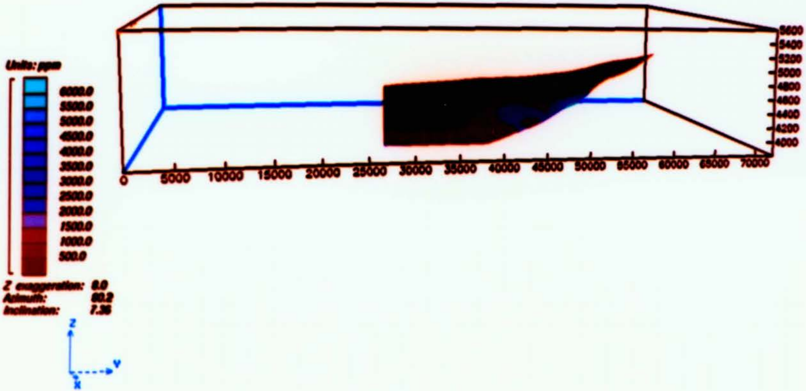

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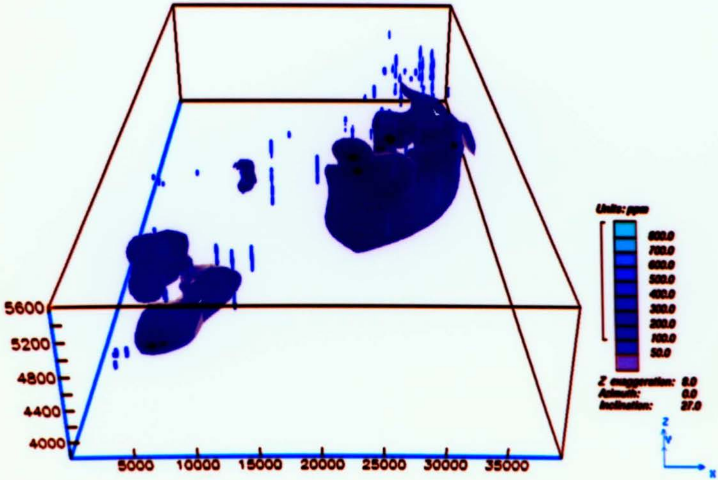

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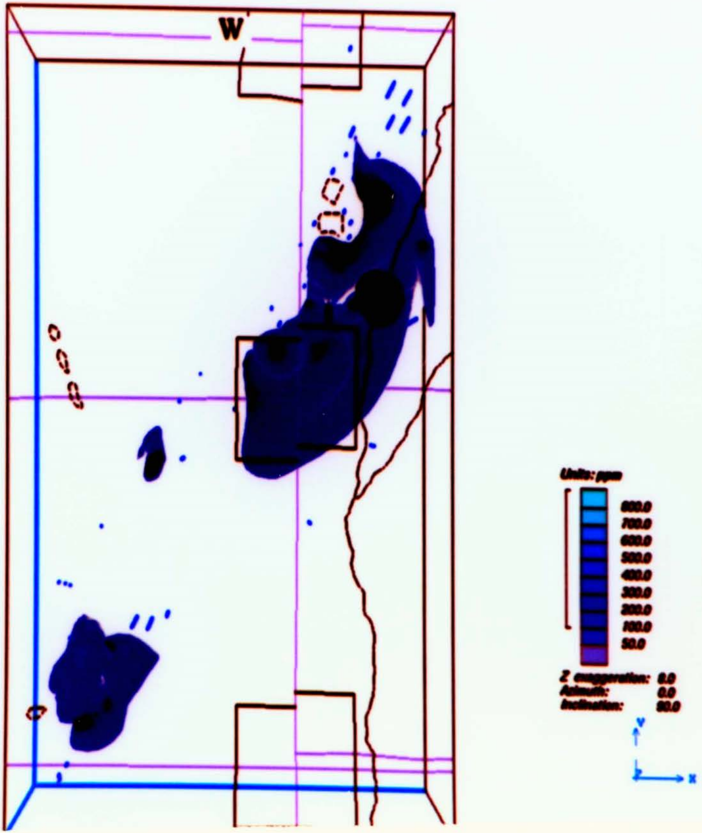
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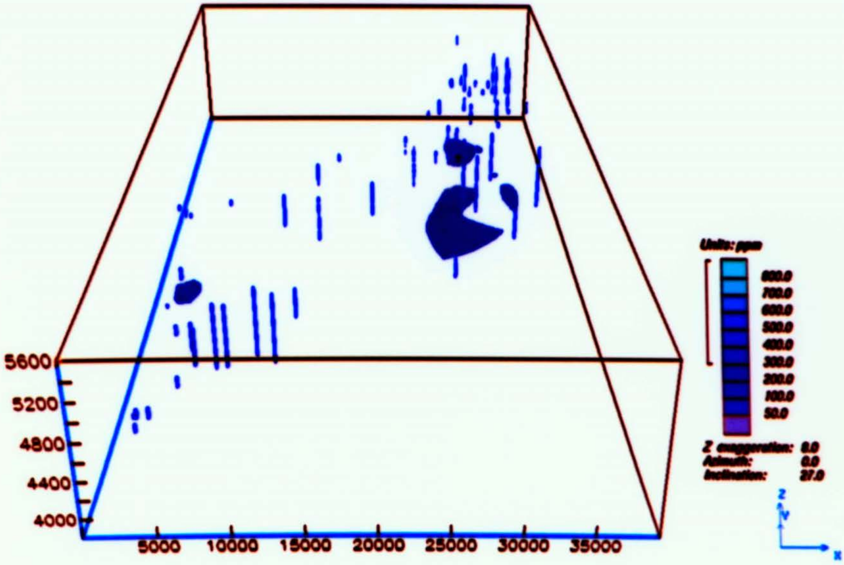

