The 33rd Lunar and Planetary Science Conference

Houston, Texas, USA, March 11–15, 2002

The Thirty-third Lunar and Planetary Science Conference was held on March 11-15, 2002 near Houston, Texas. The conference covered the full range of planetary science, including studies of all the planets, the asteroids, comets, Kuiper belt objects, interplanetary dust, planets around other stars, and life on other worlds. This year’s LPSC was among the largest, with 1160 registered attendees and 1064 abstracts of presentations. The conference is truly international in scope. A total of 25 countries were represented, including 241 scientists from outside the United States. Summarizing such a large and diverse meeting is impossible, and we have chosen a few of the scientific high points here. The complete program and abstracts for the meeting are available on the internet at http://www.lpi.usra.edu/meetings/lpsc2002/.

Many presentations dealt with the flood of spacecraft data returned from Mars in recent years. Several presentations of the initial science results from the Mars Odyssey mission were made to a standing-room-only crowd. Phil Christensen (Arizona State University) discussed results from THEMIS, an infrared imaging system. By obtaining images of a region both in daylight and at night, THEMIS can measure how rapidly different materials heat up and cool down, a property known as thermal inertia. These measurements can constrain the spatial distribution of dust and large rocky blocks. Thermal images shown at the conference showed details in the ejecta blankets of impact craters and on the floors of fluvial structures. These initial images suggest that THEMIS will be an important tool for high-resolution geomorphology studies. These results will also assist in selecting landing sites for future missions to Mars.

William Boynton (University of Arizona) described results from Mars Odyssey’s Gamma Ray Spectrometer. William Feldman (Los Alamos National Laboratory) presented results from Odyssey’s Neutron Spectrometer. Both instruments show strong concentrations of hydrogen between the south pole and 60° south latitude. Most likely, the hydrogen is present as water ice in the upper meter of the regolith. The strength of the hydrogen signal is stronger than expected, although the abundance of water ice cannot be quantified yet.

Many presentations dealt with data from the Mars Global Surveyor spacecraft. Herb Frey (NASA Goddard Space Flight Center) presented topographic data on the many subdued circular depressions on Mars' northern plains. The depressions are probably impact craters, partially buried under 1 to 2 kilometers thickness of lava and sediment that make up the plains. The northern lowlands of Mars were believed to be relatively young, but (based on these depressions) the surface beneath the lava and sediments is quite ancient. It has approximately the same abundance of craters as the southern highlands, and so is about the same age.

Chemical analyses from the Mars Pathfinder spacecraft and infrared spectra from the THEMIS instrument on Mars Global Surveyor have engendered the surprising suggestion that andesite is common on Mars. Andesite lavas on Earth form mainly near subduction zones, and there is no strong evidence for subduction (or plate tectonics) on Mars. A recalibration of the Mars Pathfinder data, at last year’s LPSC conference, revised the composition of the rocks near its landing site to have less silica (SiO2 down by 5 to 9 weight %), making its rocks look more basaltic than andesitic. At this year’s LPSC, Michael Wyatt (University of Tennessee) discussed THEMIS infrared spectra for the northern plains of Mars, which have been interpreted to represent abundant andesite lavas or ashes. Wyatt showed that the spectra are equally consistent with aqueously altered basalts. The "andesitic" spectra occur across the northern plains, which may have once contained an ocean or lake of water (based on geomorphic evidence including possible shorelines). Could the ocean’s water have altered basalt lavas?

