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The strategic implications of the lunar fusion revolution

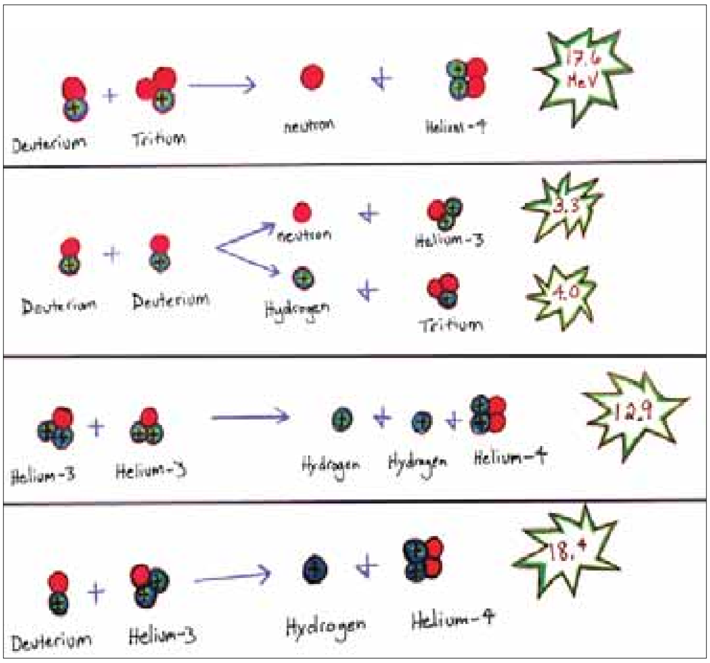
The following is an excerpt from the Jan. 22, 2014, LaRouchePAC Weekly Report featuring a report on the Moon's minerals by Natalie Lovegren of the LPAC Basement Science Team.

Natalie Lovegren: All right, well I think it's important to first situate this philosophically, because, as we've been discussing in recent reports, in recent weeks, the issue is the historical fight between Prometheus and Zeus, and what you just described with the breakdown of NASA, with the attack on the fusion energy program in the United States, that is the result of the Zeus tradition taking over in the United States. What Obama has done to kill the space program and so on, is the oligarchical principle at work. And we have on the other hand, the Promethean nature of mankind, and we can see that in the tradition of John Kennedy.

Lyndon LaRouche was joined for the Weekly Report discussion Jan. 22 by LaRouche Scientific Research Team members Natalie Lovegren and Creighton Jones, who moderated.

So, I just wanted to start with a quote that illustrates the thinking, the two choices that mankind has to make. And this is a quote by the chemist Humphry Davy. He says:

"Man, in what is called a state of nature, is a creature of almost pure sensation. Called into activity only by positive wants, his life is passed either in satisfying the cravings of the common appetites, or in apathy, or in slumber. Living only in moments he calculates but little on futurity. He has no vivid feelings of hope, or thoughts of permanent and powerful action. And unable to discover causes, he is either harassed by superstitious dreams, or quietly and passively submissive to the mercy of nature and the elements. How different is man informed through the beneficence of the Deity, by science and the arts! Knowing his wants, and being able to provide for them, he is capable of anticipating future enjoyments, and of connecting hope with an infinite variety of ideas. He is in some measure independent of chance or accident for his pleasures. Science has given to him an acquaintance with the different relations of the parts of the external world; and more than that, it has bestowed upon him powers which may be almost called creative; which have enabled him to modify and change the beings surrounding him, and by his experiments to interrogate nature with power, not simply as a scholar, passive and seeking only to understand her operations, but rather as a master, active with his own instruments."



Fusion reactions.

So, keeping that in mind, I want to go through the story of helium-3, what has developed, the work that was done in the United States, that the Chinese have now taken up. We've abandoned this tradition; the Chinese are now going in this Promethean tradition, you could say. So, our first stop is the University of Wisconsin: There's a Fusion Technology Institute there, and back in the 1980s, fusion scientists there were trying to figure out what were the most effective fusion reactions.

So, fusion is the process by which you have light elements that are forced together, their nuclei are forced together, so you get products of heavier elements, and then a great energy release. So I'm going to go through some of the reactions briefly: What they were studying were different isotopes of hydrogen: These are deuterium and tritium, and the products that they would give in the fusion reaction. So, in the first reaction you have, deuterium and tritium: They're both hydrogen isotopes; tritium is a radioactive hydrogen isotope and in that type of a reaction, when you force these two hydrogen nuclei together, you get a neutron, you get helium, and you get a big burst of energy. A similar situation in the reaction in which you use two deuterium isotopes, also hydrogen.

