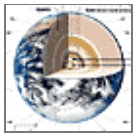
SAN FRANCISCO CHRONICLE WITH CBS 5-TV AND SFGATE.COM
SEASON OF SHARING FUND

San Francisco Chronicle

Scientific maverick's theory on Earth's core up for a test
Controversial view sees vast uranium field that serves as natural reactor

Keay Davidson, Chronicle Science Writer

Monday, November 29, 2004



▪ Printable Version
▪ Email This Article

According to comic-book folklore going back to the World War II era, Superman escaped as a child from a planet with an unstable uranium core that exploded in a super-atomic blast.

Now science is imitating pop art: Researchers are preparing to test the highly controversial theory of a San Diego scientist, J. Marvin Herndon, who thinks a huge, natural nuclear reactor or "georeactor" -- a vast deposit of uranium several miles wide -- exists at Earth's core, thousands of miles beneath our feet.

Herndon's theory is dubious, his harshest critics have charged for years. But Herndon and a small number of defenders take the theory seriously: They believe it might help to explain otherwise puzzling phenomena of planetary science, such as fluctuations in the intensity of Earth's magnetic field.

"Herndon's idea about (a reactor) located at the center of the Earth, if validated, will open a new era in planetary physics," said four Russian scientists at Moscow's Institute for Nuclear Research and Kurchatov Institute in a Jan. 28 paper published online.

It might sound bizarre, the very idea of a "natural" nuclear reactor -- a geological version of commercial nuclear power plants such as Pacific Gas and Electric Co.'s Diablo Canyon plant near San Luis Obispo. But if Herndon is right, then the reactor at Earth's core is just a much bigger and deeper version of an extinct natural nuclear reactor that scientists discovered in a uranium mine in Gabon, Africa, in 1972.

The Gabon reactor consists of geological deposits of uranium that, being radioactive, naturally emit subatomic particles called neutrons. These neutrons split the nuclei in adjacent uranium atoms, causing them to emit more neutrons and, thus, to split even more uranium atoms -- in effect, it's a slow-speed chain reaction. Research in the 1970s revealed that the Gabon reactor operated intermittently for a few million years about 2 billion years ago.

LANCÔME PARIS
RECEIVE A DELUXE SAMPLE COLLECTION
with any $50.00 purchase at lancome.com
CLICK TO SHOP!

WELLS FARGO Reach your financial goals with the right account for you

ChronicleJobs TOP JOBS

SALES
AGGRESSIVE WOMAN/MAN Nationwide corp

ACCOUNTING
Exp. should incl AP, AR, Collections

SALES
TERRITORY MANAGER Recorded Books, th

APARTMENT
Maintenance in Fremont. Live Onsite

REST
MGRS. EHS has Mgmt Opptys in the FOH

HEALTHCARE
LEADERSHIP OPPORTUNITIES
SALEM HOSPITAL

ACTIVISM
CAREER MINDED ACTIVISTS WANTED
Clean

COMMUNITY
Community Relations

Saint Mary's College
Degree Programs for Working Adults
Make this the year to advance your career.
Call 1-800-538-9999
Click here for details.
SAINT MARY'S COLLEGE OF CALIFORNIA
SCHOOL OF EXTENDED EDUCATION

a solid and liquid part composed largely of iron, the liquid circulation of which powers Earth's magnetic field. They have not thought of the core as a repository for uranium, although the possibility of uranium in the core was suggested in passing in 1939 by the scientist Walter Elsasser.

Herndon and his backers believe his theory of a uranium georeactor in Earth's core has certain advantages over existing scientific ideas, by providing more convincing ways to:

-- Explain the ratios of helium isotopes emitted from volcanoes in Iceland and Hawaii. Those ratios are consistent with the ratios of helium isotopes emitted by a nuclear reactor.

-- Explain why planets such as Jupiter emit far more heat than they absorb from the sun. Herndon thinks they, too, have natural nuclear reactors at their cores. (Because heat is continually generated by the decay of radioactive elements in Earth's crust and mantle -- the regions above the core -- scientists are uncertain whether Earth emits more heat than it receives from the sun.)

-- Explain variations in the intensity of Earth's magnetic field, which fluctuates over time. Herndon believes that in the core, the georeactor drives the motions of the liquid iron that creates the magnetic field. But the georeactor varies in activity levels over time. Those activity variations, he believes, might explain intensity variations in Earth's magnetic field.

Now, Rob de Meijer and associates at the Nuclear Physics Institute in Groningen, the Netherlands, are planning to test Herndon's theory. They're drawing blueprints for a large device that could detect ghostly particles called antineutrinos that have escaped from Earth's core. If Herndon's theoretical nuclear reactor really exists, then it should be gushing out antineutrinos that would fly through the roughly 4,000 miles of solid rock and emerge at the Earth's surface.

The European scientists have proposed drilling a shaft more than 1,000 feet deep into the island of Curacao in the Caribbean. They hope to lower into the shaft devices called photomultipliers, which could detect particles from the hypothetical deep-Earth georeactor.

The estimated cost: $80 million. In an e-mail to The Chronicle, de Meijer said he is seeking funding from the Dutch government and industrial consortiums. He and his team plan to visit Curacao in January to take the geological samples needed to design the subterranean antineutrino "antenna," as they call it.

Curacao is a good location for the antineutrino detector because "the island's rocks have relatively few natural radionuclides that could mask the (antineutrino) signal from the Earth's core," the journal Physics World noted in September. The detector could be confused by antineutrinos emitted by commercial nuclear reactors, but Curacao is far enough from the southeastern United States that reactors in Florida won't affect it.

