Kimberlites as Geochemical Probes of Earth's Mantle

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Supplement for Figure Caption Data sources and Video Animation

FIGURE 1: The data sources for the various rock types plotted are:

Kimberlites n = 143
Lac de Gras kimberlites, uncontaminated, n=76: Kjarsgaard et al. (2009)
Somerset Island kimberlites, n=18: Kjarsgaard unpublished data
Kimberley cluster kimberlites, n=25: le Roex et al. (2003) uncontaminated samples
Undachnaya East: Kamenetsky et al, n=24. (2012) including all samples with Na_2O < 5 wt.%

Orangeites (former Group 2 kimberlites) n = 141:
Bellsbank (n=32) , Newlands (n=15), Pneil, Sover North (n=28) & Barkly West & Finsch area (n=5): Tainton (1992) & Becker & le Roex (2006)
Swartruggens (n=11) & Star (17): Coe et al. (2008)
Finsch (n=22): Fraser & Hawkesworth (1992) & Becker and le Roex (2006)
Jonkerwater (n=1), New Elands (n=1), Roberts Victor (n=1), Middlewater (n=1), Sanddrift (n=1), Slypsteen (n=1) Brandewynskuil (n=2), Eendekuil, Markt: Becker & le Roex (2006) & Mitchell (1995)

Olivine lamproites n = 167:
Australia, Ellendale field, n=133: Jaques et al. (1986)
Australia, Argyle, E. Kimberley province, n=11: Jaques et al. (1986)
Aldan shield, n=8: Davies et al. (2006)
Sover North, Barkly West/Finsch area, n=15: Tainton (1992)
Prairie Creek, n=1: K. Fraser (1987)

Ultramafic lamprophyres n = 48:
Torngat Mountains, Canada: Tappe et al. (2008)
Sarfartoq, Greenland: Tappe et al. (2011)

Average for estimates of kimberlite melt compositions: n = 3
Kjarsgaard et al. (2009), Soltys et al. (2018) and Howarth & Buttner (2019).

FIGURE 2: *Data sources:* ***Kimberlites****: Smith (1985), Mitchell (1995), Becker & le Roex (2006), Kjarsgaard et al. (2009), Kamenetsky et al. (2012), Price et al. (2000), le Roex et al. (2003), Becker & le Roex (2006), Davies et al. (2001), Tappe et al. (2011), Nielsen & Sand (2008), Tappe et al. (2013);* ***Mantle xenoliths****: Boyd et al. (1993), Boyd et al. (1997); Boyd et al. (1999); Boyd et al. (2004) Irvine*

et al. (2001), Irvine et al. (2003), Kopylova et al. (1999), Simon et al. (2007), Pearson et al. (2004), Wittig et al. (2008)

FIGURE 3: *Data "pristine" or "uncontaminated"* ***kimberlites*** *from the Lac de Gras (Canada) and Kimberley (South Africa) clusters (Tappe et al. 2013 and le Roex et al. 2003) as well as from the Udachnaya East kimberlite in Siberia (Kamenetsky et al. 2014, excluding serpentinised samples). Data sources for uncontaminated hypabyssal South African* ***orangeites*** *are summarized in Mitchell (1995) and from Coe et al. (2008) and Becker & le Roex (2008). Data sources for* ***olivine lamproites*** *from western Australia, Prairie Creek and Leucite Hills (both in USA) are: Jacques et al. (1986), Fraser & Hawkesworth (1992), Fraser (1987). Data for* ***ultramafic lamprophyres*** *(mainly Sarfartoq, Greenland and Torngat Mountains, Quebec, Canada) are from Tappe et al. (2008) and Tappe et al. (2011) and references therein.*

FIGURE 4: *Data sources: Wajrakarur/Narayanpet (Paton et al. 2007), Orapa (Sakar et al. 2014), Mengyin (Yang et al. 2009), Jos (Malarkey et al. 2010), Phoenix (Eccles et al. 2003, Lac de Gras (Sarkar et al. 2015 & Pearson & Sarkar, unpublished data).*

FIGURE 5: *Data sources:* ***Kimberlites and orangeites*** *from Southern Africa (Nowell et al. 2004; Woodhead et al. 2009), Lac de Gras (Tappe et al. (2013),* ***MORB*** *(Gale et al, 2013),* ***lamproites*** *(Nowell & Pearson, unpublished data, Prelevic et al. 2008, 2010),* ***OIB*** *(GeoREM database).*

FIGURE 5 3-D Animation: 3-D animation of Hf, Nd, Sr isotope compositions illustrating the relations between kimberlites, orangeites and lamproites with MORB and selected OIB. Data sources are the same as those documented in Fig 5 of the main paper. Key: Turquoise = kimberlites; yellow = orangeites; white = lamproites; red = MORB; purple = selected EMII OIB; orange = selected EM I OIB.

FIGURE 6: Data sources from Araujo et al. (2001) and Pearson et al. (2008). Parameters for mixing lines plotted on figure:

Mixing Scenario	Perid + Kimberlite Os ppb	Perid + Kimberlite Gamma Os	Crust Os ppb	Crust Gamma Os
Kim + perid + crust 1 *crust contaminating kim-perid mix*	1.58	-10.52	0.03	10002
Kim + perid + crust 2 *crust contaminating kim-perid mix*	0.86	-5.53	0.03	10002
	Peridotite Os ppb	**Peridotite Gamma Os**	**Kimerlite Os ppb**	**Kimberlite Gamma Os**
Kimb_peridotites *lithosphere mixing with kimberlite*	4.1 ppb	-14.17	0.5	10.23

	Sulfide Os ppb	Sulfide Gamma Os	Kimerlite Os ppb	Kimberlite Gamma Os
Kimberlite + Sulfide 1 *metasomatic sulfide into kimberlite*	40.3	920.8	0.5	0
Kimberlite + Sulfide 2 *metasomatic sulfide into kimberlite mixed with perid*	40.3	920.8	1.5	-9.44

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