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Tungsten mineralized Neoproterozoic Degana Peraluminous Granite around Rewat Hill, Rajasthan, NW India: Implications from sub-surface data and geochemistry

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The present study emphasises occurrence, mineral assemblages and mineral chemistry of the Neoproterozoic Degana Peraluminous Granite (DPG) around Rewat Hill and its fertility. Based on field evidences and nature of occurrences of wolframite, the tungsten mineralization of the Rewat Hill has been classified into five types; Type-I: quartz–wolframite vein, Type-II: quartz–muscovite–wolframite–polymetallic sulphide vein, Type-III: DPG hosted wolframite, Type-IV: stock-works hosted wolframite in phyllite and Type-V: gravel bed hosted wolframite. Tungsten mineralization in DPG was established in the exposed part by various workers but extension of fertile DPG and its potentiality for tungsten and associated mineralization in the soil-covered area around Rewat Hill remained unexplored. In this study, sub-surface exploration through vertical and inclined boreholes studies has been established which suggest a possible extension of fertile DPG, i.e., Type-I and Type-III tungsten mineralization in soil cover. Tungsten concentration in fertile DPG under soil cover ranges between 402.98 and 5025.45 ppm with higher LREE (58.36–288.67 ppm) and relatively lower HREE (14.64–92.48 ppm). Sub-surface data and geochemistry reveal that soil covered northern and northwestern parts around Rewat Hill of the Degana area is the future potential for tungsten mineralization.

Keywords. Degana peraluminous granite; tungsten deposit; trace elements; fertile granite; NW India.

1. Introduction

The Neoproterozoic (827 ± 8.2 Ma, Anand *et al.* 2018) Degana Peraluminous Granite (DPG), emplaced along the western fringe of the Delhi–Aravalli belt in Rajasthan, host significant tungsten deposit, which is located in the Nagaur district, NW India (Lahiri and Krishnan 1966; Khan and Laul 1974; Gupta *et al.* 1980, 1997; Sood 1989; Jain 1990; Grover 1990; Chattopadhyay *et al.* 1994; Srivastava and Sinha 1997; Anand *et al.* 2018). Tungsten mineralization in DPG and other Neoproterozoic granitoids (table 1) are mainly distributed in the western part of Aravalli craton (Anand *et al.* 2018); in Degana, it occurs in three neighbouring but isolated hillocks, Rewat Hill, Tikli Hill and Phyllite Hill. The study area is covered with 3–15 m thick soil cover as well. The Neoproterozoic DPG is part of Malani Igneous Suite and intruded within Mesoproterozoic phyllite of Delhi Supergroup (Tobisch *et al.* 1994; Pandian 1999; Pandian and Verma 2001; Krylova *et al.* 2012; Singh 2016; Anand *et al.* 2018). Table 1 represents the available U–Pb and Rb–Sr

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Table 1. *Radiogenic isotopic ages of Neoproterozoic granitoid of Rajasthan, NW India.*

Granitoids	Age (Ma)	Method	Reference
Malani Igneous Suite	771±2	U–Pb	Torsvik *et al.* (2001)
Abu granite	765±5	U–Pb	Ashwal *et al.* (2013)
Balda granite	795±11	Rb–Sr	Anand *et al.* (2018)
Degana Peraluminous Granite (DPG)	**827±8.2**	Rb–Sr	Anand *et al.* (2018)
Erinpura Granite	900	Rb–Sr	Choudhry *et al.* (1984)

radiogenic isotopic ages of Neoproterozoic granitoid of Rajasthan, NW India.

The fertile DPG hosts tungsten (W) and associated mineralization is one of the most significant findings of strategic importance in Rajasthan, NW India. The tungsten and associated mineralization are considered to be of vein-type deposits, which is randomly and erratically distributed (Lahiri and Krishnan 1966; Khan and Laul 1974; Sood 1989; Grover 1990; Jain 1990; Pandian 1999; Pandian and Verma 2001; Krylova *et al.* 2012; Singh 2016; Anand *et al.* 2018). Tungsten and associated mineralization in the exposed part of these three hills have already been established by drilling (Lahiri and Krishnan 1966) and major tungsten mineralized quartz vein and pegmatite vein form Rewat Hill and Tikli Hill and stock works from Phyllite Hill were mined out up to ground reduced level (RL) of 340 m. Most of the works on the Degana Tungsten Deposit focus on either geology or geochemistry and only a few on ore-forming fluid of ore deposit (Pandian 1999; Pandian and Verma 2001; Krylova *et al.* 2012; Singh 2016; Anand *et al.* 2018). Therefore, occurrence, mineral assemblage and mineral chemistry of fertile DPG under alluvium cover around Rewat Hill remain uncertain. In this paper, we studied fertile DPG having tungsten (W) content equal to or more than 400 ppm (0.05% WO_3). The understanding of the fertility of DPG in soil-covered areas is key to advance research into the Degana Tungsten Deposit and to enlighten further prospects and exploration. To trace the fertile DPG under soil cover, sub-surface exploration has been performed.

