Farouk El-Baz, Ph.D.

Geologist Proposes '1,000 Wells' for Darfur; Use Science To Serve Mankind

"A new humanitarian initiative to bring life-sustaining water resources to Darfur has been launched by the Government of Sudan," according to a July 11 Boston University (BU) press release, which reported on a meeting in June, "between Omar Al Bashir, President of Sudan, and geologist Farouk El-Baz, Director of the Boston University Center for Remote Sensing. Called '1,000 Wells for Darfur,' the plan aims to create new groundwater resources to help establish peace and economic security in the region.

www.bu.edu/remote sensing

Dr. Farouk El-Baz is the director of the Center for Remote Sensing at Boston University, and adjunct professor of geology at Ain Shams University in Cairo. He is currently working with the government of Sudan on developing the "1,000 Wells for Darfur" program.

"In addition to Sudan, the project has gained immediate support from the Government of Egypt as Dr. Mahmoud Abu Zeid, Minister of Water Resources and Irrigation, has pledged to drill the initial 20 wells. The UN Mission in Sudan also plans to drill several wells for use by its peacekeeping forces."

*Dr. El-Baz led a mapping project, in which the outline of an ancient lake that he and Eman Ghoneim, a BU research professor, identified based on radar data from space (**Figure 1**). The ancient mega-lake, about the size of Lake Erie, would have contained some 2,530 cubic kilometers of water, when full during past phases of humid climate. Seepage from the sandstone substrate of the lake, would have accumulated as groundwater. Today, windblown sand covers the features of the former lake, whose shorelines would have been 573 meters above sea level.*

Dr. El-Baz has long experience as a space geologist, and champion of exploring Earth's resources for economic development, especially water. From 1967 to 1972, he served in NASA's Apollo program. In July 1975, he was NASA's Principal Investigator of the Earth Observations and Photography Experiment on the Apollo-Soyuz Test Project, the first joint American-Soviet space mission. In 1986, he became the Director of the newly established Center for Remote Sensing at BU, to promote the use of space technology in the fields of geology, geography, and archeology. Today, he is also Adjunct Professor of Geology at the Faculty of Science, Ain Shams University, Cairo, Egypt.

His desert research spans 25 years. He is President of the Arab Society for Desert Research, and serves on the boards of many science societies. He has authored over 200 science articles, and 12 books, including such titles as, The Moon as Viewed by Lunar Orbiter, Apollo Over the Moon, Egypt as Seen by Landsat, Deserts and Arid Lands, *and others.*

Dr. El-Baz was interviewed Aug. 27 by Marcia Merry Baker.

EIR: Your "1,000 Wells" initiative for Darfur, announced in July, is very welcome. I'm speaking to you Aug. 27, and the *Washington Post* once again is covering how there's an attempt to muster more United Nations and African Union peacekeeping troops, but you're trying to mobilize water for peace in Sudan. Would you give us the particulars of what you're proposing?

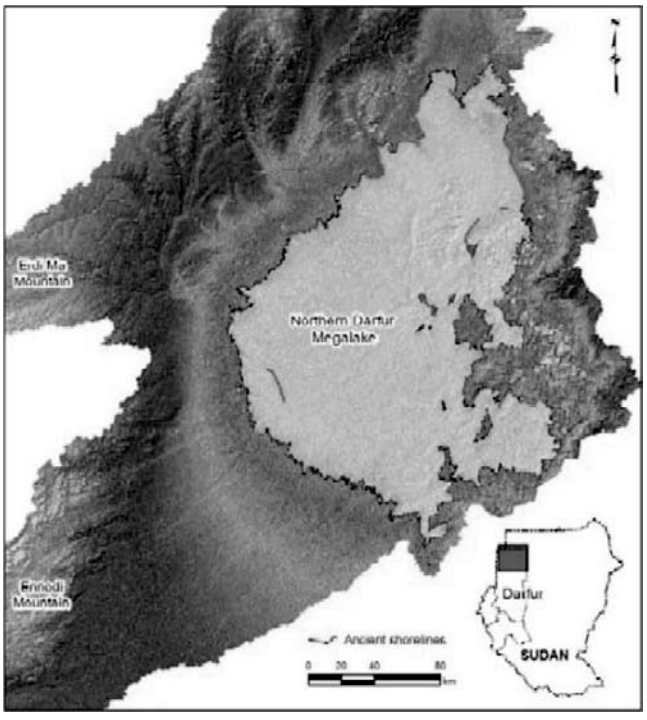
El-Baz: We're actually proposing a well-drilling program to include at least 1,000 wells; we hope it will be many thousands of wells. In northwest Sudan as a whole, and in Darfur province, particularly.

