Magnetostratigraphy of upper Miocene-lower Pliocene sediments of the Black Sea Basin (Taman Peninsula, Russia)

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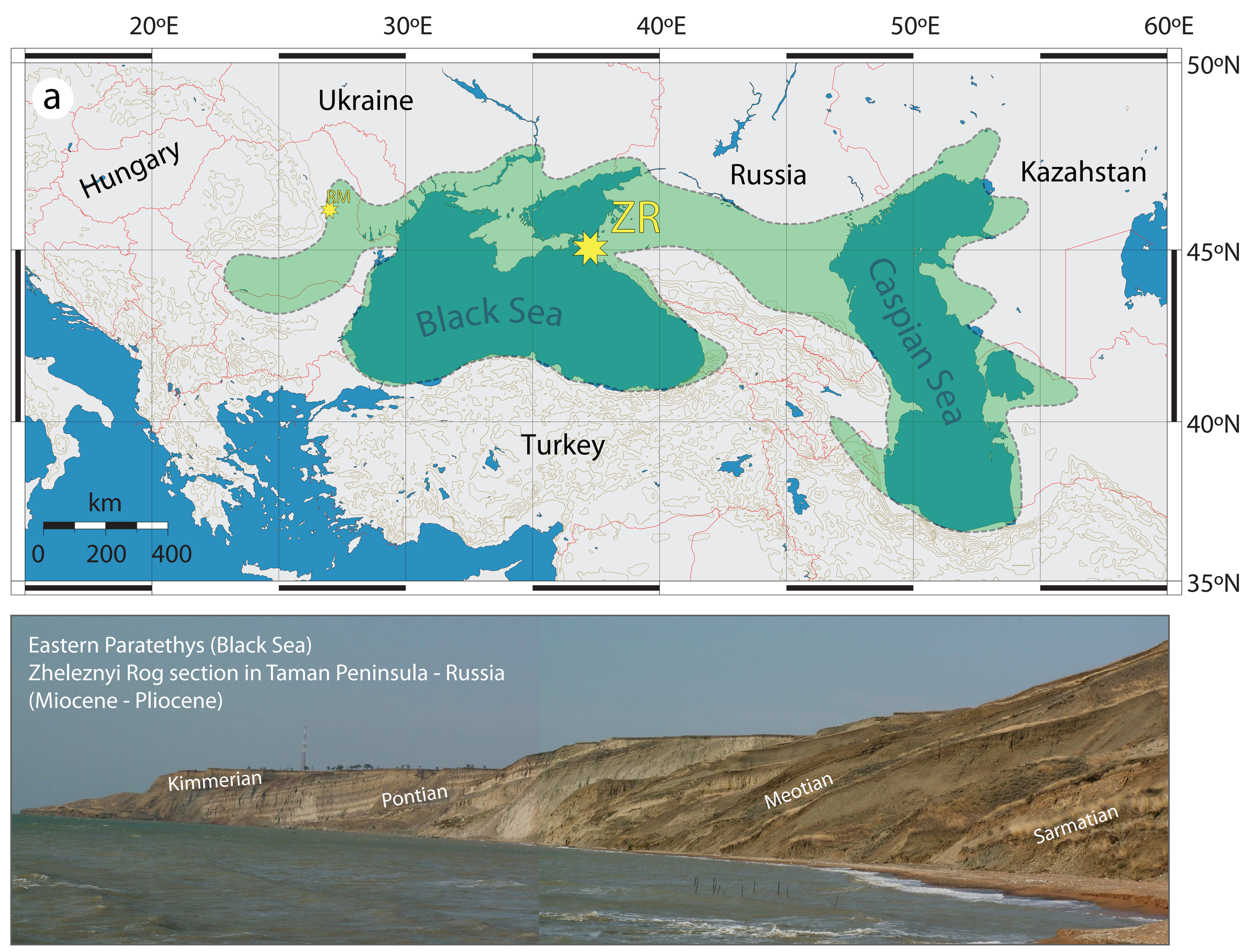

Figure 1. a) Schematic palaeogeographic map of the late Miocene/early Pliocene, showing the Paratethys area and the present-day land configuration. The big star locates the Zheleznyi Rog (ZR) section on Taman Peninsula, Russia. The small star indicates the position the Rîmnicu Sărat section, studied in Romania. b) Zheleznyi Rog section.