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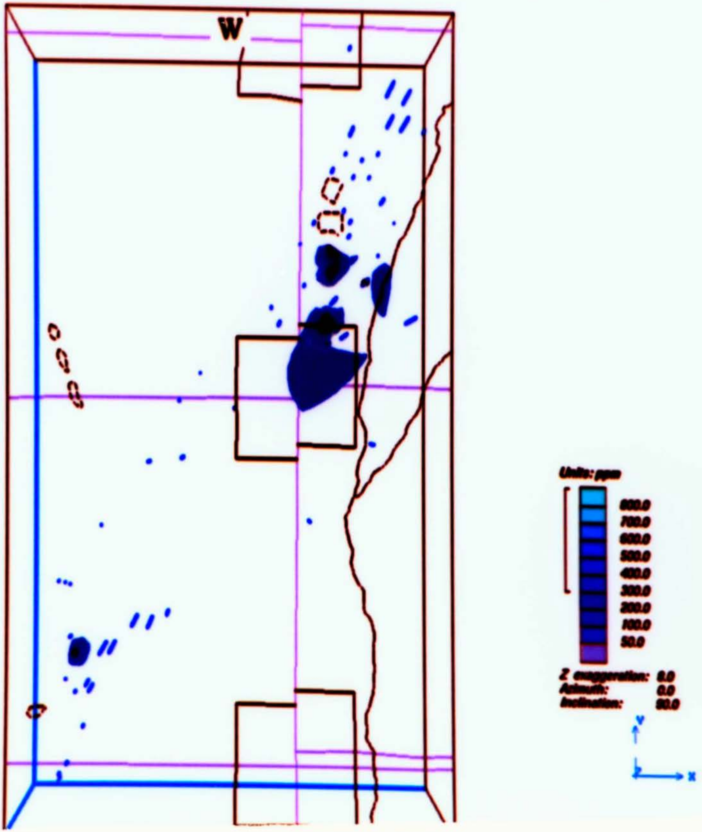
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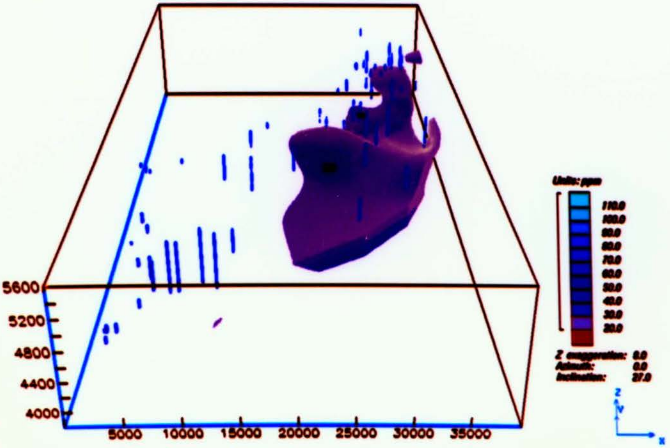

