The development and implementation of these techniques takes time and money. Presumably, more money would mean less time.

Low cost nuclear power is a long-range solution to sulfur oxides pollution. But, says Lee, the rate of increase in nuclear power plants is such that they will not halt the increase in sulfur oxides emissions until late in this century. ◇

CRACKED EGGS

The case of the tip-toeing hens

Far too many hens, these days, are drawing themselves up to their full height and standing on tiptoe when in the act of laying an egg. An egg thus fecklessly laid has a fall of about seven inches to the floor of the nesting box. So hundreds of millions of eggs every year are cracked on touch-down, have to be downgraded, and cost Britain's egg and poultry industry something over $5 million.

This is one of the conclusions emerging from the observations at the Agricultural Research Council's Poultry Research Center, at Edinburgh, Scotland, where 1,000 hens in individual cages have been having their production lines plotted over the past few months.

The center's director, Dr. Thomas Harper, explains that it had been discovered that certain individual hens lay a high proportion of cracked eggs; one had a personal tally of 56 percent damaged eggs.

"We have an interesting character of a hen here," he continues, "which will lay only when standing at full stretch, with its head over the barrier into its neighbor's cage. Other curious behavioral patterns have emerged—birds, for example, that will lay only when facing in a certain direction, or put their eggs down in exactly the same spot each time."

The causes are being studied. What of the cure? "Well, by keeping detailed records of egg production for one month, the poultry farmer could detect the sinners and wring their necks. However, I've already been criticized for suggesting this.

"Another possibility is that hens could be disciplined and put into smaller boxes which would not allow them to stand up fully. But then the animal welfare people would be right on top of us."

And so for the moment the team's thinking is following this line: make the hens lay eggs with stronger shells, so that they can tip-toe around to their heart's content. Meanwhile, the mass of research data is to be fed into the inevitable computer.

RARITY AND TRAGEDY

To the limits of the knowable

It is rare, in scientific investigation of the past, for anyone to discover a limit. There is always the chance that something older, deeper, bigger, smaller or more basic will be turned up in the next spadeful of dirt. Recently, however, rock samples chipped from the mountains of Rhodesia have revealed traces of what may be not only the oldest life forms ever found, but the oldest that ever will be found.

The samples were collected from an exposed edge of a layer of rock called the Onverwacht, which dates back more than 3.2 billion years and is believed to contain the oldest exposed, well-preserved sedimentary rock beds on earth. They were gathered to provide raw material for a training project to aid researchers at the University of Arizona's department of geochronology, who plan to apply similar life-hunting methods to pieces of lunar rock brought back from the moon by Apollo astronauts.

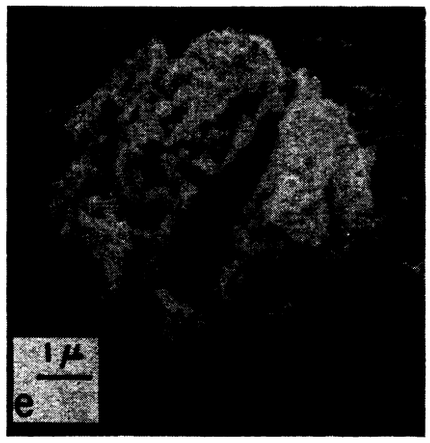
The investigators hoped to find fossilized remnants of primitive one-celled algae. Because some of the objects were expected to be as small as one ten-thousandth of an inch, the processing of the samples was done in clean rooms designed to keep out even the tiniest forms of contamination.

After being cleaned with high-frequency sound waves, some of the samples were sliced into layers so thin they were transparent, then fastened to glass microscope slides, while others were powdered and cooked in hot acil to remove the surrounding material.

Examination revealed thousands of tiny objects, some of them spherical, some filament-like, some cup-shaped.

Physically, they appear indeed to be microfossils, the oldest surviving remains of earth's earliest creatures. Preliminary chemical analysis has added evidence by revealing compounds that are commonly found in the presence of life. But the conclusion is far from foregone.

