NEWS RELEASE
Ocean Drilling Program

For information:
Karen Riedel
Ocean Drilling Program
Texas A&M University
College Station, TX 77840
(409) 845-9322

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ODP Leg 135

The Lau Basin: a back-arc puzzle

Scientists for the Ocean Drilling Program (ODP) recently spent two months at sea drilling in the southwestern Pacific Ocean. They returned with samples of sediment and rocks that will help them solve a puzzle about the origin and evolution of a back-arc basin behind an arc-shaped line of active volcanoes. And they also discovered what may be a remnant of a younger Australia, tectonically moved more than 3,000 kilometers from the parent continent.

Scientists, on board the Texas A&M-operated drill ship, *JOIDES Resolution*, drilled into and near the Lau Basin north of New Zealand. The basin lies between the volcanically active Tofua Arc and a remnant of an old volcanic arc, the Lau Ridge. The Lau Basin and Tofua Arc are both associated with the 6-mile-deep Tonga Trench, where the massive Pacific plate plunges westward into the earth's mantle.

The Lau Basin was the first back-arc basin to be identified as a site of seafloor spreading. Although scientists recognized this phenomenon more than 20 years ago, they did not have the evidence to determine when spreading began or how the basin itself originated.

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Before drilling into the Lau Basin, scientists surmised that it was a relatively young basin about 2 to 3 million years old. Drilling at six sites across the basin, however, produced unexpected results: an older, more complicated basin with a chaotic evolutionary pattern.

Active seafloor spreading began only 1 to 2 million years ago, they discovered, although the basin began to form more than 6 million years ago. Tectonic activity first dismembered the nascent basin into a number of smaller north-to-south trending basins separated by uplifted blocks. As the old crust stretched and foundered, seafloor spreading began in the eastern part of the basin.

The two-stage formation does not coincide with an orderly evolution in volcanic rock chemistry. Instead, the recovered rock samples vary in chemistry between lavas typical of volcanoes associated with plate subduction and lavas associated with spreading ridges.

The ship also drilled into more than three miles of water on the western slope of the Tonga Trench. The shipboard scientists recovered rhyolite lavas and tuffs, rocks dating from the late Eocene or older (older than 40 million years). The texture and thickness of the deposits dictate enormous above-water volcanic eruptions. The lavas subsequently subsided more than 5 1/2 kilometers (3.3 miles) since erupting, representing profound tectonic foundering.

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These massive deposits of rhyolite, the volcanic counterpart of granite, make this site unique, scientists say. The composition of rhyolite usually indicates an underlying crust containing granitic rocks, the building blocks of continental crust. The presence of rhyolitic material implies that these now deep-sea buried ash layers once formed above water on crust containing rocks associated with continents.

The rhyolitic rocks compare to others found in eastern Australia, raising the intriguing possibility that part of eastern Australia broke away in the past and now rests more than 3,200 kilometers (2,000 miles) to the east.

Dr. James Hawkins, Scripps Institution of Oceanography, La Jolla, Calif., and Dr. Lindsay Parson, Institute of Oceanographic Sciences, Godalming, Surrey, United Kingdom, were the co-chief scientists. Dr. Jamie Allan, Texas A&M University, was the ODP staff scientist.

JOIDES Resolution, registered as *Sedco/BP 471*, is the research vessel for the ODP, which is funded by the United States National Science Foundation, Canada and Australia, the European Science Foundation Consortium for the Ocean Drilling Program, Federal Republic of Germany, France, Japan and the United Kingdom.

The 470-foot-long drill ship's derrick towers 200 feet above the waterline. A seven-story laboratory stack provides facilities for on board examination of sediment and hard-rock cores. Laboratories contain space and equipment for studies in chemical,

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gas and physical properties, paleontology, petrology, paleomagnetics and sedimentology. Marine geophysics research is conducted while the ship is under way.

