Lasers, the Future of Mining

An Innovative New Method for Mining Using High Optical Power Lasers to Mine for Precious Metals.

U.S. & Intl Patents Pending;
Publication No. US-2017-015744-A1

The Progression of Mining:

Since the beginning of mankind, there has been mining. Man searched the hillsides for obsidian for making points and the stream beds for rocks suitable for hammers or clubs. King Solomon, of Biblical times, had iron, gold, silver and turquoise mines. His miners used moil, hammers and fire to chip and spall the rocks. The early Romans mined in those areas which they had conquered. Their mining methods were similar to those of King Solomon's day, except in this time period there were new tools of iron available.

In the mid 1880's, miners were hand steeling and using black powder to blast the rock. By the late 1800's and early 1900's, steam power, electricity and compressed air were available. Mining was becoming simpler with less manual labor involved. Today, mining is highly specialized, using diesel, electric, gas or compressed air to power all types of mining equipment. The 21st Century has brought us a new tool with which to mine. Lasers will replace drilling and blasting methods that now are presently the standard in the mining industry. Finally, man has come full circle, from spalling rock with hammers and fire, to now spalling rock with the power of lasers.

Mining Today:

Modern technology, creative thinking and long-time experience have been now combined to harness the power of the fiber laser to augment and make profitable the mining of narrow veins of precious metals as well as gem stones in remote areas of our planet and possibly elsewhere as well. Merger engineer, based on experience working with lasers in military applications and on studies conducted at Argonne National Laboratory in their Laser Application Laboratory in the early 2000's, and experiments conducted by other academic and research organizations, have expanded and extrapolated additional data that given the "right parameter" a laser beam could be configured to work within that narrow regime between just heating rock and melting or vaporizing that rock. That regime is known as "thermal fracturing" or "spallation".

See the Merger Mines Corp website at www.mergerminescorp.com for videos showing Thermal Fracturing in sedimentary rock formations as investigated by Argonne Natl Laboratories, Laser

Applications Laboratory using CO_2 Lasers.

These are some of the papers from which some of our data has been extracted:

J. Appl. Mech 40(4), 909-914 (Dec 01, 1973) (6 pages) doi:10.1115/1.3423186
History: Received August 01, 1972; Revised January 01, 1973; Online July 12, 2010

Thermal Fracturing of Hard Rock

P. J. Lauriello and Y. Chen

Proceedings of the 23rd International Congress on Applications of Lasers and Electro-Optics 2004 Laser

Spallation of Rocks for Oil Well Drilling

Zhiyue Xu 1 Claude B. Reed 1, Richard Parker 2, Ramona Graves 3

1 Argonne National Laboratory, Argonne, IL 60439, USA
2 Parker Geosciences, LLC
3 Department of Petroleum Engineering, Colorado School of Mines
Proceedings, Thirty-Ninth Workshop on Geothermal Reservoir Engineering
Stanford University, Stanford, California, February 24-26, 2014 SGP-TR-2021

The Geo-materials Fracture by Thermal Process

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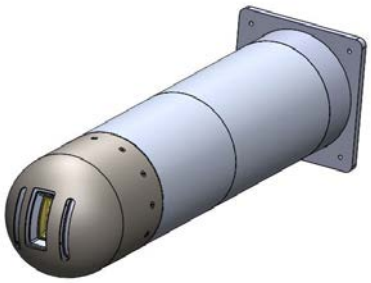
Merger believes that it has determined the ideal irradiation zone size and is near to determining the irradiation duration and laser power to fracture the chemical bonds between molecules found typically in the quartz and granite geologic structures where the sought after materials have been formed over the millennium. Our definition of an ideal spall is about half a cubic centimeter or about the size of a "pea". (The diameter of the "spot" size and about half the diameter in depth.) Merger engineers along with our technical partners, will be able to empirically determine thermally fracturing or spallation criteria in geologic samples furnished by Merger and our Underground Mining and System Training partner, Groundhog Mining and Milling, LLC.

