MARSBUGS:

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DID PROTO-ORGANISMS EVER EXIST?
By Paul Birch

When we look at the diversity of living organisms, both today and in the fossil record, we find that simpler and smaller organisms are present in greater numbers and greater variety than the larger and more complex. There are more insects, and more species of insects, than there are mammals; more small mammals than large ones; a few dozen kinds of primate; one species of man. This law runs all the way down to the microscopic world of unicellular organisms and bacteria. It would appear that there exist more prokaryotic cells, and more prokaryote "species", than all other life forms put together.

This is remarkable. Even more remarkable is the way this universal trend stops dead in its tracks. There are no life forms simpler than a cell. None. There should be billions. There are viruses, of course, but only by stretching definitions to the breaking point can they be called alive; they certainly aren't life forms, because they cannot exist without living cells to copy them. Viruses are junk mail--a primitive form of sex.

The plot thickens. For among these so-called simple cells are to be found many (if not all) of the biochemical genes utilized by the supposedly more advanced organisms higher up the evolutionary tree. As an extreme example: it would appear that many (if not all) of the basic genes in the human genome are paralleled in the genetic material of "primitive" prokaryotes (though not necessarily the control genes, and not necessarily without modification). Clearly, "simple" cells are actually nothing of the sort; they are hideously complex.

According to current dogma, bacteria evolved from proto-organisms of gradually increasing complexity, which themselves arose out of inanimate matter through some fast-talking organic chemistry. There would appear to be approximately zero evidence for this hypothesis.

If proto-organisms were the earliest forms of life, where are they now? The usual answer is that they died out. But is it reasonable to suppose that all the simplest life forms became extinct? Not just most of them, or nearly all, but every last one? In the light of the above-mentioned trend of increasing diversity with decreasing size, this seems very hard to accept.

Furthermore, we know that although it is exceedingly difficult to accumulate truly new genetic information, losing existing genes by means of mutations or chromosome aberrations is easy. If progressive evolution is an uphill struggle, degeneration is a lazy slide into the gutter. Speciation often seems to take the easy route of "devolution." Moreover, mutations and evolutionary change seem to come fastest in the simplest or smallest organisms--especially in the "simple" cells, the prokaryotic bacteria.

Thus, if organisms simpler than the simple cells (that is, organisms with significantly less genetic information) can actually exist, we should expect large numbers of them to appear all the time through the degenerative mutation of simple bacteria. But they don't. Unless supplied with special nutrients, to make up for lost genes, such "devolved" bacteria do not survive. It would appear that organisms simpler than prokaryotic bacteria are simply not viable.

If this is true, then proto-organisms never existed, because they never could have existed; therefore bacteria never evolved from them; and the standard model of the origin of life is in error.

As to alternative theories, it must be admitted that one runs into difficulty. The most straight-forward notion, that God simply sat down and created bacteria (and possibly other life forms) from scratch is not popular with materialists (though I know of no actual evidence against it). The idea that bacteria may have floated in from outer space, or have been deliberately introduced by extraterrestrials, unfortunately only shifts the same problem somewhere else. That extraterrestrial bioengineers may have created (that is, engineered) terrestrial life is a possibility, but we would then need to assume either that they were similarly created in their turn, or that they are not "life as we know it", but rather some radically different form of life originating in some presently unguessable fashion.

The truth, I suspect, will eventually turn out to be stranger, more wonderful and more elegant than any of these ideas; but we will need unfettered minds to grasp it. Perhaps it is time to stop trying to fit evolutionary biology into the Procrustean bed of a preconceived hypothesis, and ask ourselves where the evidence actually leads.

About the author: Paul Birch
Paul Birch was born and bred in Liverpool and read Natural Sciences (including Biology of Cells) at Trinity College, Cambridge, then Radioastronomy at Jodrell bank (where he published a paper in Nature detailing his discovery of evidence that the universe as a whole may be rotating. He is a fellow of the British Interplanetary Society and has published numerous articles on space colonization.

[Paul notes that this article probably expresses a very heretical viewpoint. Civilized comments and alternative viewpoints are welcome. --eds.]

