Newsletter

Issue 5
July 2009

The Antarctica Issue

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CRONUS-Earth 6th Annual Meeting
October 16-17, 2009
Portland, Oregon

Room Registration Deadline:
September 1, 2009

6th Annual Meeting

By Lisa Majkowski

The CRONUS-Earth 6th Annual Meeting will be held on Friday October 16 and Saturday, October 17, 2009 at the Crowne Plaza Hotel in downtown Portland, Oregon. This is a critical meeting and it will run from 8:00 AM to at least 6 PM each day. With this in mind, please plan to arrive in Portland on Thursday, October 15, 2009. We will be paying for all of the hotel expenses directly. Please contact Lisa for you room reservation by September 1, 2009. To keep costs down, the rooms are double occupancy – please indicate your roommate preference when contacting Lisa. CRONUS-Earth will reimburse your roundtrip airfare to Portland, airport parking, ground transportation to/from the hotel and meal per diem for one day. All of the other meals will be provided during the meeting. As with previous meetings, if you are attending GSA, CRONUS-Earth will pay for half of your airfare.

We will have a group dinner on Friday night. If you know Portland well and have a recommendation on where to go, please send that information to Lisa.

The meeting itinerary is under development and a preliminary version will be sent out at the end of August. Please send itinerary items to Fred.

Unfortunately, the Crowne Plaza does not have any available rooms during GSA. It seems as though the GSA hotels are booking up very quickly this year. Please plan accordingly.

See you in October!

Intercomparison Samples!!

Do you still have ^{10}Be/^{26}Al or ^{36}Cl intercomparison samples in your lab?? Finish them up and send the results to Marion! Now!!

Antarctic Deep Coring Project

By John Stone

One of the persistent problems in the study and use of cosmogenic nuclides has been to identify and calibrate all of the individual reactions that contribute to the total production of each nuclide. This is important, because different reactions scale differently with altitude and latitude, and depend in different ways on the chemical composition of the target rock. Individual reactions can be calibrated with lab-based studies of irradiated targets, though lots of data are required to cover the range of cosmic-ray energies involved, and specialized accelerators are required to produce neutron and muon beams to simulate the dominant components of ground-level cosmic radiation. In natural samples, the products of different reactions can be separated to some degree by measuring depth profiles, which separate spallation and near-surface neutron capture products from muon-produced nuclides. The choice of sample sites is important. On the one hand, calibrating deeply-penetrating muon reactions requires a freshly created or deeply eroded surface, to avoid material previously exposed to deeply-penetrating muons. On the other, the build-up of muon-produced nuclides to measurable levels requires a long exposure period.

To address these problems, the CRONUS project proposed to drill calibration cores in ancient bedrock surfaces in the McMurdo Dry Valleys, in the Transantarctic Mountains. A great deal of previous research has shown that these are among the oldest and least rapidly eroding surfaces on Earth. Parts of the Dry Valleys are believed to have been continuously exposed for more than 13 Myr, and erosion rates as low as a few centimeters per million years have been measured. This ensures high nuclide concentrations, and makes production rates derived from the depth profiles insensitive to the erosion history. Finally, the upland landscape is dominated by quartz sandstone and coarse-grained dolerite, providing calibration material for ^{3}He, ^{10}Be, ^{14}C, ^{21}Ne, ^{26}Al and ^{36}Cl.

