

NELSAM update

July 22, 2005

The progress that was made since the previous update (June 12, 2005) is presented here/

Characterization of the Pretorius fault focused during the last month on two topics. First, new portion of the reactivated segment of the Pretorius fault were mapped. This segment was reactivated during the $M = 2.5$ event of December 12, 2004, and it was first mapped in a limited region with ~ 10 m length. Recent extension of one of the mine new built tunnels (Man & Materials haulage, 120 level development) revealed new exposures of the reactivated fault that are consistent with the previous ones: slip occurred along the contact between the quartzite host rock and the pseudotachylites, and slip occurred along multiple surfaces, both faults and bedding surfaces. Further, the new mapping shows that the slip during the $M = 2.5$ event occurred along a zone that is at least 35 m long zone. Second, we continue to map and sample in our drilling cubby area (level 118). Mapping has been done in 1:5 and 1:50 scales and oriented samples will be collected next week with cores up to 1 m long.

Long boreholes drilling. In the previous report "...we hope to start drilling by June 27..." Well, we are not there yet. The drilling rig is already inside the cubby, electrical connections are in place, and it seems that drilling will start very soon. Boart-Longyear will drill four long boreholes (40-60m long) of 75 mm diameters; the holes are as follows (see attached map):

DAFAULT1 and DFAULT2 are two 60 m long boreholes each to be drilled into both sides of the cubby, and they will be collinear with each other to facilitate commulative creep measurements. These hole are inclined at 20° (parallel to the host layers inclination), and they will extend beyond the maximum width of the Pretorius fault and its associated faults. Creep meters and thermister arrays will be installed here by USGS team.

DAFBIO will be drilled in an upward direction (25°) to length of 40 m. This hole will serve for microbiology monitoring and experimentation (Princeton & UFS teams).

DAFGAS will also be drilled in an upward direction (25°), next to the DAFBIO hole. It will be used for continuous monitoring of gas emission (GFZ and GSI).

We also plan to drill in the cubby area up to 8 short and small diameter holes (43 mm and up to 8 m long); these holes will be used for the acoustic emission array to be installed by GFZ and U of Tokyo teams.

Installation of accelerometers/EM/thermistors. These systems will be installed in nine boreholes that are 75 mm in diameter and 10 m to 30 m long, and one hole of 150 m length. The drilling for these systems in the 120 level is on its way: Sites

#10 and #13 were completed including the installation of one accelerometer (dual 3-component system) in each one (USGS); site #9 (30 m) is currently at 6 m. Malcolm finished to build 18 accelerometers/seismometer systems and all are waiting for installation in ISSI. Calulo, the drilling company of the seismic holes is late in performance.

Borehole camera logging. We reported previously that the DOPTV system was operated by the OU/Stanford team that successfully logged the vertical hole #10 (down to 10 m depth), and since that time we logged another short vertical hole (#13). These two holes display clear bedding, fault surfaces, and breakout zones, were identified in both holes, as well as drilling induced hydrofracture in hole #10.

The main camera logging challenge was accomplished in July 11-14 when we logged 418 m in the borehole LIC118. This hole is drilled by the Geology Department of TauTona mine at site #5 as part of their ore and structure assessment. The hole is inclined at 15° (deviation of 75°) and its diameter is 60 mm. Logging such gently inclined hole requires attaching the camera to the drilling system and pushing/pulling by the drilling rods, and we built a special adaptor for this purpose. The images of this logging are dark, as was observed already in the test runs, but the data is sufficiently clear for analysis. Breakout zones, fault zones and bedding surfaces can be recognized.

The logging was a major task with participants from OU, University of Western Cape, University of Free State and the Rock Engineering team of TauTona mine. Some of us stayed underground for 18 hours. While the logging was successful, the cable was damaged, and we cut about 250 m (out of the original 600 m).

People at work in TauTona mine for NELSAM (from June 12, 2005):

South African investigators and support:

We could not achieve any accomplishments in NELSAM without the incredible and indispensable support of **Shawn Murphy, Pieter van Zyl, Rob McGill, George Kgori** (TauTona mine), and **Gerrie van Aswegen** (ISSI). Also, the work, advice, and suggestions of the professionals in the **Rock Engineering** and **Geology** departments of TauTona mine, and **ISSI** made great contributions.

Students:

Two PhD students of U of Oklahoma work now full time in TauTona mine: **Vincent Heesakkers** (Jan. 4 to July 6) and **Matthew Zechmeister** (June 4 to Aug. 13). **Kate Moore** (Honor student, U of Oklahoma) worked in TauTona mine during January on the initial stage of NELSAM. **Amie Lacier** (PhD student of Stanford) came for four weeks (March-April) to participate in the borehole camera logging and site survey. The two students of University of Western Cape, **Selwyn Adams** and **Curnell Campher**, return for June 12-July 15 for another month of work in TauTona mine to complete their Honor Thesis fieldwork. They previously worked in NELSAM during the month of January 2005, when they were joined by **Reggie Domoney**, their teacher of University of Western Cape.

Investigators:

Ze'ev Reches (U of Oklahoma) has been working in TauTona mine since Jan. 4 and he will continue until July 21 (with several breaks). **Tom Dewers** (U of Oklahoma) worked in TauTona mine during January on the initial stage of NELSAM. **Malcolm Johnston** came for a week (May 15 to May 23). He was joined by **Peter Essick** of National Geographic who came for three days to photograph the accelerometer installations. The microbiology team of University of Free State, **Esta van Heerden, Derek Litthaur** and **Lizzele Piater**, came for two planning visits for DAFBIO and the continue their great logistic support. On June 2, the NELSAM site was visited by **Georg Dresen, Jorg Erzinger, Onno Oncken** (GFZ), **Alex Milev** (CSIR) and **Masao Nakatani** (Tokyo University). The setting and design of the gas monitoring borehole and the acoustic emission array were discussed during this visit. **Yair Barak**, a photography teacher in the art school Camera Obskura, Tel Aviv, came to photograph the NELSAM operations (June 2 to June 7). **TC Onstott** (Princeton) intend to come in early August.

