**Supplementary Material**

**Fig. S1.** Lithostratigraphic columns for three segments of the central UDMA (i.e., Kahak, Ardestan, and Nedoushan) selected for the present study on mafic-intermediate volcanic rocks. Simplified geological maps are given in Fig. 1.

**Fig. S2.** Major elements versus SiO2 variation diagrams for the mafic-intermediate volcanic rocks of LILE-poor (a), LILE-rich (b), and ITE-rich (c) series from different segments of the study areas (i.e., Kahak, Ardestan and Nedoushan areas) in the central UDMA. LILE and ITE are the abbreviations for Large Ion Lithophile Elements and Incompatible Trace Elements respectively.

**Fig. S3.** Primitive mantle normalized trace element patterns for the mafic-intermediate volcanic rocks from Tafresh area (i.e., 100 km towards the NE of Kahak in the northernmost part of the study area) from the central UDMA. Trace element data are adapted from Ghorbani & Bezenjani (2011) and age dated samples are from Ghorbani et al. (2014). See text for details. Normalizing values are from Sun & McDonough (1989).

**Fig. S4.** Primitive mantle normalized trace element patterns for the mafic-intermediate volcanic rocks from Ardestan area of the central UDMA. Trace element data and age datings are from Yeganehfar et al. (2013). See text for details. Normalizing values are from Sun & McDonough (1989).

**Fig. S5.** (a-c) Initial Sr-Nd-Pb isotopic ratios plot for the mafic-intermediate volcanic rocks from the W Nain (Yeganehfar et al. (2013) and Nedoushan (Jolani Varzeghani (2017) areas of the central UDMA. See caption Fig.5 for details. Sixteen samples are from W Nain (HK40, HK41, HK42, HK44 from LILE-rich series, HK46, HN51, HN54, HT75, LZ80, HT71, HT72, HT73, HT74 from LILE-poor series and HN53, HN55, HK43 from ITE-rich series) and five samples are from Nedoushan (AN19, AN27 from less differentiated samples, blue circles; and AN14, AN33, AN34 from more differentiated samples, green circles).

**Table S1.** Major oxides (wt%) and trace elements (ppm) abundances of the mafic-intermediate volcanic rocks from the Kahak (including Fordou and Vadghan), Ardestan (including Mishab, Marbin, and Kahang), and Nedoushan areas in the central UDMA. Sample locations are given in Fig. 1. Data for three samples, UC 27, UE 41, and UE 46 are from Ghorbani et al. (2014). Trace elements analysis of the samples numbered in normal fonts are analyzed in the Genalysis lab, Perth, Australia and for samples numbered in italic fonts are analyzed in the Melbourne University, Victoria, Australia (see “Methods” for details). Note: LOI = Loss On Ignition.

**Table S2.** Sr-Nd-Pb isotopic ratios of the representative mafic rocks from the Kahak and Ardestan areas in the central UDMA. The initial isotope ratios are recalculated by assuming an age of 35 Ma.

**Table S3.** Isotopic ratios and trace element contents of the end-members used in the isotopic mixing modeling. The superscripts right to the end-members denote the references: a, Kepezhinskas et al. (1997); b, Hauff et al. (2003); c, Prelević et al. (2008).