

EXPLORE & DISCOVER

A CORPORATE NEWSLETTER

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Who is Big Rock Exploration?

Big Rock is an international technical consulting company based out of Minneapolis, Minn. We specialize in natural resources, including metals, minerals and energy.



What does Big Rock do?

Big Rock is focused on identifying, exploring and evaluating mineral and other natural resources. Our vast network of geoscientists, project managers, GIS professionals and field technicians provide clients with reliable expertise for all kinds of natural resource projects.

We focus on tailored project solutions for our clients by offering diverse and professional technical services.

EXPLORE OUR SERVICES

Let's get in touch!

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Note From The Corner Office

WELCOME TO OUR NEW INDUSTRY DIGEST

By Brian Lentz, Principal & Vice President of Big Rock Exploration

Welcome to Big Rock's inaugural newsletter where we highlight happenings within our company, present relevant technical content and highlight news about various natural resources industries.

In this issue, we discuss the importance of "strategic minerals" and their importance to everyday life in a modern society. Strategic minerals are critical components for growing our food, accessing fresh water, sustaining reliable transportation infrastructure and supplying renewable energy. Exploring for new sources of these minerals provides our society and economy with numerous advantages and benefits.

We also highlight a technical aspect of applied GIS (geographic information systems) in mineral exploration to answer the question "how do you find a mineral deposit?". Mapping and computers are critical components that drives discoveries. Big Rock's innovative applications of various tools provides our clients with cost effective strategies to advance their projects.

Big Rock has seen the natural resources industry continue a gradual turnaround this year. The diversity of our projects and our geographical footprint is key evidence. We look forward to a positive 2018 to explore and discover!

Where was Big Rock in 2017?



Strategic Minerals

RESOURCES ACROSS SOCIETY

The term "strategic minerals" is a unique classification for minerals of significant importance to the economy and lifestyle of a particular region. Such minerals are deemed "strategic" because they are necessary for a) national defense & national security, b) energy infrastructure, c) domestic manufacturing, agriculture, telecom, healthcare and transportation, and d) economic security and balance of trade.

The US Geological Survey publishes an annual list of mineral imports highlighting how profoundly the US relies on foreign sources for strategic minerals. Many of the countries from which these minerals are sourced are subject to a fragile balance of trade. For example, China produces over 90% of a number of strategic minerals that the US is heavily dependent on. Any disruption in our access to that supply can have drastic implications on our economy and our National Security.

You might ask "Why should I care?" "How does this affect me?" We've established four WHY-factors delineating how strategic minerals have an impact on our economy and way of life:



1) Energy

One of the world's fastest growing industries is renewable energy. The production of wind, solar, and geothermal energy as well as the manufacture of energy-efficient vehicles is heavily reliant on strategic minerals. Cobalt, lithium, manganese, vanadium, zinc, fluorspar, gallium, scandium, and others are considered strategic to these industries. Stable and reliable supplies of these minerals are imperative to achieve growing green energy initiatives.



2) Transportation & Infrastructure

Despite being a constant political hot topic, transportation & infrastructure is the backbone to the US economy and our daily life. After President Eisenhower initiated the interstate highway system in the 1950s, the US became a global beacon of transportation and infrastructure. But in the past decades, this framework has denigrated as the US population has grown; posing many challenges and even tragic consequences. Strategic minerals are necessary to alleviate these issues and continue to build and restore American Infrastructure.



3) Agriculture

The agricultural industry has developed extraordinarily over the past 20 years and continues to be one of the largest value-added sectors of the US economy. The US exported ~\$50B of agricultural products across the globe in 2000 and grew to exceed \$140B in imports in 2014. Modern agriculture production is heavily reliant on imported and domestic sources of potash, phosphates, gypsum, sulfur, lime and other fertilizers. These are all key strategic minerals needed to feed the world.



4) Water

Water is an essential component of life as we know it. The production, purification, storage and transport of water relies exclusively on many strategic minerals. Minerals including limestone, silica sand, steel, copper, and others are crucial for supplying clean water to our society.

These four simple WHY-factors are just some of the many important reasons why minerals play an increasingly important role in our daily lives. Strategic minerals are vital to provide our society with the fundamental components of life and well-being we are all accustomed to.



CRITICAL AND STRATEGIC MINERALS IMPORTANCE TO THE U.S. ECONOMY



A Technical Briefing by The Society for Mining, Metallurgy and Exploration

GIS Fuzzy Logic Modeling

KNOWLEDGE-DRIVEN VS DATA-DRIVEN EXPLORATION

Mineral prospectivity mapping is a powerful exploration technique. It is used by exploration geologists to evaluate large regions for mineral resources. An extensive geodatabase must be compiled from available geological, geochemical, geophysical, and remote sensing data. These data layers are displayed, integrated, and processed in a geographic information system (GIS). Typically, geologists will use knowledge-driven or data-driven approaches to calculate or estimate the mineral prospectivity of an area. These approaches assign evidential weights to specific criteria and integrate evidential maps into a final mineral prospectivity maps for a specific style of mineralization. This article will discuss two common methods used to produce mineral prospectivity maps. The data-driven approach, called weights of evidence (WOE) established by Bonham-Carter et al (1989) and the knowledge-drive method known as fuzzy logic modeling, a theory proposed by Zadeh (1965).

