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Magnetic characterization of instantaneous sedimentary deposits: examples from alpine lakes

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When studying lake sediments for paleohazard reconstructions, it is necessary to highlight instantaneous deposits. Those deposits can be evidenced using grain size analysis, geochemistry, ... but also using magnetic measurements. In the present contribution, we will use the development of anisotropy of magnetic susceptibility (AMS) and magnetic mineralogy in order to evidence mass movement turbidites (MMT) in some selected French alpine lakes. Another challenging issue is to decipher between floods and turbidites seismically induced. The latter are often identified by a coarse-grained basal layer (turbidite) situated below a fine-grained homogeneous deposit (homogenite).

In the late 90th, the well-known AD 1822 homogenite from Lac du Bourget (France) has been characterized by a high value of AMS foliation. Since this time, only few magnetic investigations were carried on such deposits. Campos et al. (2013) have shown in the Sea of Marmara and Gulf of Corinth that homogenites can be differentiated from hemipelagites using their high ASM values. Other magnetic investigations are focussing on the record of Remanent Magnetization in the turbidite (Stoner et al., 1996; Tanty et al., 2016).

Mass movement turbidites were sampled for a specific magnetic study in several alpine lakes: Le Bourget, Savine, Aiguebelette, Foréant. In Aiguebelette, the magnetic parameters highlight clearly the homogenite. Important foliation of the AMS, Decay in ARM intensity and in Median Destructive Field of both NRM and ARM, combined to increase of the IRM/ARM ratio indicate coarser magnetic grains in the homogenites. The sedimentary record of Lake Foreant (Wilhelm et al., 2016) provides 171 event layers. The magnetic data from 3 of those layers is different from the 168 others. The 3 “intruders” are interpreted as MMT seismically induced. The lake Savine (Sabatier et al., 2017) exhibits 20 events over 220 that are suspected to be linked with earthquake. In the Holocene sediments of this lake, magnetic proxies were focused on a slump. The reverse limb preserves a remanent magnetization of reverse polarity.

Magnetic parameters are use in order to help the identification of sedimentary processes of instantaneous deposits (floods, mass movement, homogenite). This study highlights the efficiency of the magnetic parameters. They are a powerful tool that can fruitfully be associated to classical sedimentological studies.