Martian meteorite ALH84001 has maintained its interest as a possible host to Martian bacteria or bacterial fossils, although evidence against these ideas continues to mount. Over the last few years, this debate has focused on some sub-micrometer magnetite crystals in the Martian carbonate deposits in the meteorites. Are these magnetites identical to those made by the terrestrial bacterium MV-1? If so, does this identity imply that the Martian magnetites were also made by bacteria? Two separate groups (headed by D.C. Golden of NASA Johnson Space Center and by Andrea Koziol of Miami University of Ohio) produced magnetite grains (by thermal breakdown of iron carbonate) that they claimed were identical to the grains in ALH84001. However, Kathie Thomas-Kenntna (NASA Johnson Space Center) and her colleagues disagreed pointedly, both in their presentation and in question and answer. They maintain that these magnetite grains in ALH84001 are quite distinct from the grains produced in the laboratory. There was no consensus. Further uncertainty was contributed by M. Weyland (University of Cambridge), who showed three-dimensional reconstructions of these magnetites based on transmission electron tomography. This innovative method, analogous to CAT and PET scans used in medicine, allowed Weyland to produce accurate three-dimensional models of magnetite crystals from the bacterium MV-1. Distressingly, these tomographic reconstructions bear little resemblance to the accepted shapes of the MV-1 magnetites. In the view of Peter Buseck (Arizona State University), the shapes of these magnetites are still known poorly.

The earliest Lunar Science Conferences (predecessors of the LPSC) focussed on the Apollo lunar samples, and studies of the Moon are still integral to the conference. Results from spacecraft missions of the last five years are still being analyzed. This year, the Gamma-ray Spectrometer team from the Lunar Prospector spacecraft has produced global maps of the concentrations of all major rock-forming elements. Much of the data is direct detections, and the remainder are based on element correlations from lunar samples (e.g., Al is assumed to correlate with Fe). In general, the new global maps show consistent patterns, but large uncertainties prohibit detailed interpretations. The South Pole-Aitken basin is the largest impact structure on the Moon and presumably exposes rocks from the lower crust or upper mantle. The new maps show elevated amounts of Mg on the floor of this basin, but uncertainties in the technique prevent the determination of the precise rock composition. Because of the strength of gamma ray emissions from thorium, it is most simply detected, and a new map shows Th abundances with a resolution of 15 km.

The issue of a lunar "cataclysm" remains a point of controversy. This idea, rehabilitated by the late Graham Ryder, holds that the Moon formed rapidly at 4.5 Ga and experienced little impact cratering until about 3.9 Ga. Then, in a short cataclysmic period, all of the Moon's large basins were formed by impacts of asteroids or comets. This scenario itself is disputed—some workers argue that there was a continuous but declining flux of these large impactors, and that impact melts from these early collisions were destroyed by later impacts. On the other hand, it is possible that no ancient impact melts are found because there never were any. Dynamic models of the early solar system have difficulty explaining a cataclysm; a large population of planetesimals must be 'stored' for about 500 million years and then released into the solar system at about 3.9 Ga. A new suggestion by John Chambers (NASA Ames Research Center) is that the solar system originally had another "inner planet" which migrated away from the Sun and then broke apart at 3.9 Ga to form the objects that hit the Moon. One clear way to solve this problem would be to determine the age of the oldest and largest impact feature

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A better understanding of the geology and mineral potential of Africa is important in the overall context of social and economic development across the continent. Four decades ago, scientists undertaking geological research in Africa decided to hold a meeting to exchange ideas and discuss results. Consequently, in 1964, the "Colloquium of African Geology" (CAG) was born. At the beginning, this meeting was limited to Heads of Departments and selected scientists. Afterwards, growing numbers of participants made this meeting a must for all geologists and students of African geology, so that 500 delegates attended the colloquium in Berlin (1987) and Nancy (1990).

Between 1965 and 1990, CAG was held in Europe, and catered mainly for European scientists and African scientists and students (English- and French-speaking) domiciled in Europe. During this period, CAGs were held in London (1965), Clermont-Ferrand (1969), Leicester (1971), Florence (1973), Leeds (1975), Göttingen (1977), Montpellier (1979), Open University, UK (1981), Turin-Brussels (1983), Saint Andrews (1985), Berlin (1987) and Nancy (1990). In 1990, the decision to organize the next CAG in Africa was taken. So in 1993 the well-attended and highly successful 16th CAG was held in Swaziland, but only 45 delegates attended the 17th CAG in Harare, Zimbabwe in 1997.

The Geological Society of Africa then decided to alternate the biennial CAG between Europe and Africa. Thus, at the 18th