We report subsurface data obtained from subsurface exploration and concentration of W, rare metals and REE analyzed by XRF and ICP-MS analysis (major oxide and trace elements respectively), on the fertile DPG intersected under soil cover around Rewat Hill. The results allow us to identify new tungsten prospect that has strategic importance and establish likely evidences of fertile DPG (Type-I and Type-III mineralization) extending beyond Rewat Hill below soil cover containing W concentration in the range of 402.98–5025.45 ppm.

2. Geological setting

The Rewat Hill is entirely made up of fertile DPG and the adjoining south-western hill (Tikli Hill) is of fertile DPG and phyllite in which the DPG is intrusive (Lahiri and Krishnan 1966; Pandian 1999; Pandian and Verma 2001; Krylova *et al.* 2012; Singh 2016; Anand *et al.* 2018). The Phyllite Hill is composed entirely of phyllite with interbanded quartzite although domed up and altered to a considerable degree due to underlying intrusive DPG (figure 1). Tungsten mineralization in the Phyllite Hill is hosted in only stock works (figure 2F). Rest of the area is covered by barren lands, Quaternary sediments and alluvium. The DPG is traversed by a number of NW–SE, NNW–SSE trending W mineralized quartz veins, pegmatite veins, which are highly enriched in tungsten (figure 2A–C) and greisen (figure 2D). Semi-consolidated gravel bed around Rewat Hill (figure 2G) contains erratically distributed wolframite grains of variable size (up to 1 cm). The isolated fertile DPG intrusion has an outcrop area of about 1 km^2 and occurs as a stock and dominated by greisen veins and aplite dykes (figure 2D and E). The DPG comprises three consecutive phases distinguished on the basis of intrusive relation and texture. Phase-I, DPG cuts through phyllite, is medium to coarse-grained and shows equi-granular to inequigranular texture. Phase-II granite is porphyritic and localized within the Phase-I granitic body and separated by the presence of a zone of intrusive breccia of variable thickness. Phase-III granites are intrusive phases within Phase-I and Phase-II granite and characterized as fine-grained porphyritic granite. All the

