Are You Looking For Asteroids to Mine?

Look Down

Coincidence Sometimes Does Prove Causation.

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There is a lot of talk concerning MINING ASTEROIDS in SPACE.

In particular, an enormous Asteroid, 16 Psyche, is proposed as an exploration target that may hold thousands of years' worth of inventory of familiar and exotic materials such as Gold, Cobalt, Iron, Nickel, Platinum, and many others.

True. But Space Mining of Asteroids may not be the best use of resources. Mining Asteroids in Space and returning the products to Earth is like building a large brick house using bricks individually sent by First-Class Mail. The cost is prohibitive!

Why go to all the expense, bother, and danger of chasing and mining Asteroids in Space? Mineralized Asteroids have been arriving on Planet Earth for billions of years and are already here. Some Asteroids or their Impact Structures are already being mined or producing oil and gas.

Buried 'fossil' Asteroids likely can provide many of the minerals that people use for a very long time. We need to know how to find those Asteroids, and it doesn't appear all that difficult. Buried Asteroid Impact Structures and their associated minerals are known worldwide.

You may be standing above one of them right now and not know it.

This article features a large, buried Asteroid and Asteroid Impact Structure in southeast Missouri, USA, that serves as the Type Locality for buried Asteroid mineral exploration targets worldwide. Collectively, they could provide many of the critical minerals that people will need for the next dozen centuries.

A shift in exploration perspective, and the knowledge that mineable Asteroids are already here, will soon lead to large-scale terrestrial asteroid exploration and mining. The Exploration Model also applies to Mars and other rocky planets beyond Earth.

THE JUD-SEMO ASTEROID

Southeast Missouri, 'SEMO' (pronounced See – Mo), is home to the 16 Psyche Asteroid's little brother, the JUD-SEMO ASTEROID. A more accurate name might be the JUD-SEMO Asteroid SWARM.

The enlarged and more detailed map identifies the leading Asteroid Impact Site in Carter County and possibly two smaller, separate Impact Sites to the north. Many more small Impact Sites will likely be discovered as exploration gets underway.

Iron Mountain, Shepherd Mountain, Pilot Knob, and possibly including Camel's Hump and Boss-Bixby, are a loosely associated group that may overlie and derive their Iron minerals from smaller independent Asteroids or Asteroid fragments that were orbiting or broke off from the big Asteroid during atmospheric entry. There are likely many more, currently undiscovered, Asteroid fragments too small to be resolved at the scale of the Missouri Gravity map.

Pea Ridge and Bourbon could likewise be a separate Impact group. Gravity data, not included with this article, does suggest a possible large Asteroid fragment close below the massive Pea Ridge Rare-Earths and Magnetite Iron ore deposit.

THE STRUCTURAL ILLUSION

The enlarged, detailed map shows several Iron Mines and Iron mineral deposits clustered on the north side of the Impact Structure, but not elsewhere. That probably is an illusion caused by tilted regional geology.

Southward, the Precambrian host rocks are deeper. Some Iron ore and Iron mineral deposits in the Older Precambrian, Melt Rock, Debris Field, and Younger Precambrian volcanic rocks are buried beneath thicker overlying rock and may not appear on the Gravity map.

Very likely, the size, richness, and number of deeper Iron deposits increase along a radial gradient across the Impact Center and Debris Field, but were not detected by the gravity mapping equipment.

A BIT OF GEOLOGIC HISTORY

JUD-SEMO's impact structure clearly appears on the Missouri State Gravity Map at the south end of the Missouri Gravity Low, but may not be evident to the casual observer. Once you recognize the circular gravity pattern and diagnostic semi-circular ejecta Debris Field, the JUD-SEMO Asteroid Impact Site is obvious. You can't un-see its unique pattern.

The JUD-SEMO asteroid crashed and splashed into the Precambrian continent Columbia sometime around 1.8 billion years ago, long before Missouri existed.

