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New paleo- and rockmagnetic results from La Chaine des Puys during the Laschamp event: Evidences of mineralogical disturbances.

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Forty years ago Bonhommet and Babkine (in 1967) reported on two lava flows (Laschamp and Olby) and a scoria cone (Laschamp) from the Chaîne des Puys with almost reversed directions of magnetization which were interpreted as the record of a geomagnetic excursion named after the Laschamp village. Due to specific magnetic mineralogy, these rocks were shown to be prone to self-reversals, potentially misrecording the ambient magnetic field during their emplacement. This new discovery raised a controversy regarding the origin of the directions recorded by these lava flows. Many studies were then conducted to determine the age of the event at 40 ka, which coincides with a period of low dipole field intensity and thus a high probability to observe significant departures of the field from the axial dipolar direction.

Taking advantage of new Potassium-argon age determinations, we revisited some sites and sampled several new ones in order to clarify the origin of their magnetization and hopefully improve the resolution of the Laschamp event. This study involves thermal and alternating field demagnetization of 257 samples from 20 units, including 12 new localities, and also experiments of magnetic mineralogy (susceptibility as a function of temperature, thermomagnetic curves, IRM acquisition curves and hysteresis parameters determination). The magnetic mineralogy is dominated by primary titanomagnetite with a Curie temperature of $130\pm60^{\circ}$C ($0.6<x<0.8$) accompanied with variable amounts by titanomaghemite derived from low temperature oxidation of the primary phase. Several specimens are characterized by almost pure magnetite with

Curie temperatures of 540±25˚C which can be seen as a final inversion product of titanomaghemite (0.5<z<0.8). The magnetic mineralogy is also characterized by very large within-site variability. Among the 20 units, 9 have a full normal polarity with a mean pole of 82˚N, 193.3˚E (α95=7.4˚,κ=49.6) and a dispersion of 14.3˚ (between 10.6 and 20.8˚ at 95% confidence level). The six sites studied at Olby, Louchadière and Royat display intermediate directions, which are in rather good agreement with the results of the previous studies. However at least 50% of the samples did not yield reliable direction for these intermediate lavas, whereas only 20% were rejected for the normal polarity lava flows. This points out a significant difference between the "intermediate" and the "normal polarity" lava flows. In addition the individual directions of 5 flows were too scattered to provide any suitable mean direction. Remagnetization due to lightning has been frequently observed, but it does not account for the dispersion and the absence of suitable remanence. Thus the large dispersion inherent to lava flows with intermediate directions, the large number of rejected samples and the absence of mean directions in several units that are coeval to the Laschamp questions somehow the origin of the intermediate components of magnetization measured in the Chaîne des Puys. New investigations of some rockmagnetic parameters will hopefully help to clarify the question.