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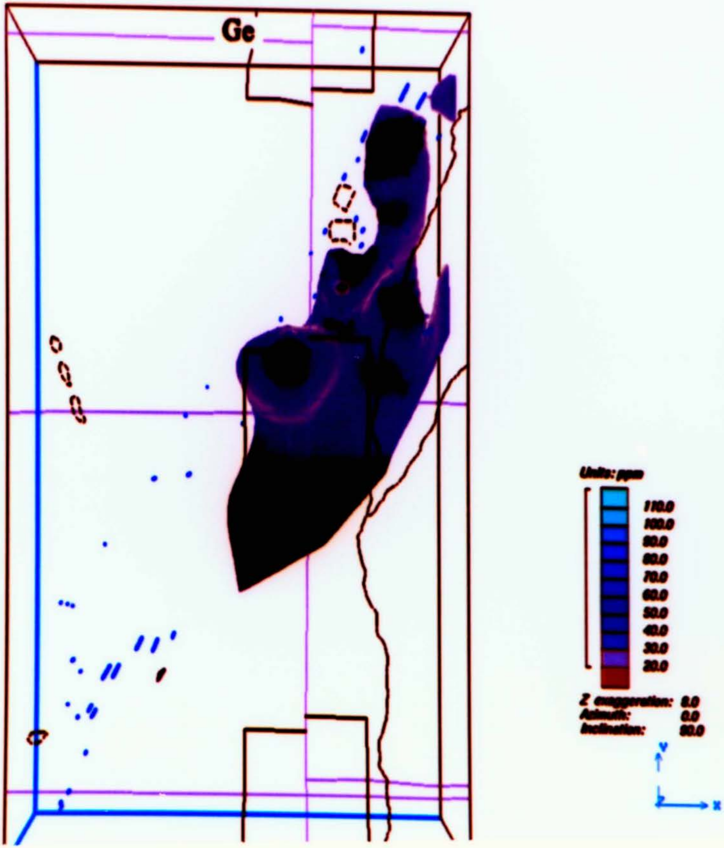
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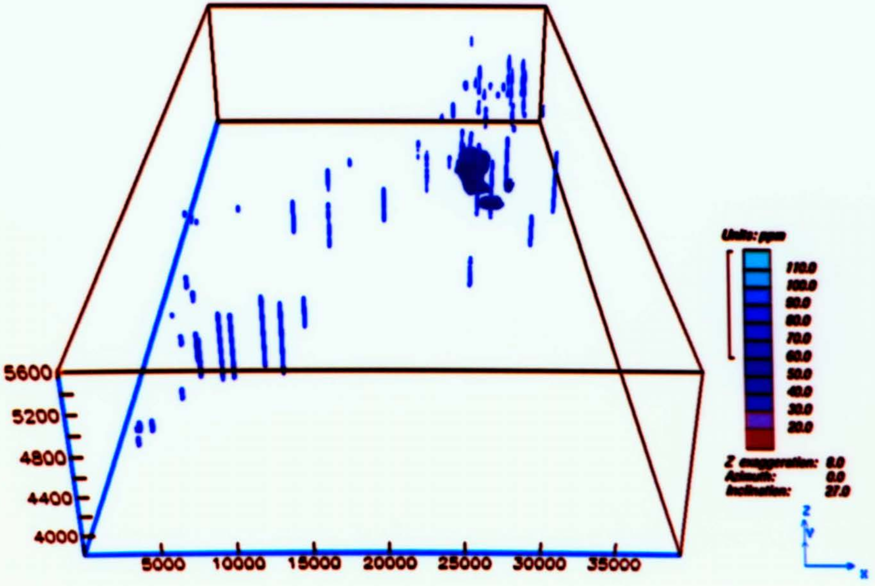