Introduction

During the late Miocene to early Pliocene (~11 to 3 Ma), the Eastern Paratethys domain extended from the Dacian Basin in Romania to the Aral Sea in Kazakhstan (Fig. 1). The Paratethys became progressively isolated from open ocean system, resulting in environments marked by varying salinities with marine to brackish and fresh water conditions. The Mio-Pliocene chronostratigraphic scale for the Eastern Paratethys encompasses the regional Sarmatian, Maeotian, Pontian and Kimmerian/Dacian stages, which are all defined on the basis of characteristic faunal assemblages endemic to Paratethys Sea. Correlation to the global Geological Time Scale is highly debated because radiometric age determinations are scarce and magnetostratigraphic studies are generally controversive (e.g. Trubikhin, 1977; Pevzner and Chikovani, 1978; Trubikhin, 1989). As a consequence, the ages of the Paratethyan stage boundaries can differ more than a million years in the various geological time scales (see Vasiliev et al., 2004).

Methods

In this paper, we aim to establish a magnetostratigraphic framework for the upper Miocene-lower Pliocene successions of the Black Sea Basin (Fig. 2). The Zheleznyi Rog (Iron Cape) section on the Black Sea margin of the Russian Taman Peninsula was selected. One volcanoclasic layers from upper Sarmatian deposits have been radiometrically dated using $^{40}Ar/^{39}Ar$ method.

Results

Our magnetostratigraphy sustains both, earlier obtained, black and white patterns of Trubikhin (1989) and Pevzner and Semenenko (2003) despite of the different interpretation given by the two papers. Additional $^{40}Ar/^{39}Ar$age constrains indicate that important non-deposition and/or erosion let to significant hiatuses in the Meotian part of the Zheleznyi Rog section (Fig. 4). The $^{40}Ar/^{39}Ar$ dating the volcanoclastic layer from Zhelezyi Rog, Taman Peninsula–Russia yielded a homogeneous age population at 8.7 ± 0.09 Ma (Fig. 3). This $^{40}Ar/_{39}Ar$ dating indicate that the Sarmatian/Meotian boundary in the Eastern Paratethys has to be younger than 8.7 Ma, in agreement with the magnetostratigraphy provided by Vasiliev et al., 2004 based on the Sarmatian-Meotian section in Carpathian foredeep.