After the impact, the Precambrian continent Laurentia broke off from Columbia and began a long global journey riding on moving Tectonic Plates, at times attaching to and then separating from various landmasses. The Asteroid and Impact Structure went along for the ride.

Finally, Laurentia became the 'Basement Rock' now underlying much of North America, bringing the JUD-SEMO Asteroid and Impact Structure home to Southeast Missouri.

You can't see the Impact Structure. It's buried under Paleozoic, mainly marine, sedimentary rocks that overlie a thick layer of Younger Precambrian volcanic rocks, on top of Older Precambrian gneiss (pronounced 'nice') and schist on which the impact actually occurred.

Total depth from surface to the Older Precambrian impacted rock is currently under investigation and varies considerably with location.

Depth to Target is a critical factor in mining.

A thousand tons of pure gold at a thousand feet depth is an ore deposit. A thousand tons of gold at five miles depth is beyond reach of mining and is only a curiosity. The economic cutoff depth of most mineral deposits is commonly two to three miles.

The Missouri State Gravity map (with interpretation) indicates that the JUD-SEMO Impact Structure is currently about 120 miles wide, despite half a billion years of erosion. The Impact Structure is bowl-shaped, wider upward, and at the time of impact would have been much larger than it is today.

This (tentatively) places the 120 miles wide JUD-SEMO Impact Structure's size in the Number 2 position worldwide, based on its initially estimated crater diameter, between the Number 1 (Goldfields) Vredefort Crater in South Africa at 186 miles, and the Number 3 (dinosaur killer) Chicxulub Crater in Mexico at 112 miles. JUD-SEMO's estimated crater size will change as new research data become available.

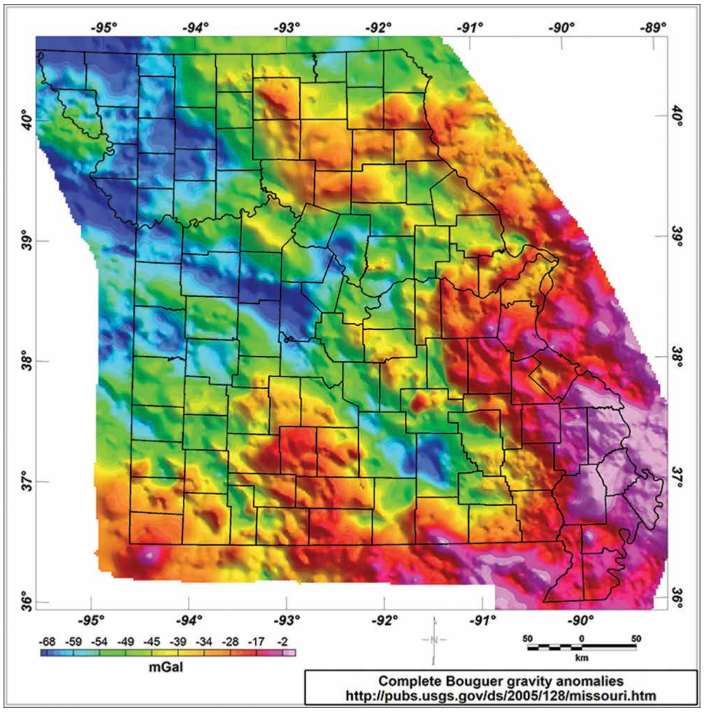
The JUD-SEMO Asteroid's story is presented here as a graphic.

Let's take a tour of the maps.