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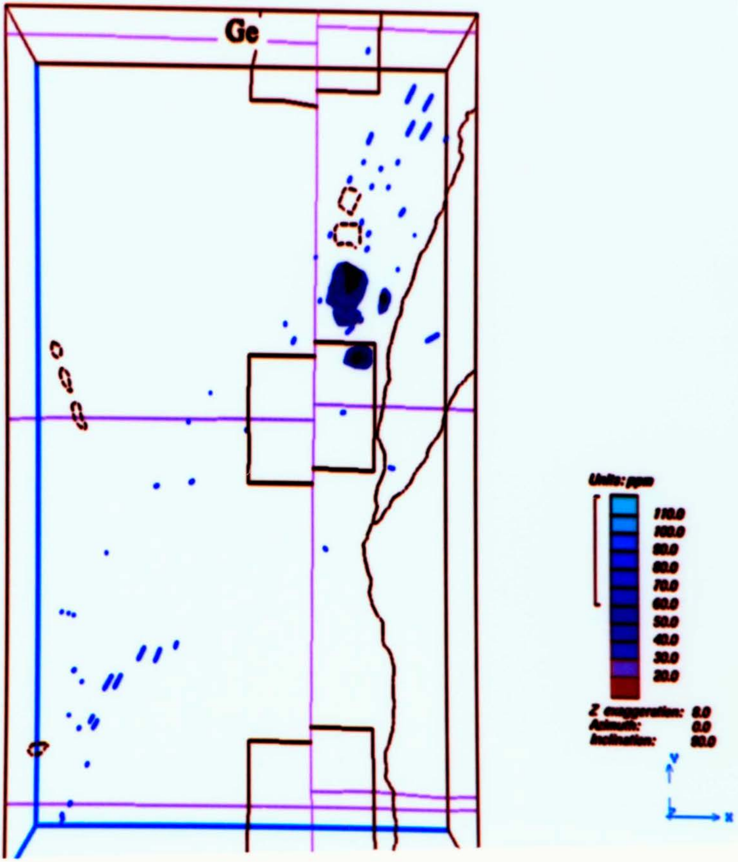
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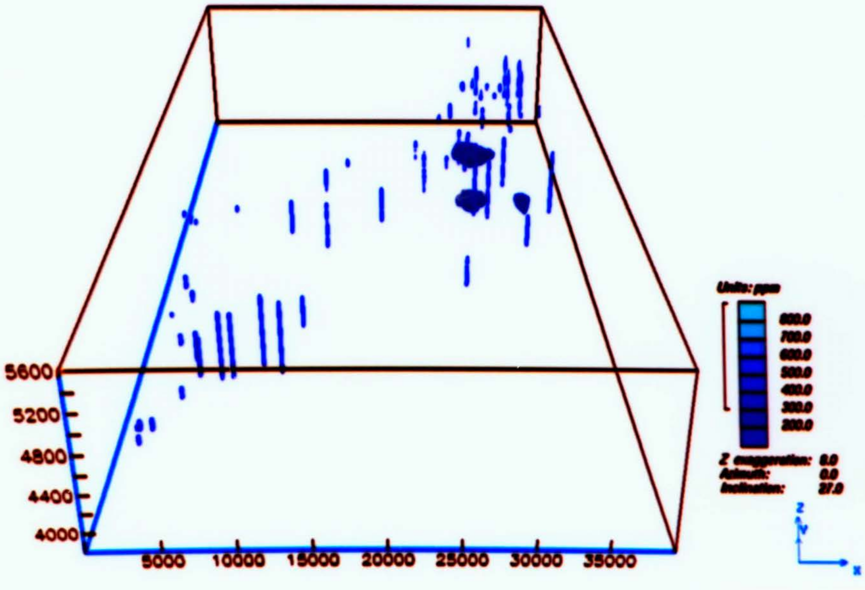