In January this year John Stone, CRONUS graduate student David Argento, and drillers Kyle Webster and Steffan Colls met in McMurdo, collected together 7000 lbs of drilling equipment, fuel and food and established camp on Beacon Heights, a narrow neck of sandstone separating Beacon and Arena Valleys. Drilling at rock temperatures well below zero is difficult – you can't use water to cool and lubricate the operation. Drilling in the Dry Valleys is doubly complicated by the need for zero environmental impact. For the quartzite core at Beacon Heights we used compressed air to cool the bit and flush cuttings back up the hole, a technology that Webster Drilling has pioneered for coring intact permafrost. This took us rapidly to 5.2 meters with close to 100% recovery. Below this we struggled for a few meters, looking for the right combination of drill bit, penetration rate and drilling speed. Core quality dropped off a little down to 9.2 meters, where Kyle hit on the long-suffering tungsten carbide bit – "Old Faithful" – that then took us on to 23 meters. In the end, six days drilling produced 27.63 meters of accurately located core, with roughly 90% recovery. The core diameter is 62 mm, so each meter provides us with 7.5 kg of clean quartzite, which should amply cover our calibration needs.

For the rest of the season we moved on to a dolerite plateau in Wright Valley, at the eastern end of The Labyrinth. Here, our second effort was less successful. Earlier in the season the drillers had learned that compressed air was ineffective for drilling dolerite, which requires an antifreeze fluid, propylene glycol, to prevent overheating of the diamond bits. Fortunately the plumbers in McMurdo had a stock on hand and NSF worked overtime to approve the unanticipated change in our environmental plan. (Unlike the green fluid in your car's radiator, propylene glycol is a benign substance used in everything from toothpaste to Twinkies, including protecting McMurdo plumbing through the winter). After setting up an elaborate fluid containment and transfer system, drilling proceeded smoothly to 1.8 meters. Here we hit a joint or fracture and began to lose the drilling fluid, necessitating a quick shut down and baling out of the hole. Unable to risk further fluid loss, having no means to seal the fracture, nor water at the site to drill on with, we reluctantly shut down, packed up and returned to McMurdo.

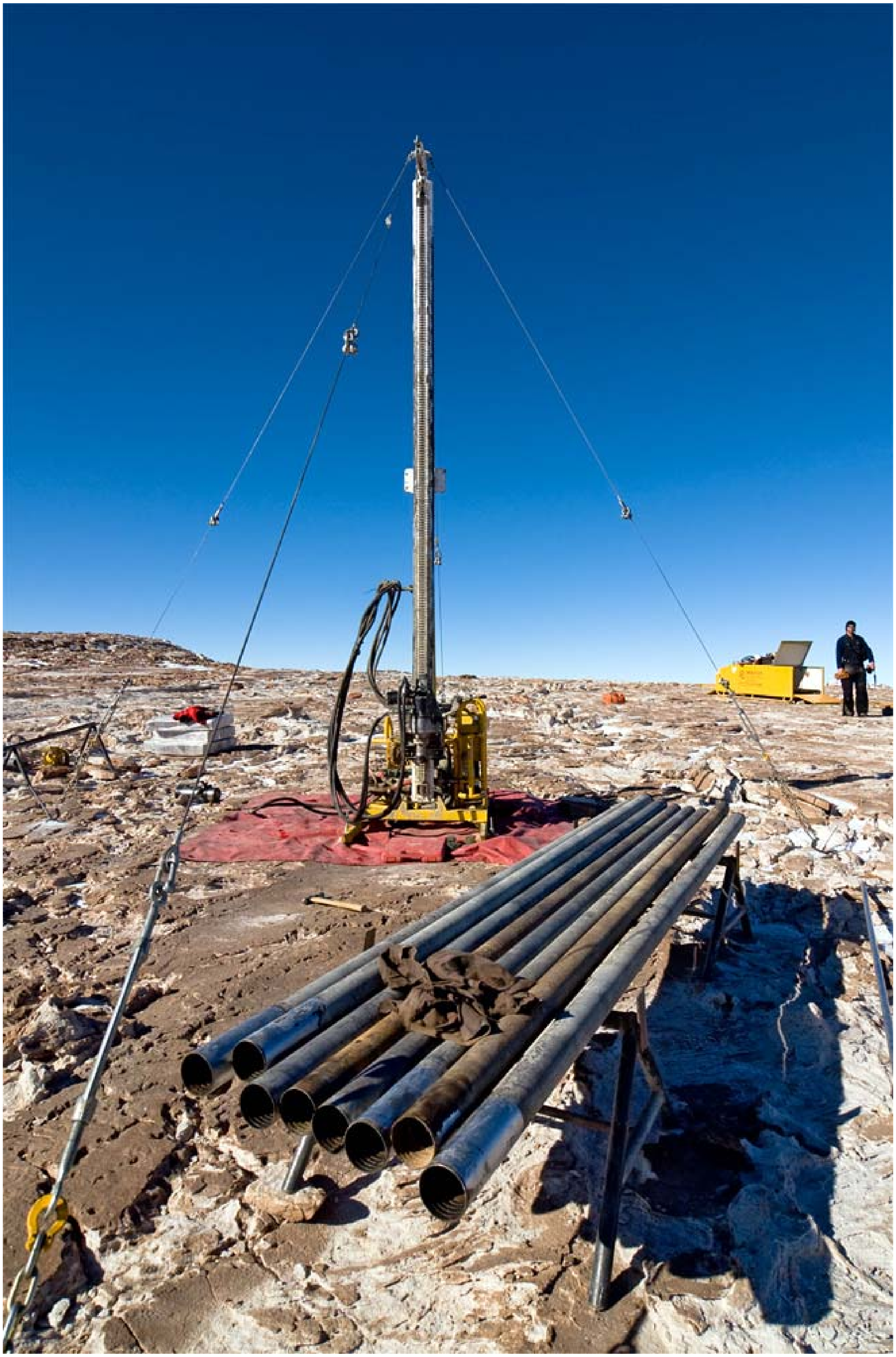
Although the dolerite core does not extend deep enough to reach the muon-dominated part of the profile, it will be useful to the project. It covers more than three attenuation lengths for spallogenic production, allowing us to define this part of the depth profile precisely. It consists of clean, coarse-grained plagioclase and pyroxene which will be easy to separate for ^{3}He, ^{21}Ne and ^{36}Cl measurements. To install the flow-return system we also had to drill out a 15cm diameter by 12 cm deep plug of dolerite from the outcrop surface, which provides us with a further 5-6 kg of rock for detailed study at the top of the profile.

