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Long lasting paleolandscapes stability of the French Massif Central during the Mesozoic

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Regional geodynamical evolution is mainly constrained by the sedimentary record in the basins. Usually, little is known about geodynamics of the peripheral areas and even less on the evolution of the basement areas. Continental unconformities are essential to estimate erosion rates of basement and to model the crustal dynamics that control subsidence of surrounding sedimentary basins but also uplift and erosion on their edges. Dating such unconformities has always been the stumbling block while it is a prerequisite to constrain geodynamical models.
Paleomagnetism has been proven as a suitable tool to date ferrugineous paleoweathering features. The method has been applied to paleoweathering occurrences resting on the Massif Central crystalline basement as well as to paleoweathering features affecting the crystalline basement itself. The remanence measurements were obtained at the Paleomagnetic Laboratory of the Institut Physique du Globe de Paris and data analyses were carried out using PaleoMac 5 software (Cogné, 2003). Relative dating of the paleoweathering profiles have been acquired by comparing the recorded paleomagnetic poles from the analysed samples to the apparent polar wandering path of the Eurasian plate (Edel et Duringer, 1997 ; Besse and Courtillot, 2003).
Thick red kaolinitic formations rest locally on the Massif Central basement. They are generally bounded by the Tertiary grabens and buried by the Oligocene formations. Thus these azoic red formations have classically been ascribed to the “Siderolithic” formations of Eocene-Oligocene age. They show many pedogenic features (termites burrows, illuviation and hydromorphic features and nodules) and strong relationships with paleolandscape organisation (leaned against fault scarps, infilling paleovalleys, etc.). Macro and micromorphological arrangements show that these formations are in situ paleosols. Paleomagnetic ages range from 160 Ma (Late Jurassic) in the centre of the Massif Central to 140 Ma (Early Cretaceous) in the northern parts of the massif (Ricordel et al., 2005; Ricordel, 2007;). These new ages, fairly older than the expected ones, bring considerable changes in the palaeogeographic evolution of the Massif Central during Mesozoic and Cenozoic.
Basement rocks (granites, gneiss, rhyolites and even Permo-Carboniferous sediments) show often pinkish facies throughout the Massif Central. It has been shown that these pink facies are albitised (mainly pseudomorphic replacement of the primary plagioclases into albite and alteration of the biotite into chlorite) (Schmitt, 1992; Parcerisa et al., 2009). These albitised facies are arranged in a clear succession against (?) the Triassic unconformity that gives significant constraints about their development in relation with the Triassic palaeosurface. Secondary albite and chlorite contain minute hematite inclusions, which have been dated, using paleomagnetism, to be Triassic in age (245 Ma) (Ricordel et al., 2007). Given that the alterations are of the same age as the unconformity, it then follows that the albitised facies be related to the Triassic palaeosurface and be used to track back the Triassic palaeosurface through wide crystalline areas, even far away from the Mesozoic cover.
Palaeomagnetic analyses allowed dating a large range of paleoweathering features for which no objective datings were previously available. Spatial and temporal distributions of the paleoweathering features and related unconformities provide key arguments to unravel the geodynamic evolution of the Massif Central. [U+F020]Triassic, Late Jurassic and Tertiary unconformities are superimposed on large areas of the Massif Centrall. This implies very little erosion of the crystalline basement since Triassic time, as shown by the widespread preservation of the Triassic albitized facies. Since the red kaolinitic paleosols of Late Jurassic/Early Cretaceous age rest directly on the basement rocks, large areas of the Massif Central were uncovered at this period, and more importantly no Jurassic cover was preserved (if such a cover was even deposited?) on the massif. Consequently, the Massif Central probably never did support an important (more than 500 m) sedimentary cover during the Mesozoic.
These paleosurface ages provide important constraints to crustal dynamics modeling. Identification and dating

of the successive continental unconformities are evidence for long lasting continental evolution and landscape stability of large areas of the Massif Central during the Mesozoic. The alternative hypothesis was that the Massif Central was subsidizing during Mesozoic time and covered with a 2,000 m thick sedimentary series, which was fairly quickly eroded during early Tertiary (Barbarand et al., 2001).
In the future, making substantial progress in paleoweathering profiles dating, especially in the scope of improving time resolution, will allow attempting efficient correlation between the continental records and the diverse processes involved in their development (eustatism, climate, global and regional tectonics). Moreover, progress in dating paleoweathering features and continental azoic deposits, will allow to develop a "continental stratigraphy" of climatic and geomorphological events and to establish a mass balances between weathering/erosion weathering/erosion on land and deposition in basins.

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