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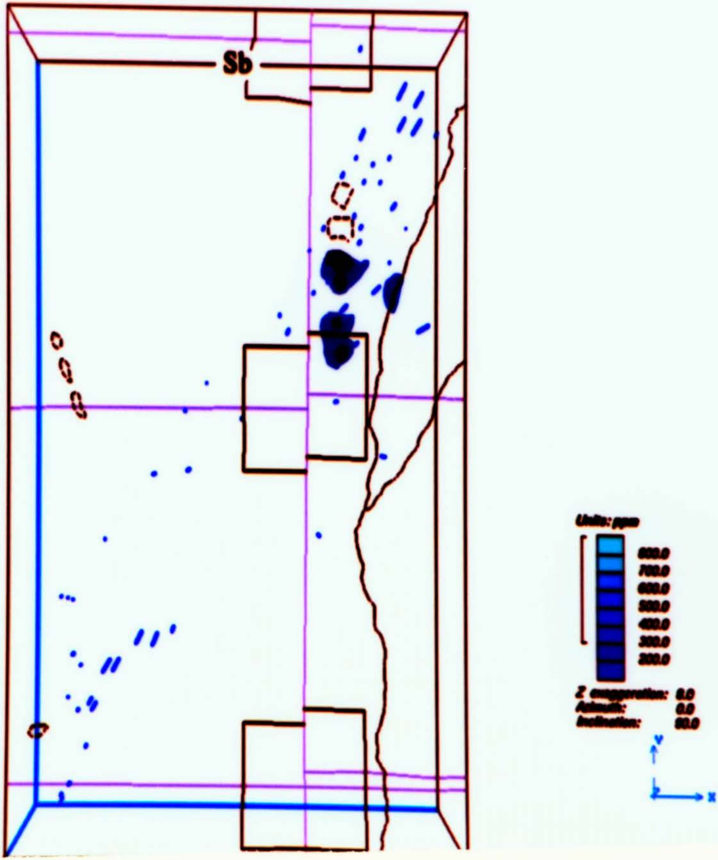
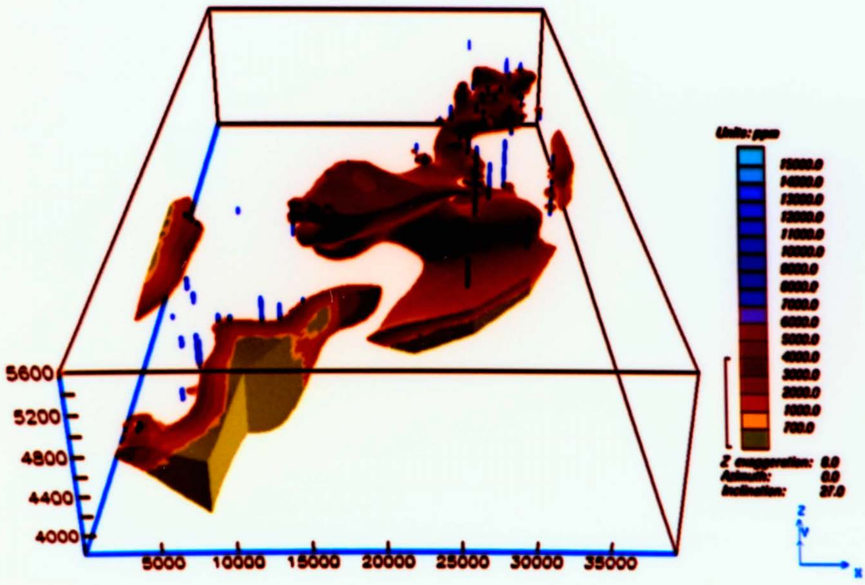
y
x

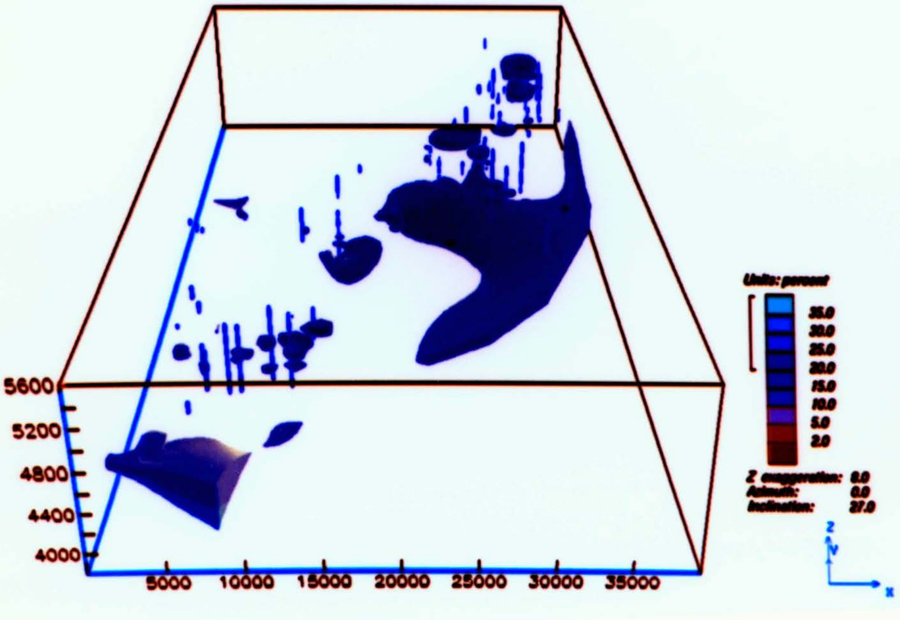

Sb
Units: ppm
800.0
700.0
600.0
500.0
400.0
300.0
200.0
Z exaggeration:
Azimuth: 0.0
Inclination: 90.0
Y
X