COTI MUNDI WORLDBUILDING PROJECT
By Greg Barr

CONTACT: Cultures of the Imagination would like to invite exobiologists to help us in our three year project to design an alien world. At CONTACT X, in 1993, we began work on a planet in a hypothetical solar system established around the star 82 Eridani. One of 82 Eridani's planets, dubbed Epona, is in a life-bearing zone, but has a drastically different environment to offer life. Will life evolve to sentience and what form will it take? Arm yourself with imagination and the basic facts on this page and then join us electronically on BIX to capture all the material published to date.

This is a planet where the land is only habitable 10 million years in every 100 million. These habitable windows are only stable for as long as biogeochemical cycles are closed. When they occur, a rapid and dramatic adaptive radiation of sea and shore dwelling creatures sweeps the planet, similar to the explosive evolution of the mammals following the demise of the dinosaurs. When the cycles fail and some essential nutrient becomes depleted (in this case gaseous carbon dioxide) a mass extinction driven by the failure of planetary homoeostasis drives advanced life back into the equatorial seas. These extreme fluctuations in the health of the biosphere are linked in a quasi-periodic 100 million year cycle, in phase with the moribund planet's outbursts of "terminal vulcanism."

The work to date has created three life kingdoms on the planet. The ARCHAEPLANTAE were the plants that used to rule the world, but many of its former advanced forms are long extinct. Archaeplantae now are "algae"-types, such as aquatic "phytoplankton", mats of photosynthetic slime and symbiotic forms such as that which grows with the Moss Sponge.

The ARCHAEANIMALIA are animals with mineralized endo- or exoskeletons (mostly carbonate) and tensile muscles. Again, they are much reduced from their former diversity ~1.7 billion years ago. Many groups are primitive and sessile, such as the reef-building Tubeworms, the Moss Sponge and the host of bottom dwelling detritus-feeders on the sea floor.

The MYOSKELETAL Kingdom is a relatively new innovation in Epona, but is now a major taxonomic group and the one containing the most sophisticated forms. Its origin probably dates to not more than 2 billion years ago and may be as close as 1 billion. The progenitor was probably an Archaeplant that evolved primitive osmotic muscle that later become animal myoskeleton.

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NASA SELECTS SCIENTISTS FOR NEUROLAB SHUTTLE MISSION
NASA press release

NASA announced today the selection of 34 scientists who will participate in the experiment definition phase of the Neurolab Space Shuttle mission. Neurolab, a 14 to 16-day joint Shuttle mission with the National Institutes of Health (NIH) devoted to brain and behavioral research, is scheduled for launch in early 1998.

The 34 investigators were selected from over 170 scientists from around the world who submitted proposals for experiments to be conducted on the mission. All of the proposals underwent rigorous peer review conducted by the NIH Division of Research Grants which evaluated them for their scientific merit. The chosen studies were deemed to be the best experiments that could be accommodated on the Space Shuttle. The selected scientists are from the United States, Japan, France, Canada, Italy, Germany, the Netherlands and Nigeria.

The Neurolab scientists will be organized into investigator teams, based on the scientific areas of their research. Examples of topics that will be studied include how the brain develops in microgravity, how the sense of balance and control of movement is altered in microgravity and what effects the space environment has on sleep and the body's biological rhythms. The teams will undergo a ten-month science definition period during which time each team will produce an integrated research plan based on the original proposals. After the science definition period, the integrated research plans will once again be reviewed to ensure that the experiments to be conducted on the mission are of the highest quality.

The Neurolab Mission is being carried out by NASA in cooperation with a variety of domestic and international partners. The major domestic partner is the NIH, specifically the National Institute on Aging, the National Institute on Deafness and Other Communication Disorders, the National Heart, Lung, and Blood Institute, the National Institute of Neurological Disorders and Stroke, the National Institute of Child Health and Human Development and the Division of Research Grants. The National Science Foundation and the Office of Naval Research also are domestic partners. International partners include the European Space Agency and the space agencies of Japan, France, Germany and Canada. The partners are supporting the mission by providing some funding for the scientists, supplying scientific equipment to be used on the Space Shuttle and participating in mission planning.

The Neurolab scientists whose experiments were selected for definition are:

Friedhelm J. Baisch, M.D.
DLR Institute of Aerospace Medicine
Cologne, Germany

Kenneth M. Baldwin, Ph.D.
University of California, Irvine
Irvine, Calif.

