Geochemical composition of erosion products in Central Nepal : contraints on landslide and soil erosion processes.

GUILLAUME P. MORIN[1*], CHRISTIAN FRANCE-LANORD[1], MAARTEN LUPKER[1], FLORIAN GALLO[1], JÉRÔME LAVÉ[1], ANANTA PRASSAD GAJUREL[2]

[1] CRPG-CNRS, 15 rue Notre-Dame-des-Pauvres, 54501, Vandoeuvre-les-Nancy, France gmorin@crpg.cnrs-nancy.fr (* presenting author)

[2]Department of Geology, Tribhuvan University, Kathmandu, Nepal

In order to interpret continental sedimentary archives in terms of erosion processes in the past, we made an effort to characterise actual landslides and soils geochemical signatures, in order to trace these processes in the river suspended load (SL) throughout a monsoon season.

To assess this question, daily monitoring of SL chemistry have been conducted during 2010 monsoon in two watersheds : the Narayani river that drains whole central Nepal and the Khudi khola, one of its minor High Himalayan tributaries. In addition, systematic sampling was conducted on hillslopes material from soils and landslides in Khudi. This catchment was chosen because it represents typical South flank Himalayan basin exposed to severe precipitations (3.5 m/yr), and undergoes intense erosion rates as high as 2-3 mm/yr [1]. Characteristics of this watershed are : 800 to 4500 m elevation, 152 km^2, dense forest cover up to 3500 m, and active landslide erosion for at least one decade.

Source rocks, soil and landslide samples are compared to river suspended sediment using mobile to immobile element ratios. Data clearly show that soil material has undergone weathering with loss of Na, K and Ca relative to average source rocks. In contrast, landslide products and suspended sediments have close chemical signature and are only slightly depleted relative to source rocks. Geochemical composition of the Narayani SL have similar characteristics suggesting that even at large scale the erosion is dominated by physical erosion processes rather than by progressive soil development.

The results of this study show that chemical composition of SL are close to those of pristine source rocks, and contrasted with those of soil products. Therefore, active and steep reliefs are mostly eroded through landsliding rather than through soil erosion. The later is difficult to quantify using SL composition in spite of enhanced soil erosion by agricultural activity [2-3] that is significant in the Narayani Basin.

[1] Gabet *et al.* (2008) *Earth and Planetary Science Letters* **267**, 482–494. [2] Gautam *et al.* (2003) *Agriculture, Ecosystems & Environment* **99**, 83–96. [3] Merz (2004) ICIMOD *Institute of Geography, University of Berne, Switzerland*.

Electron microprobe and LA-ICP-MS analyses of ilmenite from lunar samples

CAROLINE-EMMANUELLE MORISSET[1*], SIMON JACKSON[2], MARIE-CLAUDE WILLIAMSON[2], VICTORIA HIPKIN[1] AND KIMBERLY TAIT[3]

[1]Canadian Space Agency, Saint-Hubert, Canada, (* presenting author: caroline-emmanuelle.morisset@asc-csa.gc.ca), victoria.hipkin@asc-csa.gc.ca

[2]Geological Survey of Canada, Ottawa, Canada, simon.jackson@NRCan.gc.ca, marie-claude.williamson@NRCan.g.ca

[3]Royal Ontario Museum, Toronto, Canada, ktait@rom.on.ca

Oxygen can be liberated from ilmenite at lower temperature than from silicates present in the lunar regolith, making ilmenite a key resource for human settlement on the Moon. Major and trace element concentrations of ilmenite contained in twelve samples selected from the six Apollo landing sites (10 basalts, one impact melt, and one impact breccia) and in one lunar meteorite (NEA 001) have been determined using electron microprobe and LA-ICP-MS. These analyses help us to understand the role of ilmenite in the crystallization of magma on the Moon and to determine if the ilmenite from different rock types has a specific chemical signature. Ilmenite can reach a modal proportion of up to 20% in basaltic rocks. Some ilmenite grains contain rutile, Cr-spinel and baddeleyite needles. The TiO_2 in the analyzed ilmenite from the Apollo samples varies from 52.4 to 55.9 wt% while it is noticeably lower in the meteorite sample (i.e. 51.7 to 52.8 wt%). In all samples, FeO varies from 37.4 to 46.7 wt% and MgO from 0.1 to 5.1 wt% except in the impact melt where it is higher (5.3-5.7 wt%). The largest variation observed in MgO within an ilmenite grain is of 0.3 wt% (e.g. 4.7-5.0 MgO wt%), implying that the observed variation between grains cannot be attributed to mineral zoning. So far, three basaltic samples have been analyzed by LA-ICP-MS. Cr varies from 1080 to 7580 ppm, V varies from 80 to 453 ppm and both elements are positively correlated with MgO. Zr (123-2330ppm) and Hf (5.95-85 ppm) concentrations are highest in the baddeleyite-bearing ilmenite grains. Nb (20-107 ppm) and Ta (1.85-8.52 ppm) are positively correlated but are not well correlated with Zr or Hf. REE patterns show enrichment in HREE (Ce_N/Lu_N: 0.0001-0.005) with a strong negative Eu anomaly (Eu/Eu* from 0.003 to 0.413). The ratio of MgO vs TiO_2 of the ilmenite permit discrimination of what type of sample the ilmenite is from. Ilmenite from the basaltic samples form a trend (n=355; slope=1.89; r^2=0.86) that is richer in TiO_2 for the same MgO than the impact breccias (n=11; slope=1.5; r^2=0.91) and the meteorite (n=10; slope=4.38; r^2=0.42) samples. LA-ICP-MS analysis of the remaining samples will permit evaluation of whether the observed geochemical distinctions between the three sample groups are identifiable using trace elements.