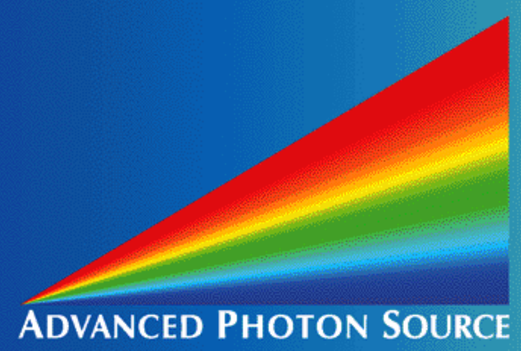
The U.S. Department of Energy's
Advanced Photon Source
Argonne National Laboratory



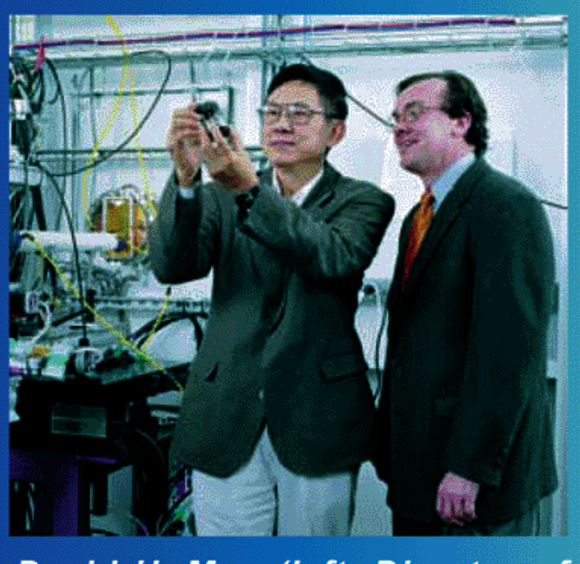
Research

Methane Production: Not Just from Cows

Hydrocarbons such as methane are believed to arise mainly from organic sources. Although it has been found in the Earth's crust, where there are no living systems, most methane is still assumed to originate in the biosphere, such as from bacterial metabolism in the rumen of cows. Challenging this assumption, new research shows that methane readily forms inorganically at the high pressure and temperature conditions encountered in the Earth's interior, forcing a new look at the planet's hydrocarbon budget. The insertion device beamline on the High Pressure Collaborative Access Team (HP-CAT) sector at the APS aided investigators from Indiana University South Bend, the Carnegie Institution of Washington, Harvard University, and Lawrence Livermore National Laboratory in their study of hydrocarbon generation under conditions simulating those in the Earth's upper mantle. Their data show that methane formation can occur at a broad range of pressure and temperature conditions, which may be widespread in the Earth's mantle. The probable existence of large abiogenic hydrocarbon reservoirs inside the Earth can no longer be ignored. See: H.P. Scott, R.J. Hemley, H.-k. Mao, D.R. Herschbach, L.E. Fried, W.M. Howard, and S. Bastea, "Generation of Methane in the Earth's Mantle: In situ High Pressure-Temperature Measurements of Carbonate Reduction," PNAS 101(39), 14023 (September 28, 2004).

From the HP-CAT mission statement: HP-CAT has been developed to optimize and integrate multiple novel synchrotron x-ray diffraction and x-ray spectroscopy probes, as well as complementary optical and electromagnetic probes, with diamond-anvil cell samples at high pressures and temperatures, thus addressing specific scientific problems in multidisciplinary fields.

HP-CAT operates three end stations on their sector: one bending magnet (energy range: 10-100 keV) and two insertion devices (energy range: 6-15 keV and 24-35 keV; resolution: 1×10^{-4}). Techniques supported include: powder diffraction, single-crystal diffraction, x-ray absorption fine structure, Compton scattering, x-ray Raman scattering, x-ray emission spectroscopy, resonant inelastic x-ray scattering, inelastic scattering, microdiffraction, nuclear forward scattering, nuclear-resonant inelastic x-ray scattering, nuclear-resonant scattering, powder diffraction, and diamond anvil cell.



David H. Mao (left, Director of HP-CAT) showing a panoramic high-pressure diamond-anvil cell to APS Director Murray Gibson, inside the beamline 16-ID-D research station.

This APS research highlight on methane is excerpted from "APS Science 2004 - the annual report of the Advanced Photon Source," which is available in .pdf format online at http://www.aps.anl.gov/News/index.htm. Printed or CD format versions are also available by sending a request (including your mailing information) to apsinfo@aps.anl.gov, with "annual report" in the subject line.

Call for Proposals

At the APS, our door is open to experimenters from all scientific disciplines, whose research requires the highest brilliance hard x-ray beams in the Western Hemisphere.

General-user proposals for beam time during Run 2005-3 are due by July 15, 2005.
Information on access to beam time at the APS is at: **http://www.aps.anl.gov/user/beamtime/get_beam.html**
or contact Dr. Dennis Mills, DMM@aps.anl.gov, 630/252-5680.
Information on APS research techniques and beamline capabilities is also at:
http://www.aps.anl.gov/user/beamtime/get_beam.html

Argonne National Laboratory is operated by The University of Chicago for the U.S. Department of Energy Office of Science
The Advanced Photon Source is funded by the U.S. DOE, Office of Science, Office of Basic Energy Sciences

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