Alain Berthoz, Ph.D.
CNRS/Coll ge de France
Paris, France

Ingrid M. Block, Ph.D.
DLR German Space Research Institute
Cologne, Germany

C. Gunnar Bloomqvist, M.D., Ph.D.
University of Texas Southwestern Medical Center
Dallas, Texas

Otmar Bock, M.D.
Institute of Space & Terrestrial Science
Ontario, Canada

Scott T. Brady, Ph.D.
University of Texas Southwestern Medical Center
Dallas, Texas

Barbara Chapman, Ph.D.
California Institute of Technology
Pasadena, Calif.

Gilles R. Clement, Ph.D.
National Center for Scientific Research
Paris, France

Bernard Cohen, M.D.
Mount Sinai School of Medicine
New York, N.Y.

Charles A. Czeisler, M.D., Ph.D.
Harvard Medical School/Brigham & Women's Hospital
Cambridge, Mass.

Dwain L. Eckberg, M.D.
Medical College of Virginia
Richmond, Va.
Charles A. Fuller, Ph.D.
University of California, Davis
Davis, Calif.

Stephen M. Highstein, M.D., Ph.D.
Washington University
St. Louis, Mo.

Gay R. Holstein, Ph.D.
Mount Sinai School of Medicine
New York, N.Y.

Eberhard R. Horn, Ph.D.
University of Ulm
Ulm, Germany

Bruce G. Jenks, Ph.D.
University of Nijmegen
Nijmegen, Netherlands

Haig S. Keshishian, Ph.D.
Yale University
New Haven, Conn.

Kenneth S. Kosick
Harvard Medical School/Brigham & Women's Hospital
Cambridge, Mass.

Bruce L. McNaughton, Ph.D.
University of Arizona
Tucson, Ariz.

Philip C. Njemanze, M.D.
Chidicon Medical Center
Owerri, Nigeria

Richard S. Nowakowski, Ph.D.
UMDNJ-Robert Wood Johnson Medical School
Piscataway, N.J.

Charles M. Oman, Ph.D.
Massachusetts Institute of Technology
Cambridge, Mass.

Ottavio Pompeiano, M.D.
University of Pisa
Pisa, Italy

Jaqueline Raymond, Ph.D.
University of Montpellier
Montpellier, France

Danny A. Riley, Ph.D.
Medical College of Wisconsin
Milwaukee, Wis.

David Robertson, M.D.
Vanderbilt University School of Medicine
Nashville, Tenn.

Muriel D. Ross, Ph.D.
NASA Ames Research Center
Moffett Field, Calif.

Tsuyoshi Shimizu, M.D., Ph.D.
Fukushima Medical College
Fukushima City, Japan

Tracey J. Shors, Ph.D.
Princeton University
Princeton, N.J.

Shiro Usui, Ph.D.
Toyohashi University of Technology
Aichi, Japan

Kerry Walton, Ph.D.
New York University Medical Center
New York, N.Y.

John B. West, M.D., Ph.D.
University of California, San Diego
San Diego, Calif.

Michael L. Wiederhold, Ph.D.
University of Texas Health Center at San Antonio
San Antonio, Texas

JPL/MARS GLOBAL SURVEYOR CONTRACTOR SELECTED JPL Press release

Development of the Mars Global Surveyor--the first in a series of low-cost spacecraft to explore the Martian environment--will begin this month, leading up to a November 1996 launch and America's return to the red planet.

NASA Jet Propulsion Laboratory Director Dr. Edward C. Stone today announced the selection of the contractor, Martin Marietta Technologies Inc. of Denver, Colo., to build the light-weight orbiter after a rapid, industry-wide competition.

"Martin Marietta Technologies Inc. has a successful record of developing unique planetary spacecraft, including the highly successful Magellan Venus radar mapping mission and the Viking Mars landers," Stone said.

"This is the beginning of a new era in the exploration of the Martian environment and a new way of conducting business with our partners in industry," he said. "We are now on the way to building a viable, state-of-the-art spacecraft that will be ready for launch by November 1996 and assure us of many scientifically important results."

The Mars Global Surveyor will be readied for launch from Cape Canaveral, Fla., in just 28 months, beginning NASA's decade-long plan to launch orbiters and landers to Mars every 26 months through the year 2005. The rigorous timeline--trimmed from an average five years or more in the past--reflects NASA's new policy of streamlining the development and deployment of new planetary missions.