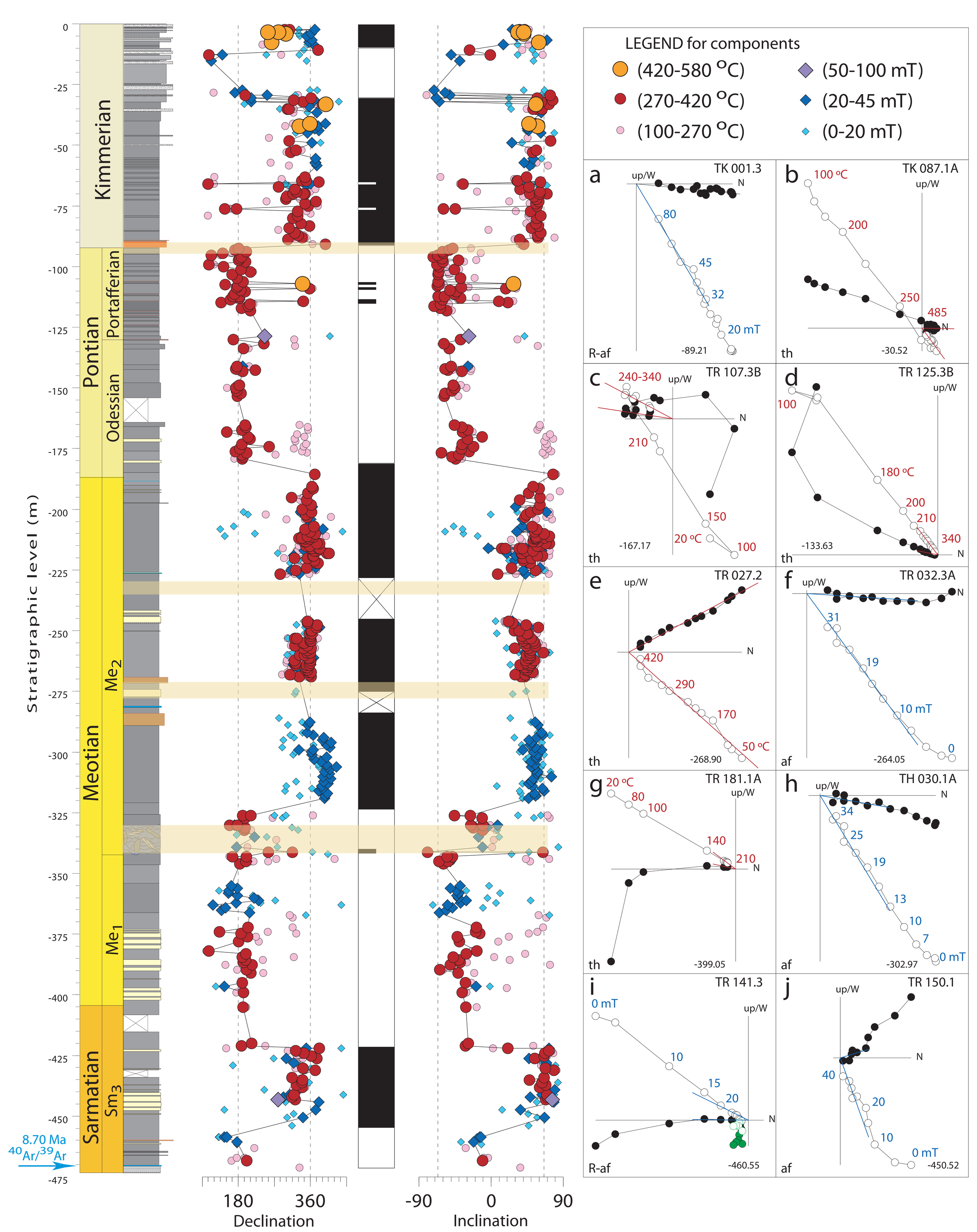

Figure 2. Schematic lithological column and polarity zones for Zheleznyi Rog section. Position of dated volcanoclastic layer is indicated. Eastern Paratethys substages are given next to lithology. In polarity columns black (white) denotes normal (reversed) polarity intervals. Different symbols in declination/inclination plots represent reliable direction of demagnetisation and the steps are according to legend (inset in right-hand side). Representative demagnetization diagrams (a-j), after tilt correction. Selected examples are displayed in stratigraphical order from youngest (a) to oldest (j). Solid (open) circles denote projection on the horizontal (vertical) plane and the attached numbers indicate temperatures in ºC.

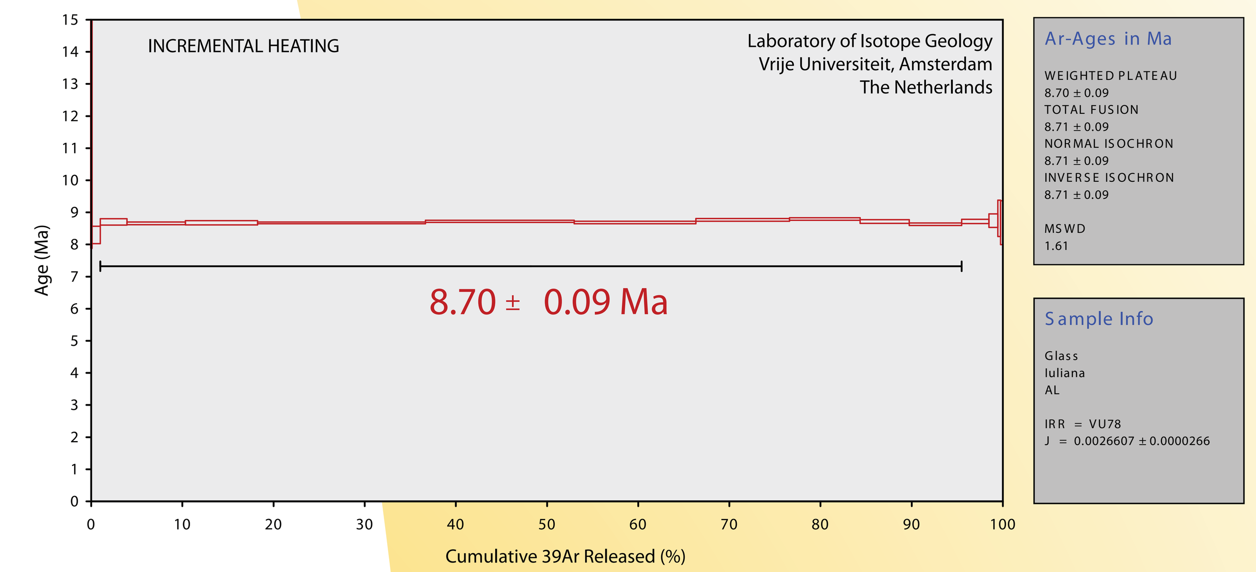

Figure 3. Results of dated volcaniclastic layer.