You can get a couple of different options here: either you get neutrons and helium-3, or you get hydrogen and tritium. Now, the interesting thing, the key point here that they were looking at, is the distinction between having neutrons in your reaction and having other, positively charged particles. So, if you now look at the helium-3 reactions, you have only positively charged particles. Why is that important? That's important because if a particle has a charge you can control it in a magnetic field. And also electricity is nothing more than a current of charged particles. So instead of having to convert heat into electricity, you are getting electricity directly out of the plasma. Another problem with the neutrons, is, because they are neutral, they have no charge, you can't control them, and they tend to bounce around and destroy the reactor walls; this is a big issue of how to protect the reactor walls from energetic damage from the neutrons.

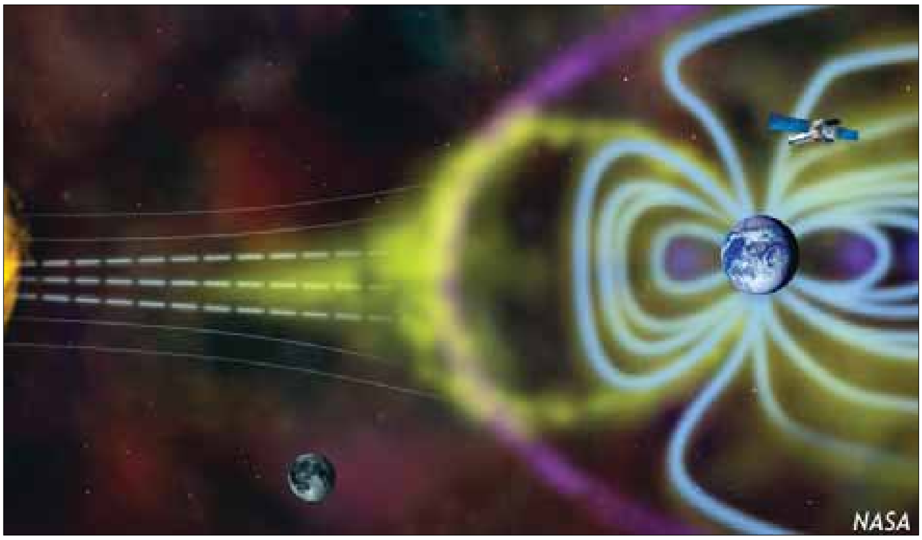


FIGURE 1. Solar wind: Earth surrounded by its magnetic field, with Moon exposed.

So, for these two reasons—you get a higher order of power, because you're able to have direct energy from the charged particles, rather than if you take the energy from neutrons, it's kinetic energy, it's energy of the motion, it's heat energy. So you then have to convert that heat energy into electricity; it's an extra step.

So these scientists figures out, well, wow, if we use helium-3, we're getting rid of one of those neutrons from the helium-4—this is an isotope of helium, meaning it has one less neutron—and so the reactions give you only these charges particles. So, where do we get helium-3?

Creighton Jones: You have a lot more control with the helium products.

Lovegren: Right. You have more control, and you have direct electricity; so this is more efficient.

Now, these scientists asked, "where can we get helium-3?" It's a very rare isotope on the Earth. If you take all of the natural gas out of the Earth, you would only find about 200 kg of helium-3 trapped in the Earth, so this is clearly impractical. The other source is the decay of tritium in thermonuclear weapons. But, still, the United States has about 500 kg worth of helium-3 as a result of that. So that was also not a feasible option; you can use it to get the program going, but for continuous energy, it's not viable.

So these fusion scientists, being fusion scientists, remembered, "Wait, the Sun is a giant thermonuclear reactor. The Sun must be producing helium-3." The reason we don't have helium-3 on Earth is because we're protected by a magnetic field.

