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Interactive comment on "Maskevarri Ráhppát in Finnmark, North Norway – is it an earthquake induced landform complex?" *by* R. Sutinen et al.

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Response to Referee Michael Sebrier; (1) Rather than being negative, we raised an alternative option for the genesis of the Maskevarri Ráhppát. This was because it has been previously classified as push moraine of the Tromsø-Lyngen sub-stage in Finnmark (Sollid et al., 1973), marginal moraine by the Nordkalott Project (1986), and as ablation hummocky moraine in the Quaternary map by Olsen et al. (1996). Push moraine involves active ice movement whereas ablation moraine is developed in stagnant ice conditions and often from supraglacial debris. On the basis of morphology (surface roughness, anastomosing esker pattern, absence of surface streamlining) and sedimentary-anisotropy (parallel-to-ridge crests of the sinusoidal eskers) we argue that other mechanism than ice-frontal pushing or stagnant ablation is needed to explain the

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Maskevarri Ráhppát.

(2) Due to lithospheric plate stresses and glacio-isostatic rebound postglacial fault deformations are common features in northern Fennoscandia. The faults most commonly are trending NE-SW, yet the lineaments and faults in Finnmark are trending WNW-ESE (Roberts et al. 1997 Tectonophysics 270, 1-13; Ottesen et al. 2008 Quat. Sci. Rev. 27, 922-940; Tanner 1930 Bull. Geol. Finl.). Even though the latter orientation is also found at Maskevarri, reactivation of the old structures should be seen indirectly as landslides (Sutinen et al. 2009 Global Planet. Change 69, 16-28), Pulju moraines and anastomosing esker systems (Sutinen et al. 2014 Global Planet. Change 115, 24-32) and/or seismites (Lagerbäck and Sundh 2008 Sver. Geol. Unders. C386; Brandes and Winsemann (2013 Int. J. Earth Sci.). The only evidence suggesting indirectly seismic event(s) was the anastomosing esker system on the slope of the Maskevarri fell. Since we don't have diamond drillings to verify the PGFs (cf. Sutinen et al. 2014 Int. J. Appl. Earth Obs. and Geoinf. 27, 91-99) we have replaced the term three terraces by three elevations, the word escarpment has also been removed. It is our conjecture that earthquake(s) occurred subglacially in a similar manner as the Kultima fault in Finnish Lapland (Sutinen et al. 2014 Global Planet. Change 115, 24-32).

(3) In the revised MS, two new paragraphs (w. citations) has been added to discuss on the periglacial features. We have argued that pingos and palsas are typically located on flat terrains (Jones et al., 2012 Geomorphology 138, 1-14; Seppälä, 2011 Quat. Res. 75, 366-370; Tabuchi and Seppälä, 2012, Polar Science 6, 237-251; Wetterich et al., 2012 Quat. Sci.Rev. 39, 26-44), not on the slope of the fell. Also, pingos tend to be formed of soft-sediments, palsas are ice-cored peat hummocks. We are aware that in some cases thermokarst features can develop on push moraines, such as those in Yukon, Canada (Lenz et al. 2013 Palaeogeogr. Palaeoclim. Palaeoecol 381-382, 15-25). Soft-sediments are absent in the Maskevarri Ráhppát. The lake/pond pattern in Maskevarri is different from talik lakes in the arctic (Grunblatt and Atwood, 2014. Int. J. Appl. Earth Obs. and Geoinf. 27, 63-69; Morgestern et al. 2013 Geomorphology

SED
6, C285–C287, 2014

201, 262-379). One of the arguments is that no evidence has been found to indicate that permafrost persisted through the Holocene in the Maskevarri area (Lilleøren et al., 2012, Global Planet. Change 92-93, 209-223). Although mountain permafrost is commonly found in Norway (Lilleøren et al., 2012, Global Planet. Change 92-93, 209-223) and many of the mountain rockslide deformations in northern Norway are permafrost-controlled (Blikra and Christiansen, 2014 Geomorphology 208, 34-49), the morphology of the rockslide talus deformations is, however, dissimilar to bouldery esker ridges and mounds in Maskevarri Ráhppát.

(4) Sinusoidality of the esker (esker-like) ridges strongly emphasizes the presence of subglacial water and suggests the origin to be associated with full-pipe flow mechanisms, not time-transgressive evolution at the ice margin (Banerjee and McDonald 1975 Spec. Publ. Soc. Econ. Paleont. Miner., Tulsa 23, 132-154; Clark and Walder 1994 Geol. Soc. Am. Bull. 106, 304-314). Possible source of water may be attributed to lithospheric hydromechanics (Neuzil 2012 Geofluids 12, 22-37) and the triggering meachanism may have been subglacial earthquake (or glacial earthquake; Ekström et al., 2006 Science 311, 1756-1758; Nettles and Ekström, 2010 Annu. Rev. Earth Planet. Sci. 38, 467-491; West et al., 2010 Geology 38, 319-322). A new paragraph on the esker sedimentation/network has been added into the discussion of the revised MS.

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