The cores arrived in Seattle in May and are currently being marked and sectioned. If you'd like to work on this material, please contact Fred (phillips@nmt.edu) and John (stone@geology.washington.edu).

A final word of thanks goes to Tom Wagner and Polly Penhale from the NSF Office of Polar Programs, who did so much to facilitate the project, and just about everyone from the US Antarctic Program at McMurdo.


Quartzite strata beneath University Peak, on Beacon Heights. This section is stratigraphically equivalent to the section penetrated by the sandstone core. Note the dolerite sill climbing through the section.


View east across Beacon Heights to Ashtray Basin, Arena Valley and Taylor Glacier. The sandstone core site is in the middle of the small triangular plateau in the center of the picture.



Rig and drill rods on Beacon Heights (before installing the shelter around the drill).

View over camp and drill site on Beacon Heights, after a snowstorm on the second night.

Setting up the drill and fluid circulation system at The Labyrinth (dolerite) site.

Drillers Kyle Webster (right) and Steffan Colls on the summit of University Peak, waiting for helicopter support to move the drill across to the Labyrinth site.

Quartz sandstone core from 1.4 – 2.6 meters. Recovery was close to 100% in the top 5 meters of the hole, as shown by the quality of the core here.

Sandstone core interval from 10.3 – 12.7 meters.

Upcoming Conference and Meetings

CRONUS-Earth Science 6th Annual Meeting
October 16-17, 2009 (Portland, Oregon)

GSA 2009 Annual Meeting
October 18-21, 2009 (Portland, Oregon)
http://www.geosociety.org/meetings/2009/

AGU 2009 Fall Meeting
December 14-18, 2008 (San Francisco, California)
http://www.agu.org/meetings/

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