Universal Test Unit

To make that determination, Merger engineers, along with mechatronics partner, Frencken-America, have designed a universal Test Unit for our Scan Head. The Merger Scan Head conditions and directs the laser beam produced by an IPG Photonics' Fiber Laser. Initial laser parameters will be determined by the IPG Photonics, Laser Testing Facility. In the facility, IPG, along with Merger engineers and partners, will then be able to empirically determine optimum thermal fracture or spall criteria from a number of geologic samples furnished by Merger and our

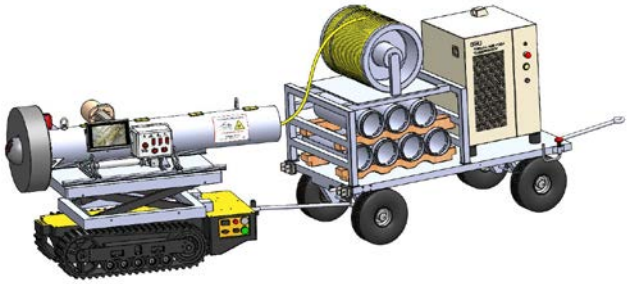
Underground Mining and System Training partner, Groundhog Mining and Milling, LLC. This series of tests will define the range of laser power needed and will allow tuning of the software for both the laser and the scan head.



Scan Head

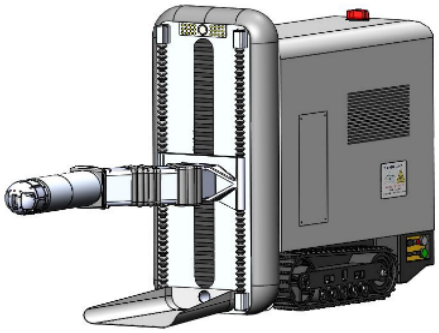
Recognizing that the geologic structures vary from mine site to mine site, Merger has developed a Characterization Unit. This unit, mounted on Movex Innovation's heavy duty "Track-O" electrically driven, low profile vehicle will be transported to a mine site and be used to determine the exact power density and scan dwell time necessary for optimum spallation at the site by drilling a fourteen inch diameter opening to a depth of fifteen to thirty feet as appropriate. That data will then be pre-programmed into the Merger Miner or any derivative thereof. The Characterization Unit, with its companion laser and material collection system can be augmented with an appropriate power generation system as well as a gaseous material compressor and material collection system should these items not be available on site.

Move-X Vehicle



Characterization Unit

The Merger Miner is also built on the Track-O vehicle with the Scan Head carried on a Robotic Arm. The Robotic Arm's movement is software controlled allowing the arm to move the Scan Head to carve out any pattern selected. Since most narrow veins or stringers on planet Earth are anywhere between 3" and 18" wide and varying in thickness as well as generally on a decline, the movement of the Scan Head may be easily programed to remove waste rock from below the vein material, then the vein material itself and finally the remainder of the waste. This over a surface area of some 16 square feet (32" wide X 72" height) and extending about 12" inches deep. The Miner then moves forward in the same fashion or in a software altered pattern.



The Merger Miner

A single Scan Head on the Miner is predicted to spall about 2.7 tons of material per hour. To guide the Miner along a drift, it is equipped with a small laser displacement sensor, a video camera and illumination system allowing an operator to maneuver the Miner on site or remotely. With inclusion of some additional monitoring equipment, it is not difficult to imagine a completely autonomous mining system.

The Robotic Arm allows the Scan Head to present the smallest aperture necessary for performing the thermal fracturing or spallation task. The aperture window must be protected from flying debris as well as any accumulation of dust to preclude damage from the laser beam itself. Meanwhile the waste may be directed to one location for use as backfill or to a nearby storage area with the vein material to another location for further processing.

While a single Scan Head is designed to produce the smallest aperture allowing a man passage, 32" x 72". Larger openings may be produced by adding additional Scan Heads mounted on the Track-O or other electrically powered vehicle. It would also be quite possible to mount a Scan Head vertically to effectively maneuver the unit in a surface scraping mode rather than a tunneling or burrowing mode.

