Detrital paramagnetic (clays) minerals controlling the magnetic susceptibility signal and detection of detrital ferromagnetic minerals during Danian and Selandian time (Loubieng quarry, France).

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Abstract: The abandoned Loubieng quarry located close to Pau (France) encompasses the Danian/Selandian boundary (DSb). The section could be subdivided into three parts: i) the basal part of the section consists mostly of Danian whitish carbonate beds with only scarce and thin marly layers, ii) several limestone/marl alternations at the uppermost part of the Danian, and iii) the Selandian marls. The transitions between those divisions are linked to the Late Danian Event (LDE) and the DSb interval respectively. The three parts are clearly distinguishable in the low-field magnetic susceptibility curve established on 272 samples collected every 10 cm along the section up to 23 m (including the first three meters of the Selandian) and then every 25 cm in the marls.

The low-field magnetic susceptibility (X_{LF}) curve could be subdivided into eight major trends (orange arrows noted from 0 to 7) as highlighted in figure 1. The lithology has clearly an influence on the X_{LF} values as the marls have always higher X_{LF} values compared to the Danian limestones and the Selandian sandstones. Moreover, some specific carbonate beds have very low X_{LF} values, sometimes even negative suggesting a diamagnetic behaviour. Some of these beds clearly corresponds to mass-gravity deposits (probably debris flows) as confirmed by microfacies (thin sections) analysis.

To better constrain the X_{LF} fluctuations, hysteresis data have been obtained with a J-coercivity magnetometer on 55 samples selected along the section including all the different lithologies and the whole range of X_{LF} values. A very strong correlation ($r = 0.93$) is highlighted between X_{LF} and X_{HF} values suggesting that the paramagnetic particles (i.e. the clay minerals) are clearly controlling the signal. Nevertheless, ferrimagnetic particles are also detected indicating a clear contribution of these minerals

on the X_{LF} curve. The magnetic viscosity (S_d), the remanence coercive force (H_{cr}) and the contribution (%) to the high-field remanence parameters have generally good correlations between them. These parameters reveal two specific intervals where their values are higher: i) around the LDE in an interval displaying yellowish colours and ii) during the DSb interval characterized by reddish marls and limestones. The behaviour of the remanent magnetization was determined in eight samples during cooling and warming cycles on a MPMS3 – VSM (vibrating sample magnetometer). These analyses confirm the presence of goethite and hematite minerals present essentially during LDE and DSb time interval, respectively. We suggest that the paramagnetic (clay minerals, i.e. illite, kaolinite and smectite) and the ferromagnetic minerals are essentially primary minerals (detrital) deriving probably from extensive soils developed on the surrounding continental areas bordering the marine realm.

Keywords: Danian/Selandian boundary, magnetic susceptibility, magnetic mineralogy, goethite, hematite.

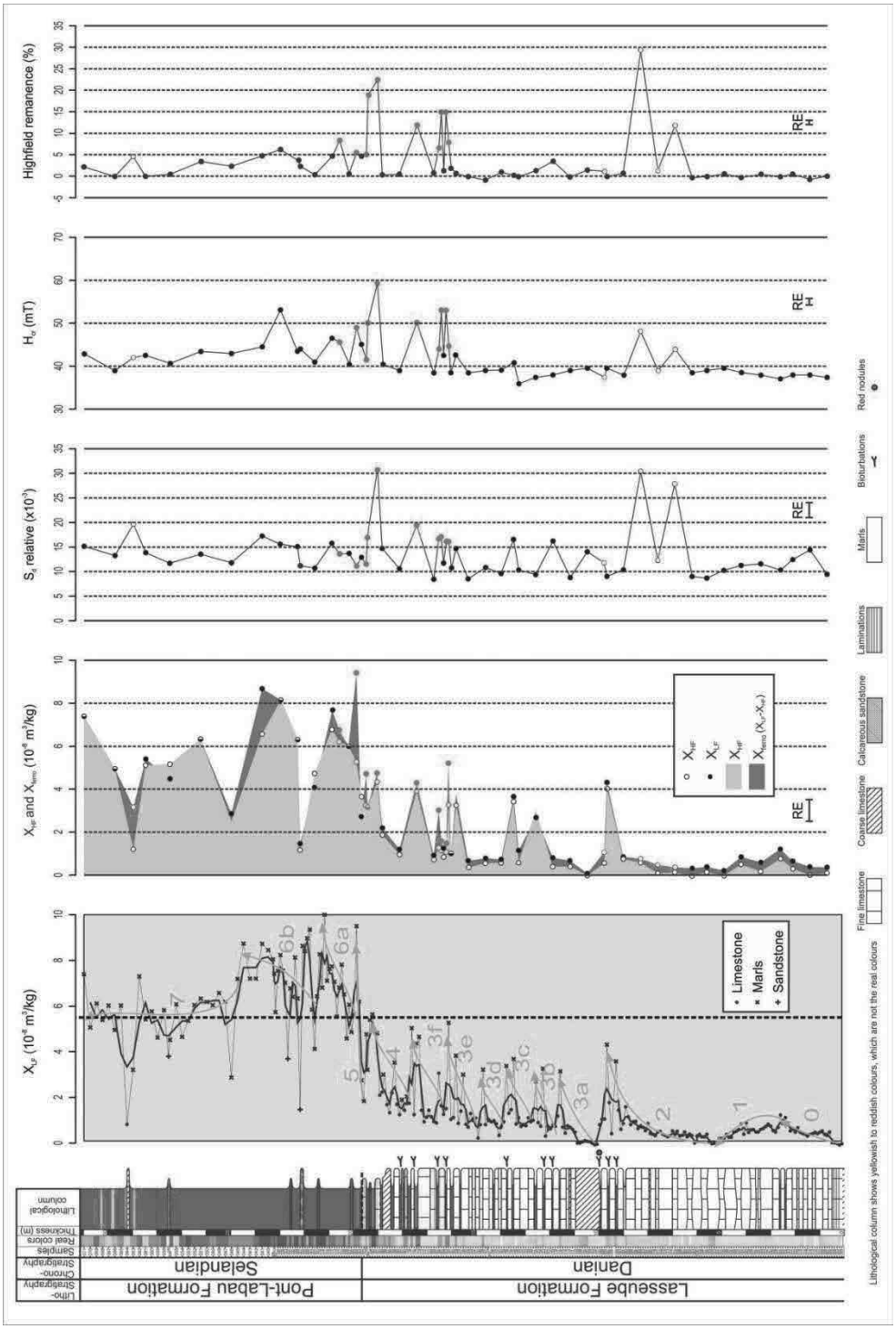

Figure 1: Low-field magnetic susceptibility and magnetic parameters deduced from hysteresis curves reported in front of the lithological column of the Danian-Selandian interval in Loubieng (France).