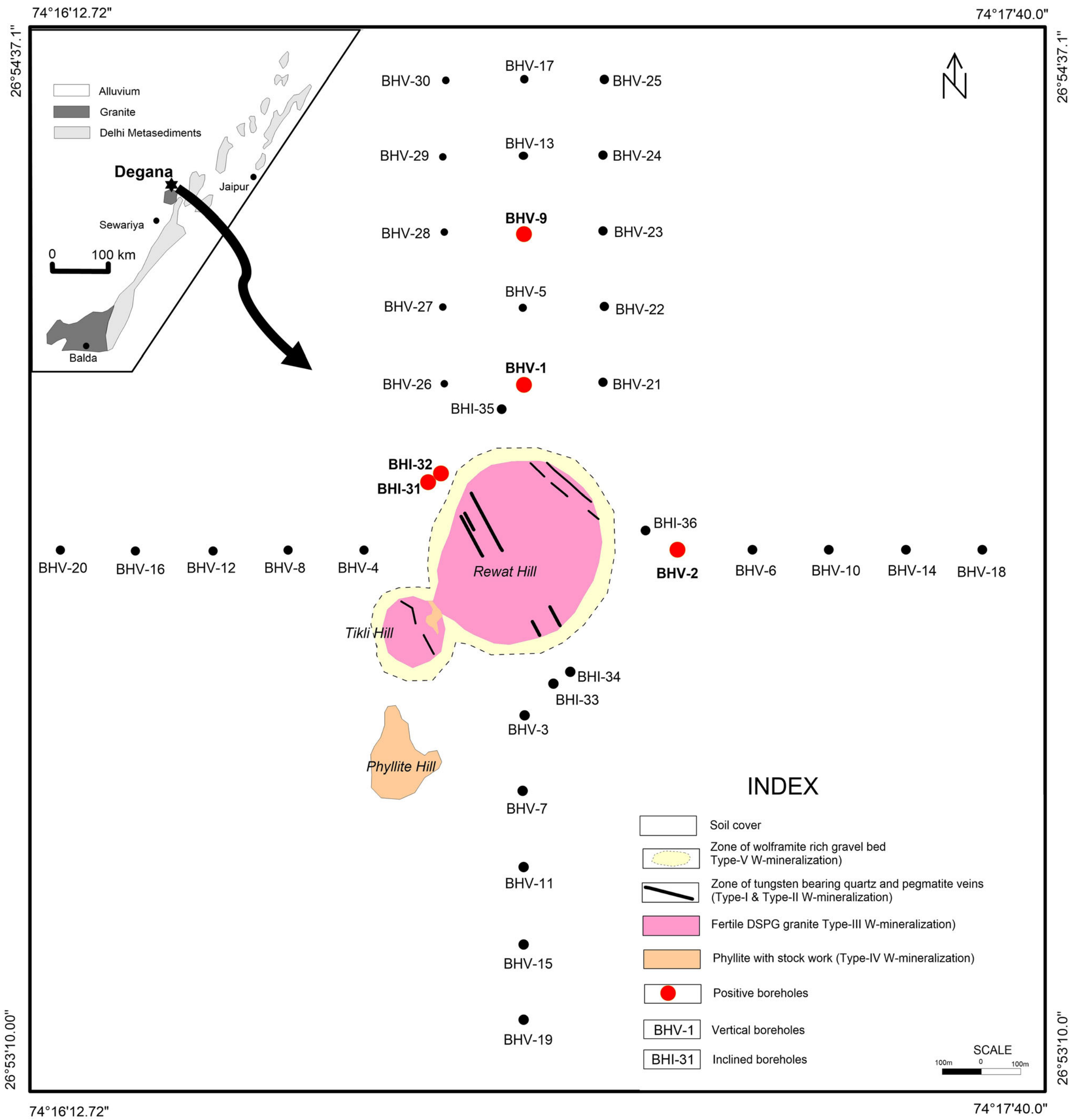

Figure 1. Simplified geological map of Degana Tungsten deposit along with boreholes drilled in soil cover.

three phases of granites are peraluminous and show similar mineralogy, however, have different texture and grain size (Krylova *et al.* 2012; Anand *et al.* 2018).

3. Subsurface exploration

A total of 30 vertical shallow boreholes of 35–60 m depth and six inclined boreholes of 50–72 m depth were drilled (figure 1) around Rewat Hill to know the extension of W mineralized quartz veins in soil covered area (Kumar 2019). The vertical boreholes were drilled in soil covered area at a regular interval of 200 m from Rewat Hill to know the extension of Type-III, Type-IV and Type-V mineralization, whereas inclined boreholes were drilled in soil cover at 100 m spacing from the exposed part of mineralized NW–SE trending quartz veins to know depth and strike continuity of Type-I and Type-II mineralization. The borehole spacing for inclined boreholes was kept 100 m because of