Starting in Darfur, there is definitely a need for water. Refugees are left wanting for water today. Women and children walk maybe four to five miles every day to get a little bit of water. And the water they get is from hand-dug wells, where the water has been very close to the surface, and it may be somewhat polluted. Therefore, if we can find, scientifically and technologically, new sources for water, to satisfy the urgent needs of these people, then the science and technology can be reasonably in the service of mankind.

In addition, if you find water in greater amounts, then these people will have a better hope for the future, whereby more of that water can be utilized in agricultural production, to feed themselves, because their food and fiber requirements are increasing, because of their increased population anyway. And therefore, this would basically give them a hope for a better future.

EIR: On the physical geography side, are you talking about

FIGURE 1
Ancient Mega-Lake in Northern Darfur



Boston University Center for Remote Sensing

Using radar data from space, Dr. El-Baz and Eman Ghoneim, a fellow research professor, identified an ancient mega-lake (shown here), about the size of Lake Erie, under the desert in Darfur, Sudan. Their "1,000 Wells" program will provide desperately needed freshwater to Sudan's population.

the availability of water connected to these basins that popularly are called Nubian Aquifer systems? Your initiative refers to water associated with a former lake. What is the geology here?

El-Baz: The Nubian Aquifer is a catch-all phrase for the groundwater in deep aquifers, which is fossil water, meaning that it developed a long time ago in the geological past, and supposedly covers all the land under all of Sudan, most of Egypt, most of Libya, and parts of Chad. So, it is really a catch-all phrase for the groundwater that physically is present in the Eastern Sahara of North Africa. And it is fossil water—meaning that it's not being rejuvenated—and it is deeper water. Much of the Nubian Aquifer is several hundred to 1,000 meters below the surface. And that water is rather expensive to pump up, and you need to work with it very sparingly, because you know it is going to run out, since it is not being rejuvenated.

Superimposed upon this whole supposed continuous layer—which is not really continuous, and is not a layer, but in the perceptions of people it is a continuous layer—there are topographic depressions that include more sedimentary rocks, which are porous, like sandstone, and in some cases, limestone, where these depressions hold a great deal of water, which are partly replenished by the occasional rainfall of today. But it is still groundwater, because it is deeper than where the surface water is, or the near-surface water is, and these waters are between tens to hundreds of meters in depth, and *this* is the one that we're speaking of in the lake in northern Darfur.

And why do we say so? Because there was another lake in the same physical setting—the same features whereby many rivers and streams lead to a depression, and that depression is in Egypt, which is very close to the Darfur case, just northeast of Darfur—that basin includes a great deal of water, that is not deep like the Nubian Aquifer, and is not close to the surface like the near-surface water from the hand-dug wells, but somewhere in between. Meaning the water shows at about 100 meters or so, and comes up by its own artesian pressure to maybe 30 meters below the surface. So it needs pumping, still. And that water is, once in a while, replenished at least a little bit, from the occasional rainstorm, which some parts of North Africa still get. And that is the water that we speak of in basins, which are present today, in the location of former lakes. That's why we say this one was a lake in northern Darfur.

EIR: So, to the layman, you're talking about trapped water underneath, that perhaps seeped down from a former actual lake, as we would know it on the surface.

El-Baz: That's correct. What happens is that this region hosted much kinder water climates in the past.

EIR: And can you put a time frame on that, or is it still under your analysis?

El-Baz: No, we can put a time frame, not from the water itself, because we don't have a drop from it, but we can put a time frame from the history of the eastern part of the Sahara of North Africa, because we know the eastern Sahara of North Africa, and most likely, most of the rest of it has been going through wet and dry climate cycle periods, alternating with each other. We know, for instance, that the dry period that we live through today, began 5,000 years ago. But before, between 5- and 10- or 11,000 years ago, the area hosted much kinder climates. It was kind of a savannah-like environment, with many rivers, with lakes, with plants, animals, and man.

EIR: So it had visible run-off and lakes?

El-Baz: With lots of visible lakes, real water, and animals swimming through it: there were hippopotamuses, there were crocodiles, and fish, and you name it.

EIR: And so that's geologically very young then, you're saying.

El-Baz: Very young. This is during the most recent epoch on Earth, which we called the Holocene, less than 1 million years. And then it went through a dry period. Then it went through another wet period, between 25,000 and 35,000 [years ago], and that was very wet. And that is the period from which most

of the water in the Nubian Aquifer, that we just spoke of, is from, because this is the date of it.

Then, there is a dry period. Then, before that, another wet period—40- to 60,000 [years ago]—not as wet as the last one. Before that, dry. Before that, wet; between 90- and 120,000 [years ago], and so on, all the way to what we know for sure, down to 320,000 [years ago].

However, some of the very deep water that comes from the Nubian aquifers gives an age of up to a million years, meaning that during the last million years, we have all kinds of wet and dry periods, and water may have mixed, young water with old water, whatever, but most of the water is from these previously humid rainy periods in the past.