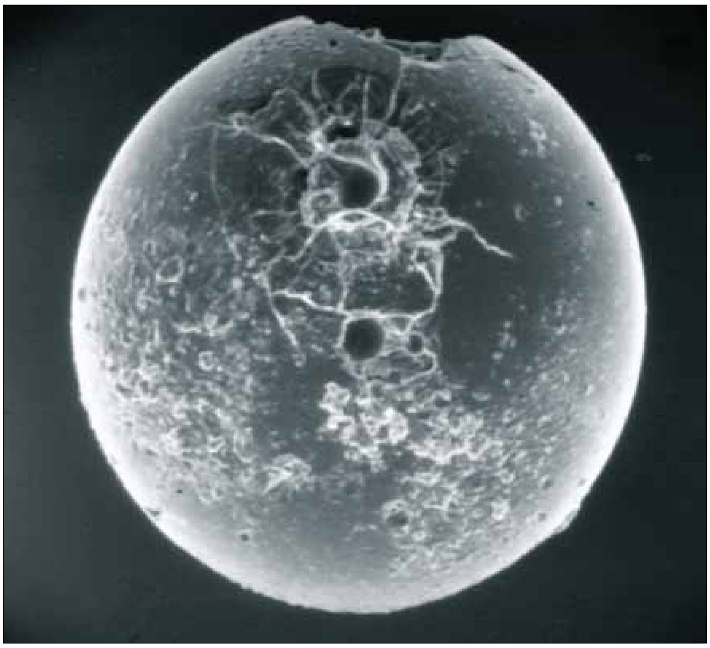
Now, this gets into the issue of the solar wind. The Sun is constantly fusing light elements into heavier elements to create its energy. So all of these flames that you see—it's not flames, it's a plasma, it's a stream of charged particles, in the form of mostly helium and hydrogen. These are coming out into the Solar System and they will reach anything in its way. But if you look at the case of the Earth, the Earth is protected by a very strong magnetic field, so we don't get these products of the solar wind [Figure 1]. The Moon, on the other hand, is completely exposed when it's on this side of the Earth. So the Moon receives the products of the solar wind.

The fusion scientists went down to NASA in 1986; they went down to Houston, and they wanted to look at the lunar samples, and they said, "we want to know if there's any helium-3 in these lunar samples." And the scientists at NASA said, "Yeah! Sure, there's helium-3 all over the place. It's in every rock, what do you want it for? Is it good for something?" And they didn't even know—they said, "we've known that since 1970 that there was helium-3, we didn't know it was good for anything." So you have this issue of specialization, people don't talk to each other, and they let 16 years go by, they finally make this connection.

Okay, now I want to get into some of the details of the Moon; here's another picture [artist's conception, from the Moon, of the solar wind being detoured around the Earth]; you can see the seemingly barren Moon, and the Earth with its magnetic field. I want to get into how the surface of the Moon is able to hold these resources. This is a famous print [of Neil Armstrong's footprint on the Moon, Figure 2], obviously, but the interesting thing about this, is look at the edges on the boot print. You can see that they're very crisp. Why is that? Because this lunar dust is extremely fine, it's much finer than even powdered sugar. It's made of the same things that we have on Earth; it's essentially sand, silicon dioxide, a little bit of aluminum. And the lunar surface has a very similar composition to the Earth, but there's a completely different weathering process. The Moon doesn't have an atmosphere; it doesn't have the magnetic field to protect it from the solar wind, so you have a process that's going on, where the Moon is exposed to these elements in a different way.

And the effect is—this is another issue of the weather: These are micrometeorites. Now, these type of meteorites, while they're extremely small, they're extremely powerful,


FIGURE 2. Apollo 11: One small step.



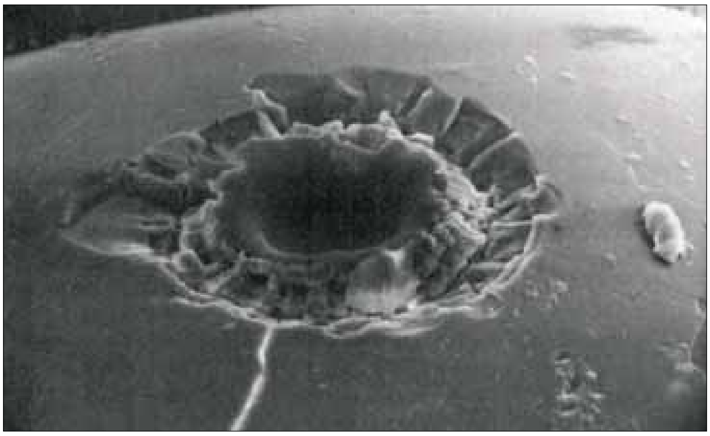


FIGURE 3. **(Left) Lunar glass sphere with impact craters from micrometeorites.** While sand on Earth is mostly composed of silica in the form of quartz crystals, which are slowly weathered into small particles by our oceans, the Moon is weathered by violent impacts of micrometeorites, whose high energies and temperatures melt the Moon's silicate "sand" into glass.
FIGURE 5. **(Right) Zap pit.**
A SEM (scanning electron microscope) photo of a high-velocity impact pit on an Apollo 11 glass sphere. The central pit is 30 microns in diameter.

very high energy: They're travelling 50-60,000 miles per hour. This one, if you take a mechanical pencil tip, the finer ones, you have between .5 and .7mm: This is a glass sphere from the Moon of about that size, the size of a mechanical pencil tip. [Figure 3] Those holes in it, those are craters from the impacts of micrometeorites. Now, the size of the projectile, the micrometeorite is even smaller than that! So you have these very, very tiny meteorites hitting the surface of the Moon all the time, at speeds of over 50,000 mph, and what are they doing? They're just pulverizing the surface of the Moon. So you have a process whereby this glass is being formed, it's being smashed, it's being melted, it's being vaporized, and then it re-agglutinates with the other minerals on the Moon.

