Composite enviromagnetic and lithological signatures retrieved from recent sediments in the Danube Delta (Romania), with a special view to the couples of lakes

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Abstract: The paper is in regards to the use of the magnetic susceptibility (**MS**; **k**) as an investigation tool in aquatic sedimentary environments. The **MS** data bank belonging to the deltaic area is based on thousands of samples, originated in surficial sediments and cores, collected during the cruises carried out in the 1976 – 2014 period. The integrated magnetic susceptibility-lithological study performed for the deltaic lakes emphasises the allochthonous sedimentation, predominantly detrital in the lacustrine ecosystems which are directly influenced by the Danube River, comparing with the dominantly autochthonous sedimentation in the distal zones, where the organic component is mostly present. Thus, the **MS** measurements performed on recent sediments from the Danube Delta lakes show – in relation with their position to the Danubian inputs – the clear differentiation of the magnetic signatures recovered from two types of deltaic environments: "dynamic" and "confined", respectively. The paper is mainly focused on several "pairs of lakes", having a different degree of connection between them, up to the situation when the two neighbouring lakes, placed close to one another, are separated through a channel. A special attention is directed towards the case of some "couples of lakes" (an example: "Uzlina – Isacova", in Fig. 1), which could represent the situation that has been mentioned before, but at a local scale: the magnetic susceptibility is a very sensitive indicator of the net differentiation – along a short distance – of the sedimentary environments when passing from a "dynamic" towards a "confined" one. The **MS** signatures simulate and actually evaluate the natural threshold existing between the two coupled lakes (Fig. 1a,b), and the briskly water transit, respectively. Based on the values of the enviromagnetic parameter (**k**) and of the contents of the lithological components achieved for the surficial sediments and the cores, several correlation coefficients (**r**) were calculated [siliciclastic fraction (**SIL**) *vs*. **MS**, carbonates (**CAR**) *vs*. **MS**, total organic matter (**TOM**) *vs*. **MS**, **SIL** *vs*. **TOM** *etc*.]. Generally, strong positive/negative correlations were determined (*e.g*., Rădan *et al*., 2013). The vertical distribution of the magnetic susceptibility and of the lithological

components (an example, in Fig. 1d,e), associated with the cores, clearly illustrates the particular characteristics of the "confined sedimentary environments" (*e.g.*, Isacova L.) *vs*. "dynamic sedimentary environments" (*e.g.*, Uzlina L.). The normal situation relating to such "*in tandem*" positioning, as in the case of "Uzlina – Isacova" coupled lakes, reveals that the sedimentary material of mineral origin (*e.g.*, coarse siltic muds) coming (by a short canal) from the Danube River into the first lake (Fig. 1d) is settled down on the way, so that the major lithological component of the sediments from the second lake (Fig. 1e) is represented by the organic substance, the muds being fluffy and (very) fine.