EIR: Good. We want to pursue that more, but one final question on your proposal: What is the next phase? It's a question of funding, I presume. But are you looking for where to dig some test wells? Is that what's going to happen?

El-Baz: So, when we realize that there is potential for groundwater in a water-starved region like Darfur, we first of all—this was published as a paper in an international journal—told all of our colleagues, the geologists and hydrogeologists and so on, about the discovery. And then we started talking about it publicly, because of the potential of resolving a problem of water shortage.

www.pipesite.com

Huge, 4-meter-diameter pipes, like this one in Libya's "Great Man-Made River" project, provide a model for what can be done in Sudan, where the pipes can be much smaller (1 meter), and travel shorter distances.

And, in addition to that, I took this finding to the people of Sudan, including the President of Sudan [Omar al-Bashir], whom I have met before, and who knows me; and I told him and his people from his government about the discovery, and that it would require some testing to prove that water exists, and how deep it is, and how salty it is, and all of that—which comes only by well-drilling.

And realize that that might also be of interest to the United Nations, because the United Nations is going to send troops, and have a force of 26,000 joint UN and African Union troops that will be spread throughout Darfur, and these people will require water. And the UN had no options of how to provide them with water, except to fly in bottled water, by air, and there are not enough aircraft, and not enough airports to allow this to happen. So there is no way for them to satisfy that force from outside, with bottled water.

Therefore, the UN needs to drill wells for water for these troops. And most of these troops will require more water than average people anyway, because some of these soldiers would want to take a shower in the morning, and a shower at night, and so on, and the locals don't do that. So they will need more water per person than the average Darfurian.

So, we have realized that this is the situation, and we realized also from my discussions with the people in Sudan, including the governor of Darfur, that there are a great many people away from that lake—about 200 kilometers away—the vast majority of people of Darfur. Therefore, if we find water in that lake region, then it, the water, would have to be transported, or pumped, through a pipeline or something, so in the meantime, while we are trying to figure out what to do about that, we need to think about new water resources where people exist today.

So, we began to look into the locations closer to the accumulation of the people, knowing that we're going to drill in that lake region. But since we know how to interpret the terrain from satellite images to suggest areas where water would most likely exist, we're going to do that for them in the locations nearer to the people.

EIR: Right. And you had experience with this in West Egypt; the scale might be different, but is that the case?

El-Baz: Actually, the scale is not different at all. The area in Egypt is almost identical in size and shape, [as is] the geology and so on, and that's in the western desert. And in the locations where the people are, away from that lake, or south of that lake, we have the experience of a very similar kind of desert environment from our studies of groundwater potential in the country of Oman, and in the northern United Arab Emirates. So we have studied things like this before, and we've located sites for potential for groundwater, and the groundwater was found. So we know how to do it.

EIR: Right, and this is very exciting. What about in Libya,

NASA

Dr. El-Baz worked with NASA's Apollo program from 1967-1972; in 1975, he served as NASA's principal investigator of the Earth Observations and Photography Experiment on the Apollo-Soyuz Test Project, the first joint American-Soviet space mission. Here, in 1972, El-Baz (right) reviews a lunar map with NASA's Ron Evans (center) and astronaut Bob Overmyer.

where water is being lifted up and transported—what they have called the Great Manmade River? Is this pumping at a great depth? What are the particulars of that system?

El-Baz: Actually, that's a very good question, because the Libyan case is very much like the Egyptian case, and the Sudanese case. In Libya, there are five basins, very much like the two basins that we found—one in Egypt, and one in Northern Darfur. So Libya is pumping water from five basins. Also the depth is over 100 meters, for all these wells, and they pump water from these basins, and move it, in a pipeline that is 2,000 kilometers long, and it's four meters in diameter. It provides water for human use, and for use in industry and agriculture, along the coast. So Libya's case says that this is quite possible, first to find water within these basins; number two, is to transport it through pipelines; and in the case of Sudan, we need only one pipe, that is of a meter diameter, and it moves only [a distance of] 100 kilometers, or 200 kilometers. In Libya, the diameter of the pipeline is 4 meters, four times larger; and it is 2,000 kilometers [long], so it is a much, much larger scale.

EIR: Right. Well, one thing is certain: that if we look at the use of resources as a bridge to the future, as a continuous thing over civilization's history, as of 40 or 50 years ago in certain parts of the world, we imagined large-scale nuclear-powered desalination, on certain coastlines, and then we imagined large-scale conveyance of pre-existing water. We imagined there would continue to be geographic engineering, the way they worked on the Colorado River basin during the Franklin Delano Roosevelt period. At the time of the Nasser years, when the Aswan High Dam was built on the Nile, in North America, there were discussions in Congress for a large-scale surface water conveyance called the North American Water and Power Alliance. It would take Alaskan, or MacKenzie River flow that is not being used up in the North, and take a partial amount of it, and bring it southward.