"There is no assurance at all that life had evolved by the Onverwacht time," says Dr. Bartholomew Nagy of the University of Arizona. The filaments, for example, could have resulted from deposits of sediment along planes and fissures in the rock, while the other shapes could have had similarly nonbiological origins. Also, the fact that chemical compounds in the samples have been associated with life does not necessarily mean that life was required to produce them.



Science

The oldest creature ever to be found.

If the traces are the remnants of life, however, they may mean that man will never be able to reach back to the very first signs of life on the planet. Finding life signs in the ancient Onverwacht would mean that the origins of life presumably occurred in still older rocks, which, the researchers believe, have been destroyed by millions of years of heat, pressure and upheaval from the evolving earth.

That the tiny objects were once life forms has in no way been established. If they were, however, and if the limit of man's discovery has indeed been reached, it is at once a rarity and a tragedy.

AFTER FALSE ALARM

Galactic magnetisim proved

When Dr. Karl G. Jansky discovered radio waves from the Milky Way in the early 1930's, the suggestion was that their polarization was due to electrons in the intervening magnetic field. The observed polarization of light waves due to the alignment of dust particles by interstellar magnetic fields is another method by which the existence of a galactic magnetic field has been inferred. But the field itself had never been measured directly, although upper limits had been set for it.

In the early 1950's, Dr. J. P. Wild, an Australian radio astronomer, and I. S. Shklovsky of the Sternberg Institute for Astrophysics in Moscow independently suggested that the splitting of radio waves from regions of the Milky Way containing huge clouds of cold, rarefied hydrogen would provide a way of pinning down the existence

and showing the strength of galactic magnetic fields.

This suggestion was based on an observation by Dr. Peter Zeeman, the Dutch physicist who showed in 1896 that the spectral line of an optical wavelength is split into several components by a magnetic field. The degree of splitting of a particular wavelength, either for light or radio waves, indicates the strength of the field.

The radio waves emitted by the interstellar hydrogen clouds in the Milky Way offered astronomers a chance to make the Zeeman-effect measurement directly, once adequate equipment was available. Dr. Wild and Dr. John G. Bolton, also of Australia, first tried this in the late 1950's; since then, many groups have made unsuccessful attempts.

There was a false alarm in 1962, when Dr. Gerritt L. Verschuur, then at Jodrell Bank in Britain, reported he and his co-workers had detected the galactic magnetic field.

Now Dr. Verschuur has, in fact, detected the Milky Way's magnetic field for the first time, using the 140-foot radio telescope at the National Radio Astronomy Observatory in Green Bank, W. Va.

Although the galactic magnetic field is exceedingly weak by terrestrial standards, it is strong enough to have a powerful influence on the formation of stars and planetary systems, as well as the stiffness of the Milky Way's spiral arms.

Earth's magnetic field is about half a gauss. In the two regions measured by Dr. Verschuur, in the directions of the strong radio sources Taurus A and Cassiopeia A, the field strengths were respectively three millionths and 20 millionths of a gauss. Dr. Verschuur attributes his success now to the sophistication of the 140-foot radio telescope at Green Bank and to a new, highly flexible 400-channel radio receiver. The latter was developed by NRAO engineers A. M. Shalloway and Robert Mauzy, based on a concept by Dr. Sander Weinreb.

Dr. Verschuur says measurements made since his report was submitted to the Sept. 9 PHYSICAL REVIEW LETTERS indicate that the hydrogen clouds may be rotating, which could be due to a collapsing gas field—possibly a star in formation. He is still analyzing his most recent results and will not take another look at galactic magnetic fields until December.