Performance objectives for the new orbiter called for a low mass, polar-orbiting spacecraft that could carry all but two of the eight science instruments that were on board the Mars Observer spacecraft when it was lost on Aug. 21, 1993. Project costs through 30 days after launch have been capped at $155 million.

The Mars Global Surveyor will provide high-resolution, global maps of the Martian surface, profile the planet's atmosphere and study the nature of the magnetic field. The orbiter will be small enough to be launched on a Delta expendable launch vehicle and will spend 10 months in transit to Mars before entering a polar orbit around the planet in September 1997.

The Jet Propulsion Laboratory will manage the Mars Global Surveyor mission for NASA's Office of Space Science, Washington, D.C.

FACT SHEET: MARS GLOBAL SURVEYOR
JPL press release

Mars Global Surveyor will be a polar-orbiting spacecraft at Mars designed to provide global maps of surface topography, distribution of minerals and monitoring of global weather.

Launched with a Delta II expendable vehicle from Cape Canaveral, Fla., in November 1996, the spacecraft will cruise 10 months to Mars, where it will be initially inserted into an elliptical capture orbit. During the following four months, thruster firings and aerobraking techniques will be used to reach the nearly circular mapping orbit over the Martian polar caps. Aerobraking, a technique which uses the forces of atmospheric drag to slow the spacecraft into its final mapping orbit, will provide a means of minimizing the amount of fuel required to reach the low Mars orbit. Mapping operations are expected to begin in late January 1998.

The spacecraft will circle Mars once every two hours, maintaining a "sun synchronous" orbit that will put the sun at a standard angle above the horizon in each image and allow the mid-afternoon lighting to cast shadows in such a way that surface features will stand out. The spacecraft will carry a portion of the Mars Observer instrument payload and will use these instruments to acquire data of Mars for a full Martian year, the equivalent of about two Earth years. The spacecraft will then be used as a data relay station for signals from U.S. and international landers and low-altitude probes for an additional three years.

Mars Global Surveyor is the first mission of a new, decade-long program of robotic exploration of Mars, called the Mars Surveyor program. This will be an aggressive series of orbiters and landers to be launched every 26 months, as Mars moves into alignment with Earth. The program will be affordable, costing about $100 million per year; engaging to the public, providing fresh new global and close-up images of Mars; and have high scientific value obtained with the development of leading-edge space technologies.

International participation, collaboration and coordination will enhance all missions of the program. Landers in future years--1998, 2001, 2003 and 2005--will capitalize on the experience of the Mars Pathfinder lander mission to be launched in 1996. Small orbiters launched in the 1998 and 2003 opportunities will carry other instruments from the Mars Observer payload and will serve as data relay stations for international missions of the future.

The Mars Global Surveyor spacecraft will be acquired from industry through a competitive procurement. The science payload will be provided as government-furnished equipment that was built to duplicate the instruments flown on Mars Observer. The payload includes the Mars orbital camera, thermal emission spectrometer, ultra-stable oscillator, laser altimeter, magnetometer/electron reflectometer and Mars relay system.

The Jet Propulsion Laboratory will manage the project for NASA's Solar System Exploration Division and will provide the mission design, navigation, and conduct mission operations. Tracking and data acquisition will be provided by a 34-meter subnetwork of the worldwide Deep Space Network.

Project costs for the Mars Global Surveyor through 30 days after launch will be approximately $155 million.

MARS GLOBAL SURVEYOR INNOVATIONS
JPL press release

Mars Global Surveyor demonstrates NASA's new approach to streamlining the development, deployment and on-orbit costs of new spaceflight missions. Features of the Mars Global Surveyor project include:

- Fast-track in development; costs constrained to $100 million or less per year.
- Uniform mapping capability, obtained with low-altitude, sun- synchronous orbit.
- Moderate, five-year mission lifetime.
- International collaboration with French-supplied data relay system that will relay information from Russian as well as future U.S. spacecraft on Mars' surface.
- Utilizes existing infrastructure and hardware to achieve rapid launch readiness.
- Initiates NASA's decade-long exploration of Mars by both orbiters and landers.

