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Paleomagnetic Evidence for the Tectono-Stratigraphic Evolution of the Mt.Galili Area / MER / Ethiopia

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The Mt.Galili area (N 9,77°, E 040,55°) is the focus of current anthropological studies on early hominid evolution *[4]. The Mount Galili Formation (MGF)*[5] is subdivided into seven Members, each representing a sedimentary cycle, sustaining temporally interruptions by volcanic activity. Our paleomagnetic investigation concentrates on ascertaining primary magnetisation vectors (PMV) of volcanic layers embodied within the MGF, applying alternating field and thermal magnetic cleaning methods. Magnetite and ti-magnetite are the main carriers of the NRM (basalt, ignimbrite). Hematite shares in amounts up to 20%, Goethite occasionally participates up to 30% in magnitude of the NRM components. Two events of magnetic polarity reversals terminate a magnetic inverse period designating the lot of the MGF unit. The amount of the PMV's rotation in respect to an expected paleodirection*[1] of 183°/-13° are in the range of 1°-52° . The resulting mean PMV data provide implications on (A) rift-related block rotation / tilting in relation to the stable African crust since the Pliocene and they also support (B) stratigraphic age determinations of the MGF: A: Rotational movements cluster in 4 sectors: (a) The SE sector demonstrates almost unchanged orientation of the PMVs whereas (b) it's continuation to the NW sector suffered clockwise rotational tilting (up to 12° rot / 19° tilt). (c) The SW sector (Mt.Galili area s.str.) in contrast embrace a unique counterclockwise rotation component of 7°-17°, but the modulus of vector inclination, concerning individual rift blocks, is variable in either direction. (d) The NE sector (Satkawini) sustained the major counterclockwise rotation (41°°-52° rot / 3°- 17° tilt) We consider the Mt.Galili area being the place where trans-tensional tectonics were active during the late Miocene to create the lateral off-set of magmatic segments marking the centre of the MER. This tectonics are considered to belong to a arcuate accommodation zone in respect to the migration of the Afar triple junction since~4my *[6]. Another impact of this tectonic environment concerns the generation of weakened zones within the thinned crust induced by crosscutting structural items, subsequently allowing the supply of supercritical crustal melts and finally resulting in explosive eruptions. An extensive dispersed ignimbrite layer (Dhidinley Mb.) yielded an absolute age of ~4,1 my(sanidine, Ar/Ar)*[5]. B: Our stratigraphic age determination of the MGF is focused on magnetic reversal events documented in magmatic layers upon and below the mentioned Dhidinley ignimbrite selfsame demonstrating reverse polarity of its PMV. The uppermost Caashacado Mb. of the MGF exhibits normal polarity contained in gray ignimbrite layers at the top of the pile. We consider this

reversal event providing a max. age of 3,58 my (Gauss/Gilbert crossover)* [2]. On the other hand the lowermost lava flow containing normal polarity was excavated by rotational rift block tilting. We consider this reversal event providing a min. age of 4,18 my (Gilbert/Cochiti crossover)*[2]. The mentioned age classifications are consistent with biochronological valuations *[3, 5]. References cited: *[1]: Besse, J. & Courtillot, V. (2002): J.Geophys.Res.107/B11/2300 *[2]: Cande, S.C., & Kent D.V.,(1995): J. Geophys. Res., 100, 6,093-6,095. *[3]: Kullmer O.et al (in rev.): Palaios. * [4]: Macchiarelli R.et al (2004): Coll. Antropol. 28 Suppl 2:65-76. *[5]: Urbanek C. et al (2005): Joannea Geologie und Paläontologie 6: 29-43. * [6]: Wolfenden E.,et al(2004): EPSL 224: 213-228.

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