Merger believes that a single laser may serve two Scan Heads with appropriate alterations to the present support structure, increasing the size of the opening to more than double the width and easily half again the height.

The Merger Mines Corp. Technical Staff

Gary Mladjan, Opto-Mechanical Engineer, Vice President of Engineering and Technology, Director

Mr. Mladjan, has over fifty-five years of opto-mechanical engineering experience with various defense contractors, most recently with Raytheon Corporation. Mr. Mladjan was a team member in the development of a number of electro-optical night vision and laser devices and is the primary holder of 6 U.S. Patents, a number of International Patents for those devices as well as eleven other disclosures. He was the lead engineer in the advanced conceptual design, engineering costing, product design and manufacturing on many projects at Raytheon, Hughes Aircraft, Northrop Electronics Div. and Aerojet ElectroSystems. He was a designated Raytheon corporate expert for Investment Casting and for Single Point Diamond Machining as well as a developer in the use of exotic materials and technologies for defense products. Mr. Mladjan has authored several published papers on New and Innovative Technology and Detail Design in Exotic Materials.

Gabriel Achenbach, Consulting Computer Aided Engineering (CAE) Engineer

Mr. Achenbach has nearly twenty years of experience in concept design and production development with extensive experience in precision manufacturing and design of electro-mechanical equipment and from the testing of production systems to large scale mining equipment. He holds a B.S. degree in Mechanical Engineering Technology from Eastern Washington University.

Jason Bishop, Consulting Computer Aided Engineering (CAE) Engineer

Mr. Bishop has over fifteen years of varied experience as a Computer Numerical Controlled (CNC) machine operator, manufacturing engineer specializing in process development, and as a Systems Engineer. Recently he has been involved as a Project Manager in Rapid Prototyping and embedded systems architecture at the Boeing Company. He holds an A.A.S. in Machine Shop Technology from Spokane Community College and a B.S. in Mechanical Engineering Technology, with a Physics minor from Eastern Washington University.

Don R. Rolfe, Mining Engineer, Vice President, Director

Mr. Rolfe is a mine engineer with over fifty years of mining industry experience. His career has included positions as a Senior Mine Engineer, Chief Mine Engineer, Mine Foreman, Mine Superintendent and Mine Manager with several leading U.S. companies including Anaconda, Hecla, Union Carbide and Homestake. Rolfe has extensive knowledge of the mine planning and development process along with expertise related to the mining of various minerals including gold, silver, uranium, tungsten, phosphate, and Bentonite clay.

Dan Nieuwsma, Consulting Laser Physicist

Mr. Nieuwsma has over thirty-six years of experience leading laser system concept, research, and product design for rugged environments and production implementation. Dan was presented with Raytheon's corporate "Excellence in Technology" award in 2001 for the design of the first Military Qualified diode-pumped laser and a second award in 2007 for leading a Team for the development of an Erbium Fiber Laser. He retired from Raytheon in 2014 as Chief Laser Physicist. Mr. Nieuwsma is currently a Consultant at Satellite Consulting Inc.

Patrick McNenny, Consulting Optical Engineer

Mr. McNenny received his B.S. in Optical Engineering from the Institute of Optics, University of Rochester in 1983. In addition to managing consulting projects and writing proposals, he performs optical system designs and analyses. His strengths include project management, lens design, and system modeling. With over 30 years of experience, he has designed and analyzed optical systems in the aerospace (TRW), commercial imaging (ECRM Imaging Systems), and medical device (Baxter Healthcare, Applied Medical) industries. Since 2009 he has been Vice President for Engineering Services at Photon Engineering.

Ed Fagg, Consulting Integration and Test Engineer

Mr. Fagg has over thirty-five years of experience in the fabrication, assembly and test of electro-optical and electro-mechanical instruments with Raytheon Corporation and its predecessors. He recently retired as the Engineering Section Manager for the “Opto-Mechanical Product Development Section” where he directed technical staff member’s providing engineering support for both Manufacturing and Development Programs.