Project Management

- Capped, cost-driven management approach; project management staff significantly reduced.
- Fast-track schedule with built-in performance measurement to assure on-time readiness for launch in just 28 months. (On average, planetary spacecraft development in the recent past has taken about 66 months or five-and-a-half years.)
- Shared launch vehicle engineering and launch site support personnel with Mars Pathfinder mission to minimize personnel and costs.
- Colocation of JPL project personnel at spacecraft contractor's facility.

Industry Participation/Procurement Innovations

- Full industry participation. Twelve Phase A contracts awarded, four to small businesses, in less than one week using streamlined approach.
- Rapid request-for-proposal preparation. Request-for-proposal prepared, distributed and reviewed by integrated project team using electronic network.
- Draft request-for-proposal provided to industry 10 days following NASA go-ahead.
- All industry comments addressed at industry briefing.
- Evaluation approach design to maximize mission return within capped budget.
- Simple, innovative fee approach that warrants on-orbit performance and rewards cost control.
- Contractor selection and contract award completed in eight weeks, compared with an average five to six months on similar procurements in the past.

Spacecraft Implementation

- JPL maintains Mars Observer-pioneered on-orbit performance award for spacecraft contractor.
- JPL and spacecraft contractor personnel will team to share in development activities.
- Spacecraft contractor will use inherited elements and new technology to minimize schedule risk and provide adequate margins for completion of sublevel system tasks.
- Contractually required documentation of task completion and developmental progress will be reduced significantly.

Science Implementation

- Internationally accepted science objectives.
- Principal science investigators will manage their hardware and science investigations to assigned cost caps.
- Preserve existing operations infrastructure by maintaining remote science operations sites. Remote science instrument command, analysis and data processing reduces travel costs.
- Merge science hardware and science investigation management.
- Immediate availability of science data to science teams through use of the Mars Observer-pioneered project database.

Flight Operations

- Use existing ground data system.
- Combine ground data system testing and flight operations training.

Flight operations system redesigned to:

- Eliminate a layer of management;
- Provide a centralized command tracking database;
- Ensure electronic document distribution;
- Establish a seamless uplink process whereby commands are generated by a single team;
- Establish a single downlink team for performance assessment.

Small And Minority-owned Business Participation

Small and minority-owned businesses participating in the Mars Global Surveyor mission will represent 33.3 percent of the prime contractor's hardware and software procurement.

Technologies that will be provided by small and minority-owned businesses include:

- Solid state recorders
- Propulsion valves
- Solar panels
- Gimbal actuators
- Central clock
- Testing
- High technology material

Educational Outreach

Mars Global Surveyor will participate in a vigorous educational outreach program to promote excellence in America's educational system and help expand U.S. scientific and technological competence.

The focus of these educational outreach efforts will support science, mathematics and space mission development curricula at the kindergarten through 12th grade levels, provide educational enrichment for teachers and a better public understanding of science.

Core Thrusts

- To establish national partnerships for the dissemination of educational resources to national teacher associations, educational advocacy groups and aerospace industry educational associations.
- To establish a science education model that will link students to the Mars Surveyor program through parallel projects that will allow them to interact with program managers, engineers and scientists.
- To establish partnerships with faculty at centers of higher education, using a science education model project for teacher enhancement.
- To establish regional science centers for teacher enhancement, student instruction and dissemination of resource materials at the home institutions of the Mars Surveyor program's principal investigators.

Educational Products

- New science lesson plans on Mars exploration, to be incorporated into standard science course curricula.
- An online database on Mars exploration for schools, libraries, museums and planetariums.
- Educational television programs for national broadcast.
- Speakers, facility tours and mission reference materials.

Support for Educational Technology Utilization

- Near real-time distribution of images and other science data from Mars may be used as source material for the classroom.
- Use of television, video tape, online public access computer sites such as Spacelink and JPL's image library, CD-ROMs and Internet as primary means of distributing information.

CURRENT PUBLICATIONS IN EXOBIOLOGY AND RELATED FIELDS
By Julian Hiscox

Andrews, 1994: Will the Space Clipper stay a DREAM? New Scientist, 28th May. p28-31. (One stage re-usable rocket).

Baron, 1994: Chill over the Cretaceous. Nature. v370. p415. (global warming, model re-evaluation).

Binot et al., 1994: Biological air filters. Preparing for the Future-ESA's Technology Programme Quarterly. v4. p14-15. (Space vehicle, air purification).