But this was all shelved for political, strategic reasons, for 50 years, and in fact, in the United States here, one Senator is famous for outlawing interbasin transfer of water, by name. He was Scoop Jackson from Washington State.

However, I think many things are now back on the agenda. You're putting the use of fossil water, where strategically necessary, on the agenda, and no buts about it. But what do you think if we could go for strategically located nuclear desalination, and otherwise, conveyance of water? How would you see that in Africa, or any other part of the world?

El-Baz: I think it will be very prominent in Africa and elsewhere. There is no question about the fact that in all of North Africa and the Middle East, these are nations that will gain increasing importance as we go along. Right now in the Gulf region of the Arabian Peninsula, 52% of the world capacity for desalination exists. And that is increasing. Therefore, there will be many more plants, and much more water to desalinate in that region, because there is not enough freshwater resources to tend to the increased population, and the attendant need for fiber.

It will increase, because of the lack of surface water, and the lack of rivers, and so on. So that will increase, and therefore, we should be thinking about potential desalination. I am not pushing one source of desalination over another, whether it's nuclear, whether it is new wind energy, what sort of energy, whatever it is.

EIR: You see that here in the United States. We have desalinaton in Tampa, Florida and elsewhere.

El-Baz: We need to think about desalination as one very large, and very significant resource for water in the future, everywhere.

EIR: And the second thing is, small or large-scale convey-

ance of water. You were speaking of pipes and so forth. What do you think, over the decades—because you're a kind of terraformer, you've studied the moon and elsewhere—what about specific, priority proposals? For example, there was always the idea of diverting a portion of the tributary flow of the Zaire River, or the Congo Basin River, northward through the Chari River Basin, into Chad. If we didn't have political and funding constraints, do you think this ranks as one of the kinds of things you might use to bring water into the region?

El-Baz: We should not ever take anything off the table. All options should be available. And as long as we consider the environmental impact of any given potential, it's fine.

As far as this case in Darfur is concerned, first, if we can find enough water for the needy population in the southern part, south of the lake, then it is great, because we can save that water in the lake for large-scale agriculture by mechanized means, and that will develop the land. People from Darfur would have these jobs, and would be trained to learn the mechanized instruments, and there will be real development. We can build towns, we can build schools, we can build training centers, we can build a science and technology university, and we can develop the region drastically, beyond their local resources.

So, I agree that all options should be open. The water could be piped to where it is needed, for a smaller pipeline, or the water can be used locally, to generate a fast development program.

EIR: Yes, I see that. Because otherwise, speaking of Sudan, if the water of the Sudd, or the southern region, where there was the original idea of—

El-Baz: The Jonglei Canal.

EIR: Exactly. But in concept for use for development, this could be on the table as well.

El-Baz: So the discussion of the Jonglei Canal, and its usage, and its potential and this and that, should back on the table, because, as I said, keep all options open, and we'll do what needs to be done to help human beings wherever they may be, and help them develop, knowing that we have to be concerned about the environment, and the environmental impact of things.

EIR: One more thing on the nature of this resource. Is it the case that this whole, roughly speaking, Nubian Lake system, with all its differentiation, but on a world scale—that you'd say it's pretty large, from your remote-sensing analysis? Like, in North America, there's the famous Ogalalla basin. Or in Australia, there's the Great Australian Artesian Basin. But your northern Africa basin does maybe have a lot of water in it, even if it's very deep?

El-Baz: It is. It is much larger because the North African desert is much larger than any other arid territory. See, all of the deserts of the world have gone through the same geologic history, or every desert in the world, wherever you have a low demographic basin that has a great deal of sand dunes—like the Simpson Desert in Australia, like the Taklamakan of China, like the Rajasthan of India, like the Arabian Peninsula, the Empty Quarter, or all of North Africa, or the American Southwest, or some of the deserts in South America—every single one has gone through the same geologic history. They were wet in the past. Water was present in huge amounts. Water seeped through the rock. Water still exists beneath the rock, as groundwater, in all cases.

In the North Africa desert, there is this discussion of the Nubian, the great aquifer, because North Africa is a much larger desert than any of these basins.

EIR: And so, in some of these other places that have certain kinds of aquifer systems, in this thin Earth's crust, that may have been in heavy use over decades and decades, we are now seeing a lowering of water tables, and subsidence of the surface? We are at the stage when something else has to be done, technologically in mankind's history, you would say. For example, this is the case in the Southwestern United States. Is that what you would look towards?

El-Baz: That's true. And it is in the American Southwest, that there are some places that have not really been explored for water either.

EIR: So you get the whole range.

El-Baz: Sure.