In data-driven approaches, such as WOE, "training" points (locations of a known occurrence of the system being modeled) are used to estimate and establish the importance of each evidential layers to a set of criteria which define an occurrence. This method uses statistical analysis to calculate relationships between each data layer and a known deposit. WOE assumes that all the data layers of the model are conditionally independent of mineralization. Due to implicit assumptions and statistical foundation, the WOE model is best suited for well-defined, and wellexplored areas.

Knowledge-driven approaches, such as fuzzy logic modeling, allow geologists the discretion to utilized their knowledge of a deposit of interest to identify and assign weights to evidential layers they believe most critical to a style of mineralization. This method relies on establishing a detailed recognition criteria that explains the occurrence to be modeled. The fuzzy logic modeling utilizes fuzzy-set theory which defines a degree of membership (fuzzification) for each layer of the recognition criteria, represented by a value between 0 and 1. The "fuzzified" evidential layers are then combined using a selection of operators to affect how each value effects the final output.



The discovery of new mineral deposits is becoming increasingly challenging. These methods have helped improve regional targeting. The validity of these modeling techniques has been studied by numerous individuals, universities, and corporations. The general consensus is WOE modeling works best in a study area with a large number of deposits and available high-resolution data. Fuzzy logic modeling is better suited in regions with insufficient data or under-explored regions.

The incorporation of many statistical and geospatial processing tools in common GIS platforms coupled with increasing availability of public geologic, geochemical, geophysical, and remote sensing data have made these techniques more viable as an early-stage exploration method. Big Rock has utilized knowledge- and data-driven modeling to generate mineral prospectivity maps identifying regional "anomalies" that, based off a set of criteria, are most likely to host a mineral deposit. Big Rock has successfully utilized this techniques in a variety of metallic and non-metallic mineral deposits.



This shows an example of applying various data layers to produce a heat map of potential cobalt mineralization. Using fuzzy logic modeling, each data source can have different weighting factors to limit or intensify specific deposit characteristics.

Big Rock: In The Field

BREAKING GROUND IN NEVADA

By Robert Bergmann, President, Big Rock Exploration

Nevada hosts a diversity of mineral commodity projects and continues to be a hotbed for economic geology; ranking #1 in the USA for nonfuel mineral revenues in 2016. In recent years, Nevada has witnessed many discoveries stemming from quality geologic investigation and a "new eyes on old rocks" approach. Newmont Mining's Long Canyon project is a prime example of how 'new eyes on old rocks' can lead to discoveries and expansion of resources.

Big Rock was retained by a junior mining client to act as their general consultant and lead technical team for development of their Nevada properties. Once retained, we developed a customized exploration plan to advance each of their property's toward discovery. The first step involved compiling, digitizing and organizing boxes of historical files, geophysics, maps and various datasets. Next, the data was incorporated into a ArcGIS spatial geodatabase supplying the client access to all property related data in one centralized location, observable in map and digital format. Once this was built, it provided a strong backbone for exploration planning and boots on the ground follow up work as well as supplying the client with a powerful toolkit for fundraising and marketing of their NV portfolio.

Continued follow up work involved a team of Big Rock geologist's, armed with rock hammers and a powerful knowledge base, hitting the ground running in Nevada. The field team systematically mapped detailed geology including; lithology, alteration, mineralization, and structure, collecting hundreds of rock chip samples for further geochemical analysis. All data collected in the field was then digitized into the spatial geodatabase continuing to provide a high-level understanding of each property. This systematic grassroots geology work resulted in the discovery of multiple mineralized, and previous unrecognized, systems on the client's various properties.

Our work continued for the client with staking up additional ground to incorporate new anomalous regions and targets surrounding their current holdings. For one property, a full 3-D model was constructed plotting all historic drilling and geologic data resulting in identification of quality subsurface targets for future drilling. We are currently finalizing permits for this property and expect to be conducting a fall/winter drilling campaign aimed at confirming historic drilling grades and testing newly formed drill targets at depth. The vision, diligence and investment of the client has continued to grow value for its shareholders and advance their properties toward discovery!