And here's a diagram of that process [Figure 4]. So you have the solar wind, the micrometeorites, these are all just churning up the surface of the Moon, and making a very unique substance. Here's another picture of an impact crater from a micrometeorite. [Figure 5] So the lunar dust particles come out to this jagged, abrasive, extremely small particle: This is so irregularly shaped that if you had a sphere the same size diameter, the lunar dust particle would have eight times the surface area. So they're extremely irregular.

Now, this was a huge problem for the astronauts that went to the Moon, because this stuff just stuck. You kicked it up, there's one-sixth gravity on the Moon, there's an electrostatic charge all over the Moon, because of this charged solar wind, and so then the dust is a huge nuisance; not only that, it's scratching up all of their equipment. Maybe some people have seen the video where Harrison Schmitt is falling down all over the place. He had a camera on the front of his suit, and he would fall into this highly abrasive dust, scratch up all his lenses, and the guys on the ground were like "Brush off your lens! Brush off your lens!" It didn't work.

But there's a secret to this lunar dust. It seems like a really huge hassle, but if you know the secret to it, it is actually one of the most valuable raw materials that we have ever found out about. The secret is that the dust is magnetic: You can see a picture here, this is a sample from Larry Taylor at the University of Tennessee; he is the lunar geologist who—he was on the ground in Houston in 1972, when Harrison Schmitt, the only scientist who went to the Moon, was on the Moon. So they were in collaboration as geologists. And over the past 30 years, they, in collaboration with the fusion scientists at the University of Wisconsin, have made some enormous breakthroughs, on the nature of this soil, what this means for helium-3, what this means for mining the Moon.

Now he made a very important discovery: you see here, somebody holding a hand magnet, and you can see the dust stick to that magnet. Why didn't they think of this before? It's magnetic, why is it magnetic? First they thought, well, maybe it's because the meteorites have iron and they're getting iron... but wouldn't it be iron oxide and...

What happens is, there is very tiny particles, much smaller even than the micrometeorites, these are on the nano-scale, so, a thousand times smaller. These particles of elemental iron are suspended in the lunar glass. So all of those little white specs, that's nano-phase elemental metallic iron, which is magnetic.

Lyndon LaRouche: Oh God, this is well-known. This is nano-engineering.

Lovegren: Right. So when they figured this out....

LaRouche: The Italian scientists were doing this in China, with the reinforcement of steel production. They would just process it with this stuff, and strengthen the whole steel structure.

Lovegren: So it's very strong! And there's a lot of implications to this. Now, the obvious one, the magnetic properties, well, that just deals with the nuisance of the dust.

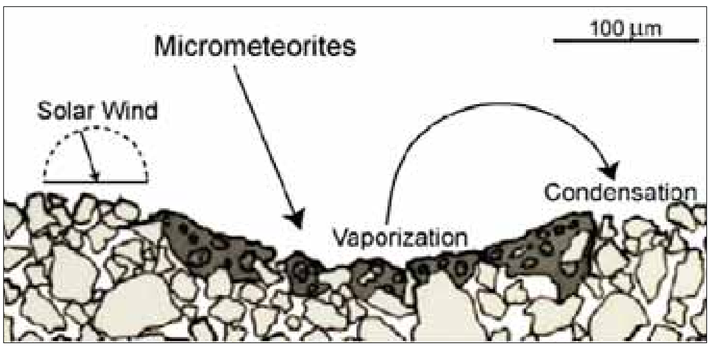


FIGURE 4. Weathering of lunar soil.

FIGURE 7 . Lunar base concept drawing.

LaRouche: That's how the strengthening process, the nanomization of metal.

Lovegren: Right! So, what does it do? They experiment with it—and this is how it becomes magnetic: The solar wind is creating this magnetic iron. You have the solar wind sending in hydrogen; the hydrogen reacts with the oxygen in the iron oxide, and it weathers these particles more, and it creates the elemental iron.