Mn



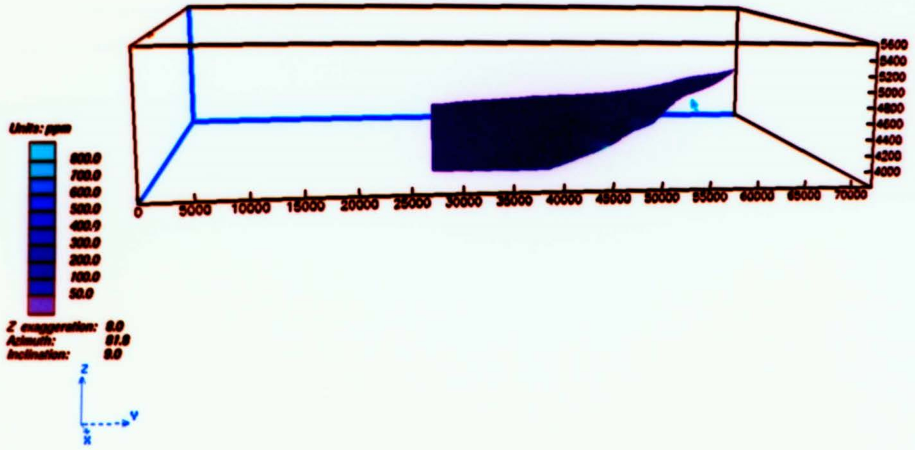
5600
5200
4800
4400
4000
5000
10000
15000
20000
25000
30000
35000
Units: ppm
15000.0
14000.0
13000.0
12000.0
11000.0
10000.0
9000.0
8000.0
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
700.0
Azimuth: 0.0
Inclination: 27.0
Z
Y
X

Fe



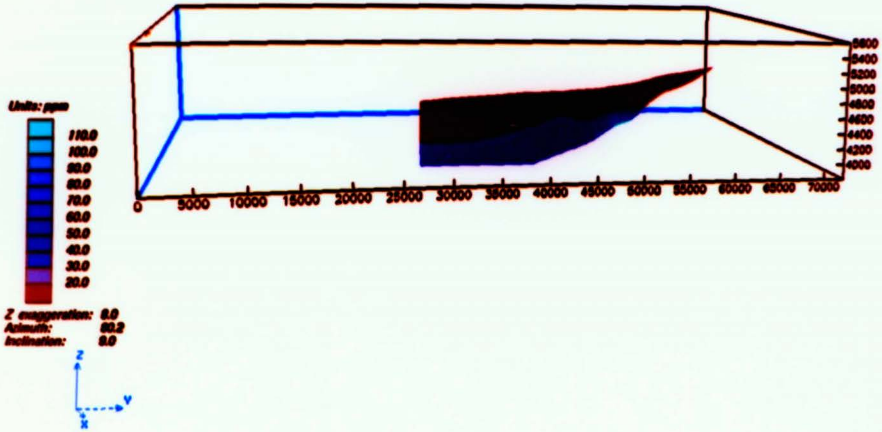
5600
5200
4800
4400
4000
5000
10000
15000
20000
25000
30000
35000
Units: percent
35.0
30.0
25.0
20.0
15.0
10.0
5.0
2.0
Z exaggeration: 8.0
Azimuth: 0.0
Inclination: 27.0
z
y
x

W



Units: ppm
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
50.0
Z exaggeration: 8.0
Azimuth: 81.0
Inclination: 8.0
Z
Y
X
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50000
55000
60000
65000
70000
5600
5400
5200
5000
4800
4600
4400
4200
4000

Ge



Units: ppm
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
Z exaggeration: 8.0
Azimuth: 80.2
Inclination: 9.0
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50000
55000
60000
65000
70000
5600
5400
5200
5000
4800
4600
4400
4200
4000
Z
Y
X

GENERAL DISCUSSION

- Au distribution
- Fe "blanket" with source to the west
- Spatial correlation of As, W, Ge, Sb with Fe
- Sources of As, W, Ge, Sb in the Basin
- Fossil Anomaly vs. Equilibrium State

FirstMiss Gold, Inc.

Gold Fields Mining Corporation

Pinson Mining Company

Santa Fe Pacific Mining, Inc.