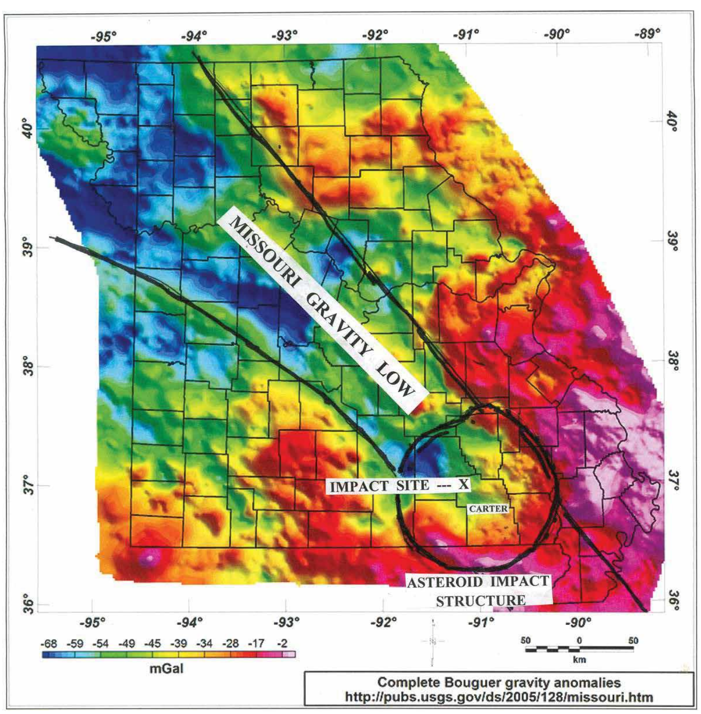
READING THE MAPS

The full-state Missouri map shows gravity intensity for the entire state, with county borders overlaid.

See maps on next page. ->



There are two approximately parallel lines crossing Missouri from the northwest to the southeast corners. They border the Missouri Gravity Low, also called the Missouri Batholith, created by the JUD-SEMO Asteroid's impact and subsequent Tectonic Plate movement.

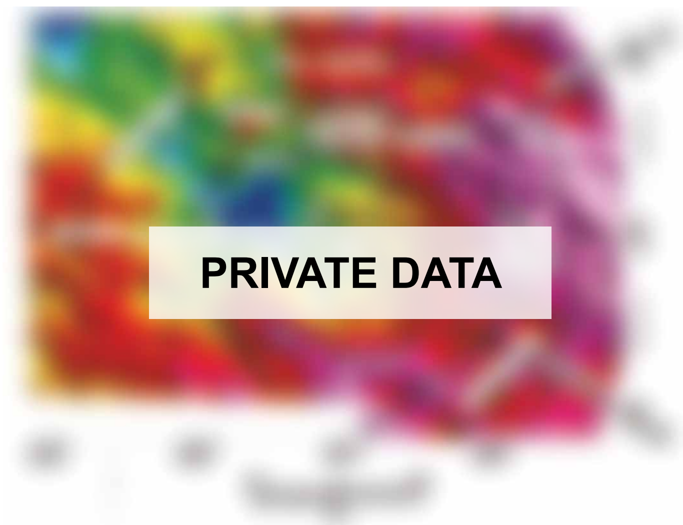


The large circle near the southeast corner approximately defines the JUD-SEMO Asteroid Impact structure.

These two structures and the accompanying Saint Francois Volcanic Province refer to the article's Subtitle: "Coincidence Sometimes Does Prove Causation".

THE ENLARGED, DETAILED MAP

The enlarged, detailed map is a visual story of the events that created the JUD-SEMO Asteroid Impact Structure and of their potential scientific, cultural, environmental, and economic importance. Remember, the actual impact happened long ago. The larger, more detailed map shows the current geology.



The Asteroid was traveling west to east at about 35 degrees below horizontal. In terms of relative size, the JUD-SEMO Asteroid was 16 Psyche's 'Little Brother', but was still a massive rock with an initially estimated volume of 523 CUBIC MILES.

Assuming spherical shape, the JUD-SEMO Asteroid was 10 miles long, 10 miles wide, and 10 miles tall, with substantial metallic content.

These numbers are preliminary and will change as new research data arrive.

The JUD-SEMO Asteroid Crashed and Splashed in today's northwest Carter County, Missouri, or possibly somewhat farther west in adjacent Shannon County.

Huge chunks of JUD-SEMO Asteroid and impacted Older Precambrian rock splashed out from the Impact Crater and fell north, east, and south, but not west, in two semi-circular clusters centered on the Impact Site.