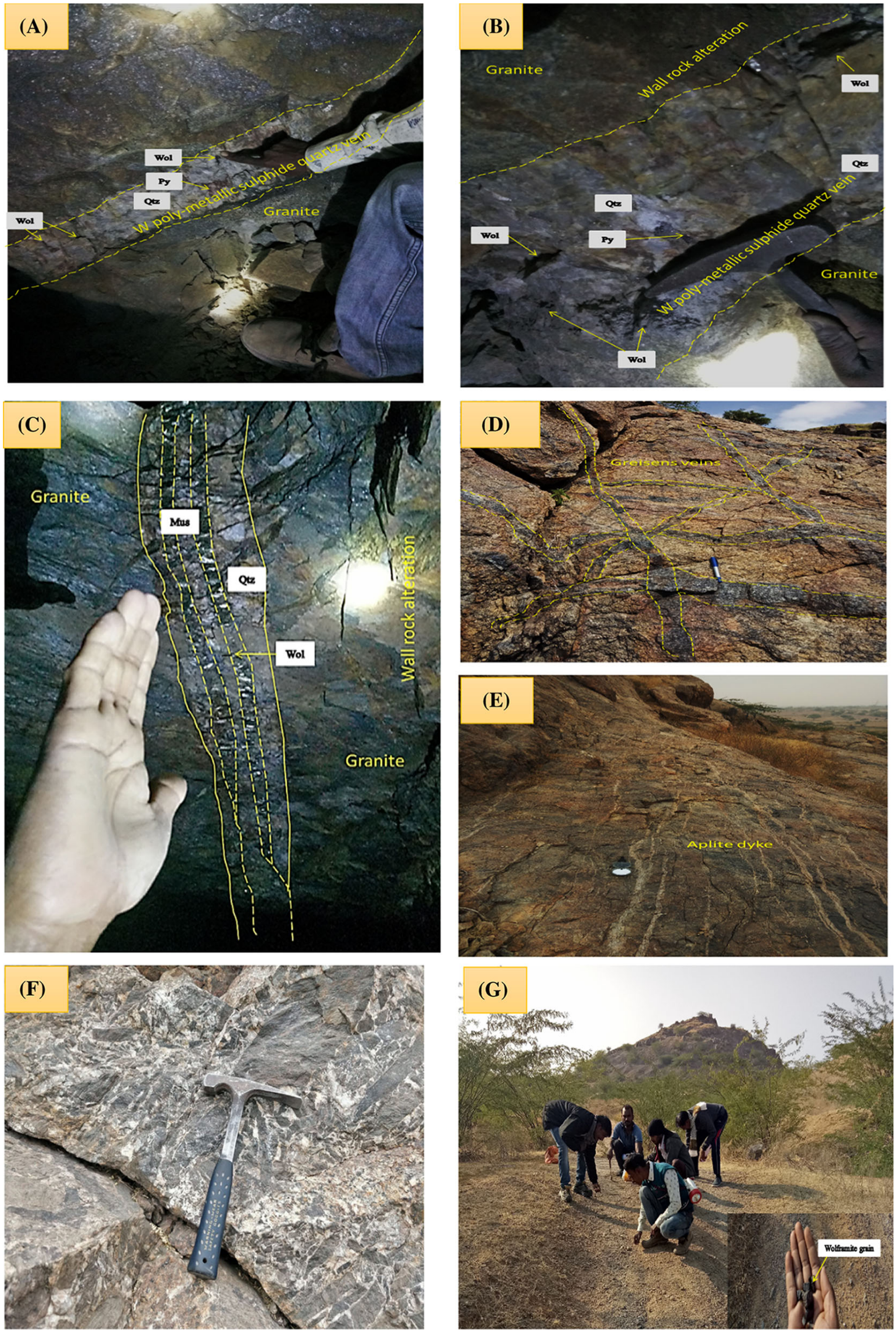

Figure 2. (**A** and **B**) Annotated photograph of the contact between the fertile DPG and the quartz–wolframite vein type (Type-I) mineralization seen on the sidewall of mine adits of Tikli Hill and Rewat Hill, respectively. (**C**) Annotated photograph of the contact between the granite and the quartz–muscovite–polymetallic sulphide vein-type (Type-II) mineralization seen on the upper wall of mine adits of Rewat Hill. (**D**) Greisen veins in DPG hosted wolframite (Type-III), Rewat Hill. (**E**) Aplite dykes intruded in DPG. (**F**) Stock work in phyllite hill (Type-IV) and (**G**) Type-V tungsten mineralization in gravel-bed around foothill of Rewat Hill. Wol: wolframite; Mus: muscovite; Qtz: quartz; and Py: pyrite.

pinching and swelling nature of mineralized quartz–pegmatite veins. A total of five boreholes, viz., BHV-1, BHV-2 BHV-9 (vertical boreholes) and BHI-31 and 32 (inclined boreholes) were reported positive. In vertical boreholes, the W-mineralization was hosted in granite (Type-III), whereas in inclined boreholes the mineralization was hosted in quartz vein as well as granite (Type-I, Type-II and Type-III). It is also confirmed by sub-surface exploration that fertile DPG is continuing beneath soil-covered area around Rewat Hill and hosts anomalous W and associated mineralization at variable depth (table 2). It was also confirmed that W mineralized quartz veins are restricted to Rewat Hill and pinching out towards soil cover in northwest as well as in southeast part of the hill but depth continuity of mineralized veins (Type-I and II) at deeper level cannot be ruled out. Recent sub-surface data reveals that fertile DPG with potential W mineralization is continuing in soil covered northern and north-western parts of Rewat Hill (table 4).