Cherfas, 1194: How many species do we need? New Scientist, 6th August. p36-40. (Closed ecosystem).

Chini et al., 1994: As planets go by. Nature. v369. p714. (Report of erroneous observation of planet by other group).

Croswell, 1994: Slow leak from interior of red planet. New Scientist, 6th August. p16. (Helium on Mars).

Curtis, 1994: Importance of dose rate and cell proliferation in the evaluation of biological experimental results. Advances in Space Research. v14. p989-996. (Radiation hazards on manned missions).

Dermott et al., 1994: A circumsolar ring of asteroidal dust in resonant lock with the Earth. Nature. v369. p719-723. (IRAS, carbonaceous material, indirect planetary detection).

Emsley, 1994: Tangled tale of self-organising fibre. New Scientist, 6th August. p17. (Precursor of biological structures).

Facius et al., 1994: Inactivation of individual Bacillus subtilis spores in dependence on their distance to single cosmic heavy ions. Advances in Space Research. v14. p1027-1038. (Radiobiological experiments).

Flam, 1994. Artificial life researchers try to create social reality. Science. v265. p868-869.

Jakosky & Jones, 1994: Evolution of water on Mars. Nature. v370. p328-329. (H_2O, hydrothermal systems, SNC meteorite).

Jones et al., 1994: A climatic model study of indirect radiative forcing by anthropogenic sulphate aerosols. Nature. v370. p450- 453. (Cloud condensation nuclei, climate change).

Kiefer, 1994: Issues and problems for radiobiological research in space. Advances in Space Research. v14. p979-988. (Heavy ions, mutation, cells).

Kraft & Scholz, 1994: On the parametrization of the biological effect in a mixed radiation field. Advances in Space research. v14. p997-1004. (Biological effects of radiation).

Kranz et al., 1994: Biophysical effect of cosmic heavy ions of distinct let-classes in a plant-model system. Advances in Space Research. v14. p1021-1026. (Biological effects of radiation).

Lagage & Pantin, 1994: Dust depletion in the inner disk of beta Pictoris as a possible indicator of planets. Nature. v369. p628-630. (Circumstellar dust disks, indirect observation of planet?).

Roques et al., 1994: Is there a planet around beta-Pictoris--perturbations of a planet of a circumstellar dust disk. Icarus. v108. p37-58. (Indirect detection of planet).

Schafer et al., 1994: Inactivation of individual Bacillus subtilis spores in dependence on their distance to single accelerated heavy ions. Advances in Space Research. v14. p1039-1046. (Effetcs of radiation on biological systems).

Sellwood et al., 1994: Cooler estimates of Cretaceous temperatures. Nature. v370. p453-455. (CO_2, global warming).

Solomon, 1994: Stirring times for Mars. Nature. v369. p606-607. (Martian plate tectonics).

Steffes & Deboer, 1994: A SETI search of nearby solar type stars at the 203-Ghz positronium hyperfine resonance. Icarus. v107. p215- 218. (SETI, advanced millimeter wave technology).

Stephens, 1994: Dirty clouds and global cooling. Nature. v370. p420-421. (Aerosol polution, cooling, sulphate aerosol).

Squyres & Kasting, 1994: Early Mars: How warm and how wet? Science. v265. p744-749. (Early Mars, climate, H_2O).

Sugisaki et al., 1994: Shock synthesis of light hydrocarbon gases from H_2 and CO - its role in astrophysical processes. Geophysical Research Letters. v21. p1031-1034. (Earth's primitive atmosphere, Titan, evolution).

Taylor, 1994: The scientific legacy of Apollo. Scientific American. v271. July. p26-33.

Telesco, 1994: Footprints in the dust. Nature. v369. p610- 611. (Indirect detection of planets).

Various authors, 1994: Planetary Report. v14 (4). Most of this issue is devoted to planetary protection and infection. (Mars, moon, earth, microorganisms, isolation, quarantine).

Wilson et al., 1994: The organic surface of 5145-Pholus - constraints set by scattering theory. Icarus. v107. p288- 303. (Organic solids, tholin, ammonia ice).

Zent & McKay, 1994: The chemical reactivity of the Martian soil and implications for future missions. Icarus. v108. p146-157. (Sample return, soil analysis).

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