The curved cluster pattern probably represents ‘frozen’ Anticlinal (Synclinal?) Ripple Ridges interacting with randomly located ejecta blocks of the Debris Field.

There was probably mineral enrichment and a reduction in permeability accompanying quartz deposition by rising hydrothermal fluids in ridgeline ejecta blocks and surrounding Asteroidiogenic sand and gravel layers. That should help to reduce water problems for miners.

Along the ridges, ejecta blocks are closer to the modern surface and easier to access.

The Impact ejecta’s map color and general pattern resemble a field of 21 enormous brown ‘Potatoes’ radiating from the Impact Site.

Each gravity-indicated ‘Potato’ is potentially an ore deposit and future mine. Collectively, they could be a new World Class Mining District.

There are likely more semi-circular impact ejecta clusters on the Gravity Map, but they are in darker red areas that obscure their identification. Displaying gravity intensity as contour lines, with or in place of colors, will fix that problem.

Impact Shock melted a massive volume of the JUD-SEMO Asteroid and Older Precambrian rock, producing a temporary magma of Melt Rock that extracted and concentrated minerals from the Asteroid and adjacent Older Precambrian rocks as the melt cooled and crystallized over tens of thousands of years.

Magma and hydrothermal fluids rapidly intruded the Melt Rock and redistributed some of its minerals into newly formed OLYMPIC DAM-type ore deposits, typically low-grade and as large as billions of tons, within erupting, overlying volcanic rocks. The name honors the type locality, the Olympic Dam Mine, which is still operating as of the year 2025 at Roxby Downs, South Australia.

Impact Shock exploded downward through the geologic Crust into the underlying Asthenosphere, creating a column of permeable broken rock. That started a Mantle Plume of semi-molten material that quickly (geologically speaking) ascended through the column of crushed rock and erupted onto the Precambrian paleo-surface.

Today, that erupted rock is the inactive Eminence-Van Buren Volcano (EVB), with a measured thickness of 5.3 miles of erupted material on the modern surface and unknown but presumably large additional thickness underground.

Regionally, erupting magma created the extensive Saint Francois Volcanic Province.

The Shock Wave continued downward and eastward, fracturing deep Older Precambrian rock and setting the stage for the earthquakes happening now in the northern Mississippi River Embayment at New Madrid, Missouri, and vicinity.

MINING AND PROCESSING THE ROCK

If the JUD-SEMO asteroid were massive, solid metal, that is, entirely metallic Iron and Nickel, and no rock, mining would not happen. Drilling and blasting of massive solid metal by conventional mining techniques doesn’t work.

Fortunately, as the Gravity Map suggests, JUD-SEMO has substantial mixed rock and metal content, enabling regular drilling-and-blasting mining operations.

Also, fortunately, Impact Shock thoroughly fractured the Asteroid, thereby doing much of the initial work of particle size reduction. The ‘Potatoes’ in the debris field are already full of fractures. Extreme crushing upon impact broke much of the Asteroid into smaller fragments, all the way down to sand size.

These mixed particle sizes fell around and on top of the big fragments, embedding them in asteroidiogenic sandstone and gravel that is also ore. They covered the big ‘Potato’ fragments, protecting them from oxidation and erosion.

Contemporaneous regional volcanic eruptions of lava and volcanic ash quickly covered the Asteroid-sourced material, further protecting the ore.

EXPECTED PRODUCTS

The expected JUD-SEMO Asteroid ore deposit will be a combination of materials from the ‘Potato’ fragments, asteroidiogenic sand and gravel, Melt Rock, and overlying Olympic Dam-type deposits. High-grade Supergene Enrichment deposits may exist.

Major metallic components will likely be Iron, Nickel, Platinum-Group (PGM) metals, and byproduct Gold, Copper, and Rare Earths.

Iron and Nickel will be present as Native Metals, offering the intriguing possibility of mining precursor Stainless Steel ingredients in massive amounts and easily recoverable form. Magnetic and density separation methods easily recover native Iron and Nickel metal alloys.