Scientific reactions to Herndon's theory are all over the map.

On the one hand, "virtually every scientist thinks (Herndon's)

Director
Elder Care Alliance

ENGINEER
wastewater management and management

ENGINEER
Project Eng. (Emeryville, CA) Under

EXECUTIVE ASSIST.
CITY OF OAKLAND

ACUPUNCTURIST
Herbalist Patient consult. & exam.,

SALES
REPRESENTATIVES WE ARE SO CONFIDENT

DESIGNER
SENIOR (San Francisco, CA). Develop

BIOPHARMACEUTICAL
SEVERAL POSITIONS AVAILALBE
CHIRON

About Top Jobs
View All Top Jobs

theory is nonsense," says geophysicist Gillian Foulger of the Earth sciences department at the University of Durham in England.

On the other hand, "Dr. Herndon is a brilliant and original thinker. I agree with his claim that his theory has been unjustly ignored," said geoscientist David Deming of the University of Oklahoma.

"The problem with most scientists working today is that they have no knowledge of the history of science," Deming adds. "As late as 1955, continental drift was regarded as the equivalent of alien abductions, Bigfoot and the Loch Ness monster. By 1970, continental drift was an accepted part of the new theory of plate tectonics."

One of Herndon's leading critics is planetary scientist David Stevenson of the California Institute of Technology. He says in an e-mail: "Herndon is a solid and knowledgeable person when it comes to (nuclear) reactors. But the amount of attention this (georeactor) idea has received is out of proportion with its plausibility. ... It's not complete nonsense, but it's highly unlikely. There are many instances in science where this happens. This one has merely received more attention than most.

"The idea is based on two very dubious propositions: (a) That uranium (or any heavy element) would naturally go to the center of the Earth. This is almost certainly untrue. It is a misunderstanding of chemistry and statistical physics at a very fundamental level. (b) That there is something about Earth's heat flow or helium that is so wildly discordant with our usual ideas that it requires an outrageous hypothesis to explain it. This is incorrect."

But Herndon is taken seriously by Richard Muller, a noted physicist and author at Lawrence Berkeley National Laboratory in Berkeley. Since the 1970s, Muller has done pioneering research in diverse fields, including cosmology and planetary sciences.

"Herndon's hypothesis is a very positive contribution to deep Earth science. He raises issues that are worth considering, and he may even be right, " Muller adds. "I consider his work to be 'out of the box' thinking, and as such, it is valuable even if it turns out to be wrong."

On a side note, in case you're wondering: Unlike the planet-busting reactor of Superman lore, neither the Gabon reactor nor Herndon's hypothetical deep-Earth reactors could explode like atomic bombs. A-bombs require highly concentrated amounts of fissionable materials that are explosively compressed together in a fraction of a second -- far faster than the snail's-pace processes that would be characteristic of the natural reactors.

Herndon received his bachelor's degree in physics at UC San Diego in 1970. He studied nuclear chemistry and meteorites in graduate school at Texas A&M, where he received his doctoral degree for a thesis on meteorites.

Iconoclastic scientists often have trouble getting their papers published in scientific literature. Herndon "is no exception," he acknowledges. "I live in a strange world where I go against a strong establishment that pretends I don't exist." NASA has

turned down Herndon's applications for research funding, he says.

No longer able to attract research funds, he quit academic science in 1980. He has supported himself ever since in a variety of ways, ranging from doing scientific consulting work for mining firms to dealing in antiques and investing in real estate.

"I can't make a living and do the science that I think is important to do, " Herndon acknowledges. As a result, "I have had less than a satisfactory career in science. But I have made fundamentally important discoveries that will reshape geophysics."

Even so, operating as an independent scientist, over the years, he has managed to publish papers in prestigious journals, including the Proceedings of the National Academy of Sciences and the Proceedings of the Royal Society of London.

His main allies and sympathizers are non-Americans, like the de Meijer team. On Dec. 16, Herndon is scheduled to deliver the prestigious annual "Christmas Lecture" at the European Commission's Institute for Transuranium Elements in Karlsruhe, Germany.

He draws unhappy conclusions from his bumpy scientific career. Had his two sons -- now physicians -- planned to become scientists, he says, "I would have steered them away from it because you can't make a living and do legitimate science; you have to 'howl with the wolves' or you don't survive. This is a sad testament to our times. There's something very wrong in American science."

Herndon’s theory

According to traditional theory, the core of Earth consists largely of iron. The SanDiego scientist J. Marvin Herndon has added a new wrinkle by arguing that a large deposit of uranium also exists in the core, where it powers a natural nuclear reactor or “georeactor.” Herndon believes the nuclear process is somehow responsible for variations in the intensity of Earth’s magnetic field.

During the radioactive decays, the georeactor releases ghostly particles called antineutrinos, which fly through thousands of miles of solid rock to Earth’s surface. Scientists hope to test Herndon’s georeactor hypothesis by using special instruments to detect the hypothetical antineutrinos as they pass through the outer crust.

Sources: nuclearplanet.com; www.ansto.gov.au/edu/about/about_neutron.htm;

NASA

E-mail the author at kdavidson@sfchronicle.com.

Ads by Google

CCFA
Help us cure Crohn's & Ulcerative Colitis.
Learn about these diseases.
www.ccfa.org

Get 50% off home delivery of the Chronicle for 12 weeks!