Team Big Rock

MEET BRANDON ISAKSON



Brandon Isakson

Principal & Director of Operations

PERSONAL HIGHLIGHTS

EDUCATION

B.A. Economics & B.A. Geology <u>University</u> of Minnesota – Twin Cities '12

CERTIFICATIONS

G.I.T., NWT WSCC LEVEL II SUPERVISOR

YEARS OF SERVICE

5 years



brandon@bigrockexploration.com



Brandon Isakson

"Big Rock is a great team of dedicated scientists that want to elevate the standard in their field"

- Brandon Isakson

Brandon grew up in Mankato, MN and attended the University of Minnesota – Twin Cities where he studied economics and geology.



While at University, Brandon assisted Dr. Joshua Feinberg in research at the Institute for Rock Magnetism (IRM), modeling the magnetic properties of a Precambrian igneous complex. As a student, Brandon also spent four years working at the Minnesota Geological Survey.

Since joining the Big Rock team, Brandon has worked in a variety of mineral commodities including uranium, diamonds, gold, industrial minerals, and more. As a Partner of the firm, he currently oversees all aspects of operations for a variety of client projects. Brandon manages drilling and exploration programs ranging from early-stage greenfield projects to mine production including surface and underground operations.

"He plays an important role in managing staff and projects for both the company and our many clients" exclaimed Big Rock's Co-Founder and President, Rob Bergmann. "We all appreciate the hard work and dedication Brandon brings to the Big Rock team."

In his free time, Brandon enjoys golfing, camping, fishing, hunting, sailing and lacing up the hockey skates.

Rocks In The News

GEOLOGY MAKING HEADLINES

USGS Estimates 40 Million Pounds of Potential Uranium Resources in Parts of Texas, New Mexico and Oklahoma

November 14 2017, USGS.gov

"The U.S. Geological Survey estimates a mean of 40 million pounds of in-place uranium oxide remaining as potential undiscovered resources in the Southern High Plains region of Texas, New Mexico, and Oklahoma. The uranium occurs in a type of rock formation called "calcrete," which has been well-documented in noted uranium-producing countries like Australia and Namibia. The calcrete formations described in this assessment are the first uranium-bearing calcrete deposits reported in the United States."



READ FULL STORY

Titanium Range? Breakthrough Could Lead To New Kind Of Mining In NE Minnesota.

Dan Kraker, May 26, 2017, Minnesota Public Radio News

"Researchers with the Natural Resources Research Institute, an arm of the University of Minnesota Duluth, announced Thursday they've demonstrated on a pilot-scale a new technique to separate high-purity titanium oxide from a mineral called ilmenite. Titanium dioxide is valued around \$3,200 per ton, compared to a value of around \$70 for the taconite pellets produced on the Iron Range. It's used in a range of everyday products, "ranging from paint to lotions to lip balm to the white on your powdered donuts," said George Hudak, NRRI's minerals, mining and metallurgy director."



READ FULL STORY

NASA Discovers Mantle Plume Almost as Hot as Yellowstone Supervolcano That's Melting Antarctica From Below

Hannah Osborne, November 8, 2017, Newsweek ©

"Researchers at NASA have discovered a huge upwelling of hot rock under Marie Byrd Land, which lies between the Ross Ice Shelf and the Ross Sea, is creating vast lakes and rivers under the ice sheet. The presence of a huge mantle plume could explain why the region is so unstable today, and why it collapsed so quickly at the end of the last Ice Age, 11,000 years ago."



READ FULL STORY

Graphic credit: NSF/Zina Deretsky

Looking Ahead

WHAT'S NEXT FOR BIG ROCK



American Exploration & Mining Association

AEMA's 122nd ANNUAL MEETING, EXPO, & SHORT COURSES

December 3 – 8, 2017 Sparks (Reno), Nevada USA

The American Exploration & Mining Association's Annual Meeting and Exposition, held the first week of December, is a preeminent and the second largest annual mining convention in the U.S. Our convention consists of short courses, technical, legislative and policy sessions, and a 250 booth trade exposition. Our sessions emphasize mineral deposits, exploration and development, operations, business and finance, environmental technology, regulation and policy and legislative affairs. The meeting has been held every year since 1895, and attracts more than 2,500 attendees from all over the world.

Source: www.miningamerica.org

AME ROUNDUP 2018

January 20 – 25, 2018 Vancouver, BC, Canada

As the industry gains momentum, and sees a resurgence in many regions, Roundup's theme, "*New Generation of Discovery*" will bring experienced mineral explorers together to examine new geoscience ideas, innovative technologies and creative business solutions to lead the way to success. Everything from 3D/VR/AR applications to undiscovered places to unlikely partnerships – the opportunities are here.

AME is the lead association for the mineral exploration and development industry based in British Columbia. Established in 1912, AME represents, advocates, protects and promotes the interests of thousands of members who are engaged in mineral exploration and development in B.C. and throughout the world. AME encourages a safe, economically strong and environmentally responsible industry by providing clear initiatives, policies, events and tools to support its membership.

Source: roundup.amebc.ca/attendees/about-roundup/