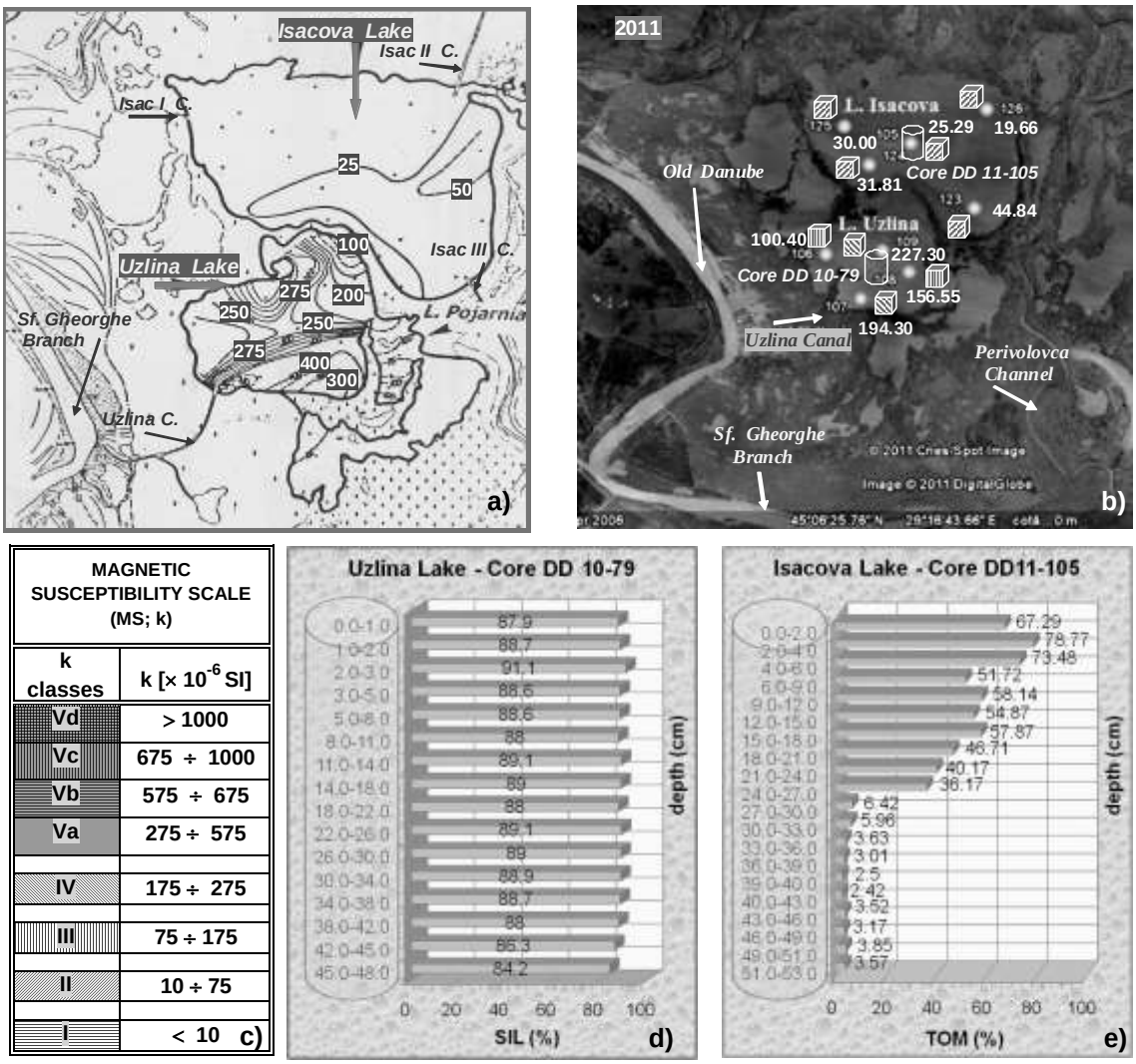

Figure 1: Magneto-lithological model for recent sediments from the Uzlina - Isacova "couple of lakes". **a)** Magnetic susceptibility (**MS**; **k**) maps (bottom sediments sampled in 1979); **b)** Areal distribution of **k** values measured on lake sediments sampled in 2011, correlated to the **MS** scale from **c**; **c) MS** scale (the color version, in Rădan & Rădan, 2007) used for bottom sediments calibration; **d)** Vertical distribution of the siliciclastic/detrital fraction (**SIL**) contents recorded for the DD 10-79 core (Uzlina Lake; core location, in Fig. 1b); **e)** Vertical distribution of the total organic matter (**TOM**) contents recorded for the DD 11-105 core (Isacova Lake; core location, in Fig. 1b). *Note*: The **MS** values in a) and b) must be multiplied by 10^{-6} [SI].

On the other side, the presence of the anthropogenic influence on some aquatic areas of the Danube Delta is clearly demonstrated by the modified magnetic fingerprints recovered from the bottom sediments and cores, at different time intervals. ”Confined” versus ”dynamic deltaic environments” were compared and defined by specific magnetic fingerprints (Rădan & Rădan, 2011). As in certain cases the bottom sediments were sampled in the same zones, in successive phases, at 5-10 years time intervals, the magnetic signatures which were recovered have clearly demonstrated the presence or the absence of the anthropogenic impact on the ecosystems. They are reliable proofs for the evaluation of the changes that were produced in the aquatic zones as a result of the pressure caused by some human activities in the area. The alterations of the hydrological regime have generated changes of the sedimentary environments, and consequently, the modifications of the magnetic fingerprints (Rădan & Rădan, 2010). To calibrate the modern sediments and to compare different magnetic fingerprints recovered from the various aquatic environments, a Magnetic Susceptibility Scale – practically originated in the sediments of the Danube Delta and the Razim (Razelm) - Sinoie Lagoonal Complex (Rădan & Rădan, 2007) – is used (Rădan & Rădan, 2007; a grayscale version, in Fig.1c). The **k** classes characterising the recent sediments can give some information on the sediment quality, which is generally evaluated by means of the geochemical and ecological scales.

Keywords: magnetic susceptibility, lithological components, sediment core, bottom sediment, deltaic environment

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