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Geophysical Research Abstracts
Vol. 12, EGU2010-11992, 2010
EGU General Assembly 2010

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Studies of soil and subsoil, also called regolith, are at the crossroads of scientific new challenging questions as well as new environmental needs. Historically, geological maps were focussed on solid geology. Present societal needs increasingly require knowledge of regolith properties: superficial studies combining geology, geochemistry and geophysics become essential to better understand the natural processes which govern the repartition and evolution of subsoil formations. Such progress is critical to better orient the use and management of natural and groundwater resources.

Among other techniques, airborne geophysics is appropriate to provide information on near surface, because of i) its high spatial coverage ii) the rapidity of acquisition and iii) the variety of available sensors (magnetic, spectral radiometry, electromagnetic . . .).

We illustrate the results of an airborne geophysical survey carried out in France, in “Région Centre” administrative region in the southern part of the Paris Basin. Spectral radiometry data were collected throughout “Région Centre” with a line spacing of 1 km. This method provides maps of potassium (K), uranium (U) and thorium (Th) which are the only naturally occurring elements with direct or indirect radioisotopes that produce gamma rays of sufficient intensity to be measured at airborne survey heights. Gamma-rays emitted from the Earth surface are related to the primary mineralogy and geochemistry of the bedrock and/or the nature of secondary weathering including regolith materials.

Obtained images are confronted with former geological investigations (1:50 000e geological maps). Geophysical data and geological maps are generally consistent on most of the covered area since the first-rate information delivered by the spectrometry derives from the geochemistry of the solid geology. Second-rate gamma-ray responses come from superimposed allochtonous deposits as well as in situ geochemical modifications. For instance, spectrometric data in the southern part of the region reveal a wide K-depleted area which is absolutely unexpected from the existing geological maps. Careful analysis of the available geological descriptions reveals that this geochemical signature is linked to the weathering, erosion and transport of specific source rock materials. In this context, K-depleted alluviums derive from clay with flint, (weathering product of the upper cretaceous chalk), whereas K-enriched alluviums are drainage products of the Loire River which were eroded in the Massif Central crystalline basement.

In conclusion, spectrometric data allows the discrimination and cartography of new geochemical signatures. This new form of visualisation of the geology provides the opportunity to enrich our perception of the regolith and will necessitate an update of our methods of cartography. As briefly developed in this paper, outcomes are expected both for human environmental applications (better understanding of the centre France alluvial system dynamics) and for scientific geological understanding (basin geodynamic).