NANGA PARBAT GEOMORPHOLOGICAL EXPEDITION

Michele Clarke and Christine Scott

Ref: 90/29

A. Fieldwork Timetable:

07.09.90 in Gilgit: purchase supplies and jeep hire
08.09.90 Gilgit - Tarshing by jeep
09.09.90 Walk to Nanga Parbat Base Camp
10.09.90 - 12.09.90 Silt sampling in Rupal Valley
13.09.90 Return to Gilgit
14.09.90 Rest day; purchase supplies and hire jeep to Rakhiot
15.09.90 Gilgit - Rakhiot by jeep and walk to Fairy Meadow
16.09.90-17.09.90 Silt sampling in Rakhiot Valley
18.09.90 Return to Gilgit
19.09.90 Rest day; purchase supplies and hire jeep
20.09.90 Gilgit - Astore by jeep and walk to Rama
21.09.90-22.09.90 Silt sampling in Rama Valley
23.09.90 Return to Gilgit
24.09.90 Rest day

B. Sample sites:

(i) Glacially ground silt was sampled from the following 5 sites:

RP1a Hange Glacier snout.
RP1b Rupal glacier end moraine.
RP1c Shaigiri glacier snout.
RA1a Sachen Glacier snout.
RK1a Rakhiot Glacier snout.

(ii) Silt produced by cold weathering processes was sampled from 5 debris fans:

RP2a Rupal Base Camp debris fan.
RA2a Forested debris slope, Rama valley.
RA2b Unforested debris fan, Rama valley.
RK2a Rakhiot Bridge debris fan.
GT2a Gilgit Valley debris fan.

(iii) Bedrock samples of Nanga Parbat Gneiss were collected both to test the overall sensitivity to thermoluminescence and to use in a series of control tests (see section D(iv)).

C. Field Report

Apart from the difficulties of field sampling due to the adverse physical environment, difficulties were experienced as regards sampling for thermoluminescence. To obtain a TL signal of intensity greater than that of background radiation, the sample must have been buried (away from sunlight) for a considerable period of time (eg 2000 years). Normal TL sampling is either undertaken in the dark at night, as is the case with unconsolidated sediment; or with consolidated sediment, blocks are cut out of the face in daylight and the outer light-exposed layers are later removed in a dark room during TL preparation. The sampling problems we experienced occurred as a result of the nature of the silt, which was found to be unconsolidated at all of the above sites and therefore required night sampling. However the terrain was too difficult and we considered it to be too dangerous for night sampling to be practical. A compromise situation was reached in which we sampled the unconsolidated material in daylight, ruling out use of the natural TL signal, but enabling us to regenerate a TL signal in the laboratory using an irradiator (see section D(iv)).

D. Proposed laboratory analysis

(i) Particle size analysis

A sub-sample of each of the above will be tested in the Sedigraph Particle Size Analyser and grain size curves plotted. Of particular interest is the 4-11μm size class which is used in TL preparation.

(ii) Scanning Electron Microscopy

Individual grains of each sample will be viewed and photographed under an Hitachi 520 scanning electron microscope (SEM). The samples will be chemically "washed" with hydrogen peroxide solution for removal of organic material and dilute hydrochloric acid to remove carbonates. Individual grains are cemented onto a 1.5cm aluminium SEM stub using quick-drying Araldite. The stubs are then placed in a sputter coating unit and a covered with a few angstroms of gold to enhance conductivity during electron bombardment.

(iii) Rock weathering control experiments.

In these control tests, lumps of Nanga Parbat Gneiss will be subjected to large overburden pressures in an oedometer until fracture occurs. Silt-sized fragments produced in this way will be then laboratory-irradiated and tested for thermoluminescence (TL). The oedometer test is designed to simulate weathering under a high-pressure environment such as that in which glacially-ground "rock flour" is formed. To simulate cold weathering, a lump of Nanga Parbat Gneiss will be subjected to freeze-thaw experiments. Any silt grains produced will also be laboratory-irradiated and tested for their TL.

(iv) Thermoluminescence

All TL preparation and testing is carried out in subdued orange lighting as normal light conditions affect the TL signal. As with the SEM method the silt samples are chemically "washed" with hydrogen peroxide and hydrochloric acid. The 4-11μm size fraction is then isolated by settling in 0.01N sodium oxalate and precipitated onto 1cm diameter aluminium discs. These discs can then be placed in an irradiator and subjected to radiation emitted from an Am/Sr90 beta source for set time periods. The irradiated discs are then "glowed" to measure their induced thermoluminescence signal over the 300°C-500°C temperature range under coloured filters of different wavelengths. As different minerals emit light in different wavelengths (quartz emits in the blue part of the spectrum whereas plagioclase feldspars emit in the green) we aim to test each sample in 8 different wavelength bands ranging from ultra-violet to infra-red.

In theory, the different stress environments involved in glacial grinding and cold weathering could have left an imprint on the crystal lattices of gneissic minerals. This imprint would be in the form of structural defects which trap electrons to produce the TL signal. Different stresses may produce different defects which, in turn, may generate changes in the TL signal emitted. This may be in the form of different wavelength emissions or varaitions in glow curve shape within a particular waveband. Therefore it is possible that the same minerals may emit a different TL signal as a result of their stress history.

E. Expenses

(i) Subsistence:

7 nights in Gilgit, food and accomodation at £10 each: £140
11 nights camping in the field and food at £5 each: £110

(ii) Jeep hire:

Gilgit - Tarshing: £30 each way
Gilgit - Rama: £15 each way
Gilgit - Rakhiot: £15 each way

total: £120

(iii) Porters:

6 porter days at £10 a day: £60

(iv) Insurance: £45

Expenses Total: £475
personal contribution: £225
MEF 90/29 grant: £250 (reduced from £500 on our request)