IGCP 317: Paleoweathering Records and Paleosurfaces

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The new International Geological Correlation Programme (IGCP) project 317, Paleoweathering Records and Paleosurfaces, is intended to bring together geoscientists interested in such topics as continental paleo-landscapes, the correlation of azyotic continental deposits, records of global change, and the economic potential of regoliths. The first meeting of IGCP 317 took place at the École des Mines de Paris in Fontainebleau, France, from November 25 to 29, 1991. The project leaders, Mérard Thiry (France) and Jean-Michel Schmitt (France), were also the meeting's hosts. Some 30 geoscientists from 13 countries attended this first meeting.

The first three days of the meeting were devoted to a workshop on silicettes led by M. Thiry and A.R. Mine (Australia). Thematic oral presentations were given during the first morning by the workshop leaders, M.J. McFarlane (England), V. Rayet and R. Simon-Coinon (France). These presentations focused on the mineralogy and geochemistry of silica in paleoweathered tertiary landscapes of South Australia. M. Oujidi (Morocco) also presented a study of the characterization of Triassic-Jurassic limestone in eastern Morocco.

Thiry and Mine gave short lectures describing pedogenic and groundwater silicettes from both the Paris Basin and the opal mining region of South Australia. Between lectures, there was time to inspect hand samples and thin sections from representative specimens. Both regions show similarities with respect to silification of the Tertiary sedimentary units. These similarities include: 1) a variety of quartz types, 2) the ubiquity of kaolinite, 3) the presence of pedogenic silcrete profiles complete with vertical dissolution features and titaniferous illuviation structures, and 4) the location of pedogenic silcretes along the basin margins and/or at higher topographic elevations compared to the more massive groundwater silcretes.

On the third day, participants were taken on a field excursion to several sites on the Brie and Beauce plateau of the Paris Basin. Different types of silicification in sedimentary rocks were observed. The first stop took us to see limestone of the Upper Eocene Champigny Formation, which exhibits metre-scale concordant zones of laminary silification ascending into more massive silification, and then into a discordant silified zone with solution pipes. Silification is considered to have resulted from groundwater movement after burial of the limestone by the quarts-rich Fontainebleau sands (Oligocene). Next, we visited an abandoned quarry near Montigny-Leucoin on the edge of the Paris Basin, where pedogenic silcrete was developed along with kaolinite in sandy clay of the Lower Eocene Argiles Plastiques Formation. This pedogenic silcrete profile exhibits characteristic vertical morphological zonation from basal granular, to massive to columnar, to a topmost nodular zone. Kaolinite, opal, microcrystalline quartz, anatase and illuviation structures are common. The final stop of the day was at the Oligocene Fontainebleau sands in an active quarry where the quartz sand is being used for glass manufacturing. Exposed within the quarry are three silica-cemented stratiform zones within otherwise uncemented sands. These silified zones are considered to be groundwater silcrete developed during progressive lowering of the water table. Locally, silification appears to have followed burrows within the beach-facies sands.

The last two days of the meeting were devoted to presentations on the general theme of mineralogical and geochemical records of paleoweathering. This portion of the conference began with an invited lecture by M. Pagel (France) on the use of U, Th and REE geochemistry in paleoweathering profiles. He discussed mass balance calculations through normalizations to Th, an attempt to use U-Th isotope systematics to date paleoweathering, and REE behaviour during laterization. These were frequently related to the paleoweathering and unconformity-type uranium mineralization in Saskatchewan. Subsequent presentations on this day described Tertiary and Mesozoic paleoweathering. Presentations included paleosurface morphologies in Morocco (Ben Brahim, Morocco), the paleoenvironmental significance of ferricretes (Fedoroff et al., France), lateritization and placer gold in Burkino Faso (Sanfo et al., Burkino Faso), karst development and subsequent sedimentary infilling near Querchy, France (Simion-Colpin and Astruc, France) and a discussion of Appalachian saprolites (Pavich, United States). An unusual example of albitization resulting from Triassic paleoweathering of the Massif Central was described by Schmitt (France). The day ended with a presentation by Stoops (Belgium), on a study which used micromorphological features to distinguish alternating paleoweathered and unweathered zones encountered in drill core in the Brabant Massif of Belgium.

Presentations during the final day of the meeting described Paleozoic and Precambrian paleoweathering. These presentations began with a description of kaolinite- and quartz-rich paleoweathering profiles developed in granite and gneiss of the Precambrian Hoggar Shield beneath the Paleozoic Tin-Serine Basin, Algeria (Estecoule-Choux and Hallouche, France and Algeria). An overview of Precambrian paleosols in Canada was then presented (Gall, Canada), which included discussion of the diagenetic overprinting of paleosols and the problems in identifying metamorphosed paleosols. This was followed by another presentation by Pagel (France) on the role of lateritization and paleogeomorphology in preconcentration uranium prior to the development of unconformity-type deposits in Saskatchewan. A description of the Theion paleosol in the Northwest Territories (ca. 1.34 Ga) was then presented (Gall, Canada). During this pre-
sensation, it was theorized that, based on paleosol features, geochronology and a gross stratigraphy, the Thelon paleosol likely developed during the same paleoweathering event as the Athabasca paleosol (described by Page), and the Hornby Bay and Elu Inlet paleosols. Together, these paleosols represent remnants of a widespread Proterozoic paleoweathering surface, now preserved as the Matonabee unconformity. The final presentation (Zalba, Argentina) described Upper Proterozoic and lower Paleozoic paleoweathering records and paleosurfaces within the Tandilla system, Buenos Aires province. The day was concluded by a business meeting.

The first meeting of IGCP 317 was successful in bringing together geoscientists from many countries who have a common interest, thus permitting extensive personal interaction. Geomorphologists, pedologists, and geologists were able to meet, and discover what aspects of paleoweathering were considered important to other geoscientific groups, and what analytical techniques each group used. It became clearer, for example, that some presentations described "deep" paleoweathering in older rocks, relying extensively on mineralogical and geochemical signatures for their interpretation. However, in younger examples of paleoweathering, the more prevalent signatures of paleoweathering appear to be morphological features, soil horizons, and organically formed structures. Whether the differences are a function of erosion level, biologic influence, or the influence of other soil-forming factors such as climate remains a challenging question. It also became clear that the extent of diagenetic overprinting of paleosols has not been realized and must be assessed, especially when studying Tertiary paleoweathering.

Papers based on the presentations at the meeting will be published in August 1992 in a special issue of the Earth Science series of the École des Mines de Paris. As well, IGCP 317 participants are currently working toward a worldwide inventory of paleoweathering records. It is hoped that much of the inventory will be complete for the second annual meeting of IGCP 317, to be held in conjunction with the Cuarta Reunion Argentina de Sedimentología en La Plata, Argentina, between 5-9 October 1992.

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