LaRouche: In other words, they're working for us—we just don't know it. [laughter]

Lovegren: Right! So, now, think about this whole process in terms of this new discovery. They found out that iron is able to be vaporized on the Moon. We didn't know iron could do that, that's amazing.

So what are the implications of this for mining? The other important discovery that Larry Taylor and his colleagues made at the University of Tennessee, they're scientists, real scientists, so they like to play; and they're also in the United States, where we like to play with microwaves. So they thought, I wonder what would happen if we put some lunar soil in the microwave? So they did, they just put it in the kitchen microwave—and what happens? It melts in a little over a minute! Which is amazing, because iron melts at 1500 degrees. And the other thing is, everybody knows you're not supposed to put metal in the microwave, so... what's going on here?

This is an issue of the difference between a bulk metal, which is if you take a solid piece of metal, it's opaque to microwaves; the microwaves just reflect off of it. But, if you take a powdered metal, the microwaves are absorbed, because of the difference in size, and you have an effect where you have a very small particles of metal acting as conductors that are layered with a dielectric, which is an insulator. So in the case of a powdered metal, it's the metal particles with the air in between and in the case of the lunar dust, you have these very small pieces of iron with layered with glass which is your insulator. So you get this effect with the microwave energy, where you take a very small amount of energy—this is a normal kitchen microwave, and the energy is amplified by this coupling effect with that particular nature of this material.

One last thing: The implications for this, is that you can make concrete out of this. You're in two resources: All of your lunar soil, then, instead of a hassle, it becomes your biggest asset. You heat it up a little bit with low-energy microwaves, and you release the helium-3! So you get it up to 700 degrees Celsius, you can put some type of dome to capture... you capture the helium, heat it up a little bit more, you capture the nitrogen, oxygen, other volatiles that are going to be useful for making water, making air, and for other purposes.

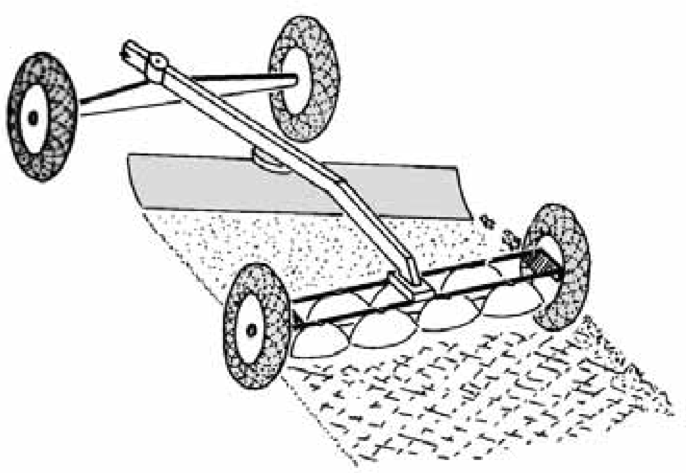


FIGURE 6. Microwave lunar paver.

LaRouche: And this is a characteristic protection, the magnetic field protection, of Earth from this crap.

Lovegren: Mm-hmm!

LaRouche: Now we have to figure out how to handle the processing of that product into the United States, into Earth, for our use, for the helium-3 application to the question of achieving a fusion system on Earth, on the basis of a dialogue, in effect, in practice, from the Moon, which is the basis of the operation, and you connect the Moon resource to this resource inside the magnetic field of Earth! And that will give us fusion. And you control the transfer by consuming the product in fusion! And that's the way this thing that China is working on can immediately work.

That's a revolution—by combining these factors together, we have the immediate solution both of the strategic situation in the planet, and also the strategic situation of the ability to utilize and develop that capability! Both are available if people have enough brains to do it. This is miraculous; this is beautiful. Absolutely beautiful! A very beautiful argument, I must say.

Lovegren: Well, I want to show one more design; Larry Taylor, this lunar geologist make all sorts of inventions based on this principle. This is a "microwave lunar paver." [Figure 6] You have microwaves attached to this lawnmower looking thing, and you roll it over the surface of the Moon, and it paves the Moon, so you can create landing pads, you can create a place for observatories, because dust is a big concern for astronomers. You could smooth out a crater, put it inside a crater and make a satellite dish. You can make all sorts of things: You can make radiation shields: The lunar soil is the perfect radiation shield, so in this picture [Figure 7] they have the dust concrete as part of the shield. And you have to know the interaction of the dust with the...

LaRouche: It all goes together, it all fits together.

Lovegren: Yeah! It's perfect.

LaRouche: So, now this means, we're no longer Earthlings if we do this.