Stainless Steel is an alloy of Iron, Nickel, and Chromium.

Iron and Nickel native metals will already be present as major ore components. Add Chromium, and you have Stainless Steel.

Iron and Nickel, being metals, require no smelting, eliminating the need for and cost of smelter fuel. Not being Sulfide minerals eliminates the need for expensive Sulfur Oxides pollution control.

Chromium is not likely to be a product of Asteroid mining, but may be available from nearby mafic or ultramafic intrusives.

Metals likely to be present in Melt Rock ore include Iron, Nickel, Copper, Silver, and Gold.

EXPECTED PROBLEMS

Two features, DEPTH and WATER, might complicate or even prevent mining.

Depth was mentioned earlier in relation to Gold and applies to all mineral deposits worldwide.

Mining becomes more difficult and expensive as depth increases, reaching a break-even point below which the cost of mining exceeds the value of the minerals. Pending geological research will map the depth of the mineral deposits.

A big problem might be water. Impact-generated sand and gravel may be excellent aquifers within the ore body. Inflowing water can be too much to handle. Miners can still work (I have) if there is only a little water, and pumps can control water inflow, up to a point.

A HUGE problem might be HOT WATER. There is a low upper limit to the temperature a human can withstand and be safe and productive. Robots, likewise. Water volume and temperature can be determined early on during exploration drilling, before mine construction begins.

MANUFACTURING

Hopefully, all goes well, and mining begins. What to do with the mineral products?

Several Industrial Parks could be built to turn the minerals into valuable products. Low-tech items might include bricks, light bulbs, jewelry, and filler materials. High-tech items may include electronics, military hardware, catalysts, and advanced industrial ceramics.

And, of course, the volumetrically and economically most important products could be inexpensive Stainless Steel, specialty metal alloys, and numerous items made from those metals.

As an important environmental bonus, a use can possibly be found for everything, and there might be no tailings piles. There are even uses for the empty underground space left by mining. The southeast Missouri economy will bloom.

SCIENCE

Do you like exploring wild caves? How about wandering around inside a very big fragment of a very big Asteroid? Could happen.

If conditions allow and mining gets underway, the JUD-SEMO Asteroid ejecta Debris Field offers a unique opportunity for study by scientists, engineers, geologists, astronomers, students, and many others. Maybe even a Sci-Fi movie set. Neat!

To date, multi-million-dollar space vehicles have been used to bring back handful-sized samples of asteroids.

When exploration drilling begins, drill cores will return samples of buried Asteroid fragments, weighing hundreds of pounds and extending for kilometers.

When mining begins, Asteroid materials will be available in tens-of-ton truckloads.

As mining progresses, the Asteroid fragments' internal structure will become directly observable for scientific research.

We might learn much about Asteroids without ever leaving Earth.

GLOBAL IMPORTANCE AND BEYOND

The JUD-SEMO Asteroid and Impact Structure are not exclusively Southeast Missouri features. Many similar structures exist on Earth and on rocky planets such as Mars.

Exploration methods are typically developed by testing a range of techniques to determine whether known ore deposits can be detected. Geological research that identifies known ore deposits is then used to develop exploration methods for discovering similar ore deposits Planet-wide.

Earth's mineral inventory could extend from the current hundred+ years to a dozen or more centuries.

Many of Earth's large mines and ore deposits may have obtained their minerals by magmatic and/or hydrothermal transfer from underlying mineralized Asteroids.

Known near-surface ore deposits are excellent starting points for deeper exploration of large buried Asteroids once exploration technology is developed.

We know where Earth's big mines and big ore deposits are located. Could there be large buried Asteroids deeper down that were the known mines' original source of minerals? Would at least some of the buried Asteroids be huge, rich, and exploitable?

If you are looking for Asteroids to mine, look down.

Altogether, a thoroughly fascinating and significant program.

Let's start exploring!

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