
Late Oligocene-Pliocene weathering periods in Europe evidenced by new $^{40}\text{Ar}/^{39}\text{Ar}$ dating on cryptomelane from the Stavelot Massif (NE Ardenne, Belgium).

Augustin Dekoninck^{*1}, Patrick Monié², Hatert Frédéric³, Sabine Blockmans¹, Gaëtan Rochez¹, and Johan Yans¹

¹Université de Namur, Département de Géologie, ILEE (UNamur - ILEE) – Belgique

²Laboratoire Dynamique de la Lithosphère (LDL) – CNRS : UMR5573, INSU, Université Montpellier II - Sciences et techniques – Univ. Montpellier II - CC. 60 Place Eugène Bataillon 34095 MONTPELLIER CEDEX 5, France

³Laboratoire de minéralogie et de cristallographie, Département de Géologie, Quartier Agora, 14 Allée du 6 Aout, B18 Sart-Tilman, Université de Liège, B-4000, Belgique – Belgique

Résumé

The Stavelot Massif (NE Ardenne, Belgium) displays numerous occurrences of Mn-rich slates Ordovician in age (Les Plattes Member, Otré Formation, Salm Group). The Mn-bearing sediments experienced metamorphism during the Caledonian and Variscan orogenesis, leading the former Mn-carbonates to be transformed into spessartine, rhodochrosite, Mn-chloritoid and andalusite-kanonaite, some of them being associated with pyrophyllite, paragonite, kaolinite and chlorite (e.g. Herbolch et al. 2016). These levels have subsequently undergone strong weathering, leading to the formation of secondary Mn-oxides. This supergene association is mainly composed of typical weathering phases cryptomelane ($\text{KMn}_8\text{O}_{16}$), lithiophorite $[(\text{Li},\text{Al})\text{MnO}_2(\text{OH})_2]$ and manganite (MnOOH).

New $^{40}\text{Ar}/^{39}\text{Ar}$ dating of pure cryptomelane samples record at least four major weathering periods at 27 Ma, 20(-15?) Ma and 12-10 Ma in the Stavelot Massif. Ages between 5-1 Ma report the more recent weathering phase. However, some ancient weathering periods (Cretaceous, Permian ?) cannot be ruled out, as they are very common in other weathered deposits of western Europe (Yans 2003, Thiry et al. 2006), and suspected in some discordant $^{40}\text{Ar}/^{39}\text{Ar}$ spectra. The late Oligocene age might be attributed to the first effect of the Ardenne uplift, which has started at the end of the Oligocene, and continued until recent times (Demoulin et al. 2018). Therefore the combined effect of the Ardenne elevation and Cenozoic climates could explain these weathering periods. Such late Oligocene to Pliocene ages are also reported in several places in Europe (Hautmann and Lippolt 2000) and North Africa (Dekoninck et al. 2014), suggesting a long-term weathering period, which is probably linked to the global effect(s) of the Alpine orogenesis across the European plate.

References

^{*}Intervenant

Dekoninck et al. (2014). Gisements supergènes d'oxy-hydroxydes de manganèse du district d'Imini (Maroc): minéralogie, géochimie et chronologie. ASF, Orsay. References

Demoulin et al. (2018). Erosion surfaces in the Ardenne-Oesling and their associated kaolinic weathering mantle, Springer, Cham, pp. 63–84.

Hautmann and Lippolt (2000). $^{40}\text{Ar}/^{39}\text{Ar}$ dating of central European K–Mn oxides - a chronological framework of supergene alteration processes during the Neogene. Chem. Geol. 170, 37–80.

Herbosch et al. (2016). Coticules of the Belgian type area (Stavelot-Venn Massif): Limy turbidites within the nascent Rheic oceanic basin. Earth Sci. Rev. 159, 186–214.

Thiry et al. (2006). Continental France and Belgium during the early Cretaceous: paleoweatherings and paleolandforms. B. Soc. Géol. Fr. 177, 155–175.

Yans (2003). An overview of the saprolites of Belgium and their potential kaolinitic supplies to Mesozoic and Cenozoic sediments. Géol. Fr, 1, 33–37.

Mots-Clés: Stavelot Massif, manganese deposit, coticule, cryptomelane, weathering, $^{40}\text{Ar}/^{39}\text{Ar}$