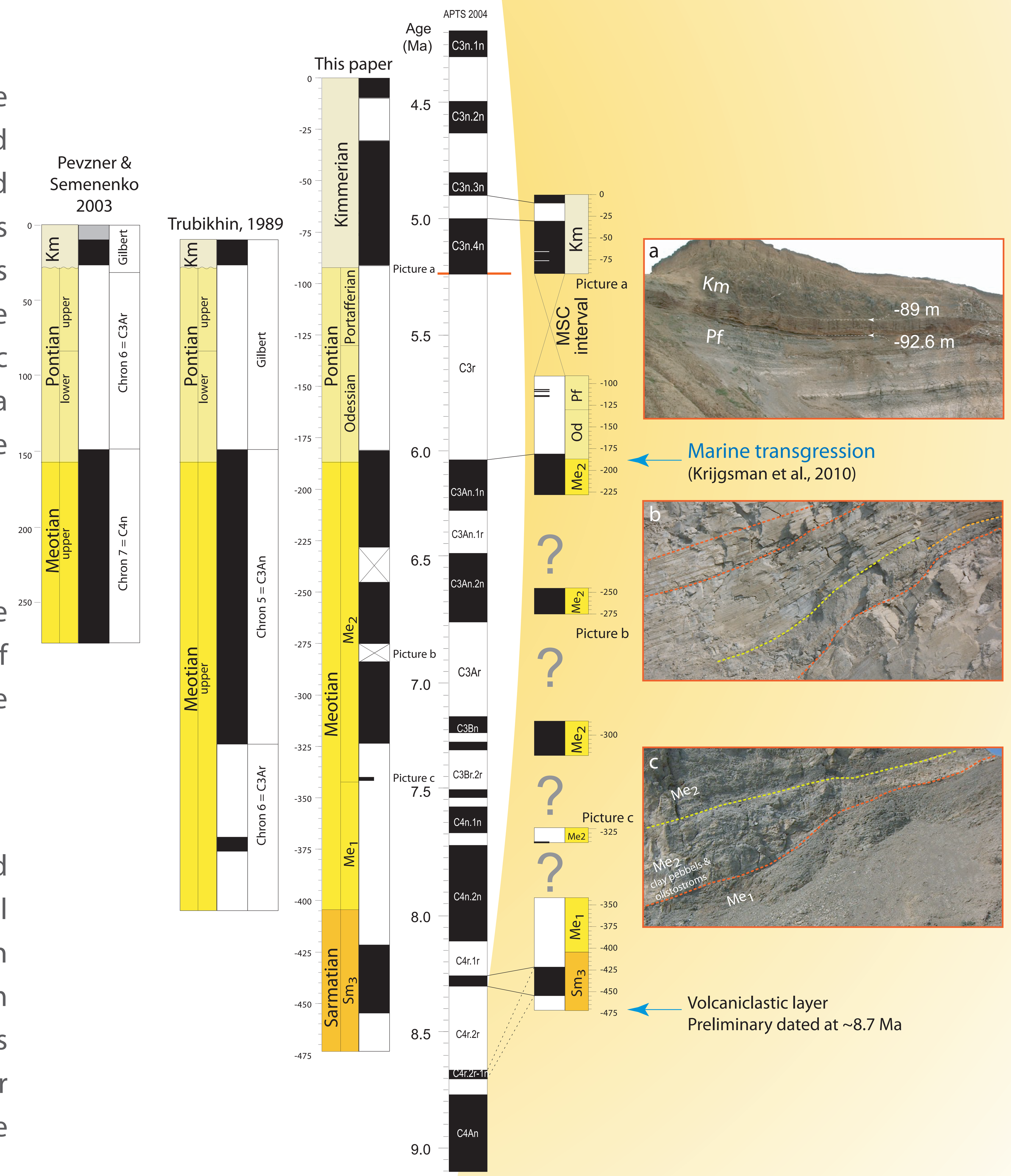

Figure 4. . Review of the paleomagnetic polarity patterns obtained for the Zheleznyi Rog section by Pevzner et al., 2003, Trubickin et al., 1989 and this research (in the let hand side). The multiple correlations of the magnetic polarity sequence to the APTS are presented. In the right hand side our correlation is indicated. The solid line between the section record and APTS connect (interepretative) simultaneous polarity boundaries. The names of the subchrons are in the column attached to the APTS. A to c are images of visible brake in the accumulation of the sedimentary deposits. a) Photograph of the distinct reddish layer marking the beginning of the Kimmerian; b) photograph of an intra upper Meotian unconformity and c) photograph at the lower Meotian- upper Meotian transition. The upper Meotian starts with the layer containing pebbly breccias and olistostroms.