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Interactive comment on "Mafic granulite xenoliths in the Chilka Lake suite, Eastern Ghats Belt, India: evidence of deep-subduction of residual oceanic crust" *by* S. Bhattacharya et al.

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The mafic granulites here are described as restites, and may be considered as cognate xenolith (as in Bhattacharya et al., 2001). In figure 2, a folded mafic granulite xenolith occurs as discordant to the charnockite gneissosity, the charnockite massif, not massive charnockite. Two major objections raised, concern changed chemical composition that should not have retained basaltic melt composition and hence mantle source characteristics should not have been inferred from them. Second, the age of the rocks is poorly constrained or not constrained at all and hence Sr-Nd compositions at an assumed age Is irrelevant. First, it is important to note that garnet granulite xenoliths from the Nortern Baltic Shield were interpreted as the high-grade metamorphic equivalents of continental flood basalts (Kempton et al., 2001). Some of these xenoliths were described as restites after extraction of partial melts, based on geochemical arguments (Kempton et al., 1995). Again, as for the nature of the xenolith protoliths, Kempton et al., (2001) referred to Kempton et al. (1995)'s argument that: from major element arguments that most of the Kola mafic granulite xenoliths represent solidified melts rather than igneous cumulates or meta-sediments. Thus if Kola mafic granulite xenoliths, inspite of the modification during granulite facies event and restite formation, could be described as solidified melts and high-grade metamorphic equivalents of continental flood basalts, why can't we interpret the restitic mafic granulite (cognate xenoliths) as metamorphic equivalent of tholeiitic basalt, in our figure 4? Kemton et al. (2001) further suggest that Kola mafic granulite xenoliths protolith "the most probable magmatic affinity of a tholeiitic basalt,. . ..however„ they are akin to LREE enriched continental flood basalt magma" and "trace element patterns for the Kola garnet granulite xenoliths are similar. . .. All are LREE enriched and most have small negative Eu anomalies. The granulite xenoliths are also markedly enriched in Pb, but show relative depletions in U,Th, Nb, Ti and P" (Kempton et al., (2001). On the basis of trace element patterns, we suggested the protoliths of these granulite xenoliths as akin to OIB. In figure 6, we also considered other basalt types, namely some of the CFBs and find that significant difference with respect to Ta to Ce, much higher than those in the CFBs, and comparable to OIB. Finally, if the protoliths could be described as akin to OIB, it is perfectly logical to discuss the mantle source of the basaltic melt. In view of the previous melting event ($\sim$2.5 Ga) producing Arc-derived basaltic melts, reported in Bhattacharya et al. (2011), it was suggested that the oceanic crustal residue from that melting event might have been subducted to great depths and mechanically mixed with mantle peridotite. Thus OIB source could be a mixed one (70% peridotite+30% oceanic crustal residue). Also low Yb and Sc contents and high (La/Yb)N ratios can be attributed to melting in the presence of garnet and hence at great depths. Finally, we would like to emphasise here that the consequence of the highly incompatible behaviour of trace elements is that their concentration ratios in the melt become constant, independent of melt fraction, and identical to the respective ratios in the mantle source. For the xenoliths here, low La/Nb is distinct from those of continental flood basalts. And Th/Ta versus La/Yb plot can define mantle source characteristics (Fig.7). Concerning age of the rocks: The pervasive granulite event in the Chilka Lake area and elsewhere in the Eastern Ghats Province, was recorded as 1.2 Ga (Simmat and Raith, 2008) [1383, l17-18] and evidence of earlier thermal events ∼1.7 Ga in the Chilka Lake area was also reported in Bhattacaharya et al. (2002)[1390, l14-15]. In the present paper we acknowledged the granulite facies event around 1.2 Ga as responsible for the production of charnockitic melt and mafic granulite restites. We also considered the protolith age indicated by TDM, which is commonly taken to mean crustal residence age or mantle derivation age. Obviously the protolith was some mafic rocks. We do acknowledge that more precise age of the protolith mafic rocks could not be obtained here, because that might have been reset during granulite facies event. Rather older zircons in the charnockite massif of the Chilka suite, as referred in the paper, could provide better constraint on the age of the mafic magmatism, represented by the restitic mafic granulites [1390, l17-18, 14-15]

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