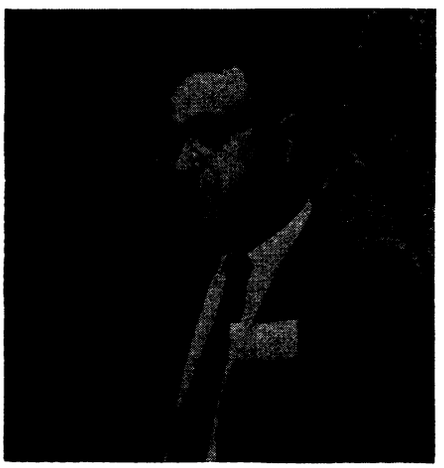
Meanwhile, theoreticians will have a chance to check their calculations concerning the strength of the Milky Way's magnetic field and its implications for stellar birth and evolution, as well as its impact on the theories of the structure and life history of other spiral galaxies. ◇

POLITICAL SCIENTISTS

View to the east: confederation

Nationalism in Eastern Europe, heavily trampled by Russian army boots, may have to take on a non-national cloak in order to survive.

Sentiments revived over the last decade in Eastern European countries hark back to the independent and traditional (and often competitive) histories of each nation. But the realities of power have created an atmosphere which leads many politicians to believe that nationalism may be possible only through some kind of latter-day pan-Slavic union which could offset Soviet power.



Paul Conklin

Gyorgy: all bets off.

The immediate effect of the invasion of Czechoslovakia seems to have been to stimulate supra-national feelings. "There is talk of reviving some form of the Austro-Hungarian Empire," says Dr. George Klein, a Czech-born political scientist now at Western Michigan University.

"This is a resurgence, not of traditional nationalism, but a consciousness that little states cannot go it alone," says Dr. Klein. As one indication, he notes that the Czechoslovaks and the Poles show evidence of reducing their historic rivalry.

Czechs fraternized immediately with Polish troops sent in with the invasion force, Dr. Klein point out. Hungarians were met with somewhat more reserve, but "the presence of East German troops shocked the people," who remember the years of Nazi occupation.

Dr. Klein describes a possible alliance of Yugoslavs, Czechs and Poles that would be a counterpoise against both Germany and Russia.

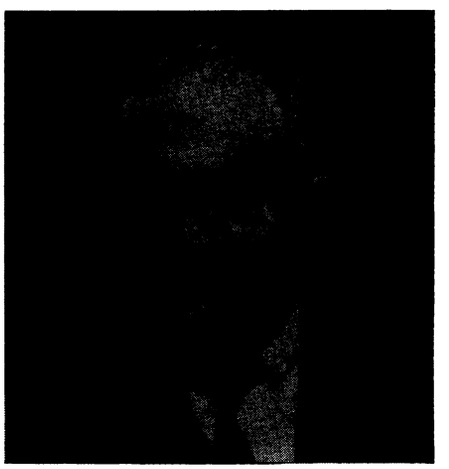
Dr. Klein was one of several political scientists who met in special sessions devoted to Czechoslovakia at the Washington meeting of the American Political Science Association. Members heard reports of new thinking in Czechoslovakia—a renewed consideration of what kind of Central European unit might be established. They were also told that Czechs and Slovaks—artificially joined after World War I—have finally been forged into a single nation on the anvil of the invasion.

But the fact that political scientists could envision several different constellations in Eastern Europe indicates how much traditional rivalries still rule.

Dr. Andrew Gyorgy of the Institute for Sino-Soviet Studies at George Washington University, for instance, conceives a possible union between the three western, Catholic, states—Poland, Czechoslovakia and Hungary.

A third political scientist, Dr. Roy D. Laird of the University of Kansas, views all the talk of unity as little more than a dream at the moment. "I can see Tito trying to effect some kind of pan-Slavic movement," he says, "but I don't see it happening in the foreseeable future."

Nevertheless, Dr. Laird agrees that nationalism in Eastern Europe must eventually prevail over even Soviet strength. Both the United States and the Soviet Union ignored the national-



Paul Conklin

Klein: German troops shocked.

istic emotions until the Hungarian revolt twelve years ago, says Dr. Laird, and he believes the feeling will overcome Russian dominance just as it destroyed the Austro-Hungarian Empire, and perhaps may even lead Ukrainians and Georgians to break away from Russia.

Ironically enough, 23 years of centralized communism in Eastern Europe might provide the theoretical framework within which Eastern European states could overcome their mutual antagonisms.

About two years ago, says Dr.