Texas A&M University, as science operator, operates and staffs the drill ship and retrieves cores from strategic sites around the world. The science operator also ensures that adequate scientific analyses are performed on the cores. To do this, Texas A&M maintains shipboard scientific labs and provides logistical and technical support for shipboard scientific teams. On shore,in the Texas A&M University Research Park, the science operator manages post-cruise activities, curates the cores and publishes the scientific results.

Lamont-Doherty Geological Observatory of Columbia University is responsible for downhole logging.

Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES), an international group of scientists, provides scientific planning and program advice. Joint Oceanographic Institutions (JOI, Inc.), a nonprofit consortium of 10 major U.S. oceanographic institutions, manages the program.

"The ship will begin this spring drilling off the west coast of the Americas," said Dr. Philip D. Rabinowitz, director of the ODP. "We'll research fundamental earth processes such as plate convergence, and the structure and evolution of ocean crust."

Note: JOIDES Institutions are: University of California at San Diego; Columbia University; University of Hawaii; University of Miami; Oregon State University; University of Rhode Island; Texas A&M University; University of Texas at Austin; University of Washington; and Woods Hole Oceanographic Institution.

Non-U.S. members are Canada and Australia Consortium for the ODP, European Science Foundation Consortium for the ODP: Belgium, Denmark, Finland, Iceland, Italy, Greece, the Netherlands, Norway, Spain, Sweden, Switzerland and Turkey; Federal Republic of Germany; France; Japan; and the United Kingdom.

The scientific party for Leg 135 was: James W. Hawkins, co-chief scientist, Scripps Institution of Oceanography, La Jolla, Calif.; Lindsay M. Parson, co-chief scientist, Institute of Oceanographic Sciences, United Kindom; James Allan, staff scientist, Ocean Drilling Program, Texas A&M University, College Station; Niels Abrahamsen, Laboratory of Geophysics, Geological Institute, Denmark; Ulrich Bednarz, Institut für Mineralogie, Ruhr-Universität, Federal Republic of Germany; Gerard Blanc, Institut de Géologie, Université Louis Pasteur, France; Sherman H. Bloomer, Department of Geology, Boston University; Reidulv Bøe, Geological Survey of Norway, Trondheim; Terry R. Bruns, U.S. Geological Survey, Menlo Park, Calif.; Wilfred B. Bryan, Woods Hole Oceanographic Institution, Mass.; George C.H. Chaproniere, Bureau of Mineral Resources, Geology and Geophysics, Canberra City A.C.T. 2601, Australia; Peter Clift, Grant Institute of Geology, University of Edinburgh, United Kingdom; Anthony Ewart, Department of Geology and Mineralogy, University of Queensland, Australia; Martin G. Fowler, Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada; Janet M. Hergt, Department of Earth Sciences, The Open University, United Kingdom; Richard A. Hodkinson, Department of Geology, Imperial College, United Kingdom; Dawn LaVoie, Naval Oceanographic and Atmospheric Laboratory, Stennis Space Center, Missouri; Jacquelyn K. Ledbetter, Department of Geosciences, University of Tulsa; Christopher J. MacLeod, Department of Earth Sciences, The Open University; Kristen Nilsson, Scripps Institution of Oceanography; Hiroshi Nishi, Department of Earth Sciences, Yamagata University, Japan; Cristelle E. Pratt, Mineral Resources Department, CCOP/SOPAC , Suva, Fiji; Paula J. Quinterno, U.S. Geological Survey; Robin R. Reynolds, Borehole Research Group, Lamont-Doherty Geological Observatory, New York; Robin G. Rothwell, Institute of Oceanographic Sciences, United Kingdom; William W. Sager, Deparment of Oceanography, Texas A&M University; Dietmar Schöps, Institute of Mining and Economic Geology, Aachen University of Technology, FRG; Sione Soakai, Ministry of Lands, Surveys and Natural Resources, Nukualofa, Tonga; Michael J. Styzen, Shell Offshore, Inc., New Orleans, Louisiana.