4. Sampling and analytical methods

Core samples (n=113) from five positive boreholes (figure 1), drilled around Rewat Hill in soil covered area, were collected and analyzed. Sampling was done from suspected mineralized zone hosted in DPG at an interval of 0.5 m (table 5). Chemical analysis was performed for tungsten (W), rare earth elements (REE) and associated rare metals (RM) of fertile DPG with the help of ICP–MS (VARIAN 820-MS SYSTEM) at the facilities of the Chemical Division, GSI, Jaipur and PANalytical AXIOS X-Ray Fluorescence (XRF) Spectrometer was used to analyse major oxide and trace elements (table 4). The mineral chemistry of wolframite from two of the studied samples was determined by CAMECA SX-100 electron microprobe microanalysis (EPMA) with five WDS spectrometers, including LLIF and LPET crystals at EPMA lab, GSI, Faridabad (table 3).

5. Petrography

The petrographic studies of fertile DPG from Rewat Hill reveal that they consist of quartz, K-feldspar, sodic plagioclase muscovite and biotite as dominant phases along with apatite, zircon, topaz, rutile, iron oxide as accessory phases and show hypidiomorphic texture. Mineralogical composition is almost similar in all the three phases. They are coarse-grained (phase-I and II), medium to fine-grained (phase-III) rock consisting of quartz (up to 45–40%), plagioclase (20–15%), K-feldspar (25–20%, muscovite, biotite (15–10%) and accessory minerals up to 5 mode% (figure 3A–C). K-feldspar occurs as phenocrysts and in quartzo-feldspathic groundmass and shows well-developed

Table 2. *Details of positive boreholes intersected fertile DPG with Type-I and Type-III mineralization beneath soil cover around Rewat Hill.*

Sl. no.	Borehole no.	RL at collar (m)	RL at bottom (m)	Drilled depth (m)	Angle (°)	Azimuth (°)	Lode intersected	Depth (m) From	Depth (m) To	Width of mineralized zone	W (wt. avg.) in ppm
1	BHV-1	341.96	291.96	50	90	0	MZ-I	9	11.5	2.5	692
							MZ-II	12	16.5	4.5	677
							MZ-III	18	20.5	2.5	718
							MZ-IV	22.5	29.5	7	778
							MZ-V	30.5	35.5	5	550
							MZ-VI	37	42.5	5.5	1204
							MZ-VII	43.5	50	6.5	590
2	BHV-2	339.37	289.37	50	90	0	MZ-I	47.0	49.0	2.0	956
3	BHV-9	342.97	282.97	60	90	0	MZ-I	46.5	48.5	2.0	917
							MZ-II	49.0	52.0	3.0	532
4	BHI-31	353.75	293.75	60	45	N50E	MZ-I	41.0	44.0	3.0	980
							MZ-II	47.5	50.0	2.5	1458
							MZ-III	51.0	53.0	2.0	615
							MZ-IV	54.5	56.5	2.0	511
							MZ-V	58.0	60.0	2.0	1398
5	BHI-32	349.52	289.52	60	45	N50E	MZ-I	50.5	53.5	3.0	634
							MZ-II	57.0	59.0	2.0	1033

Table 3. *Representative EPMA analysis (wt.%) of wolframite from core samples of fertile DPG, Rewat hill, Degana.*

Oxides (wt.%)												
FeO	MnO	WO_3	F	SiO_2	P_2O_5	K_2O	CaO	TiO_2	As_2O_3	Y_2O_3	ZrO_2	Nb_2O_3
Wolframite (Type-I and II) from DPG												
10.60	12.86	67.87	0.31	0.05	0.14	0	0.02	0.05	0	0.16	0	1.43
10.06	12.56	65.17	0.14	0.06	0.04	0.01	0	0.06	0.16	0	0	1.00
14.20	8.32	66.83	0	0.07	0.06	0.06	0.04	0.10	0	0.07	0	1.23
11.37	12.00	68.46	0.06	0	0.06	0	0	0	0	0.15	0.01	0.97
10.82	12.50	69.28	0.30	0.03	0.05	0.03	0	0	0	0.05	0	1.07
15.65	7.96	67.96	0.09	0.04	0	0.02	0	0.05	0	0.28	0	1.15
17.63	7.27	65.07	0.14	0.19	0.04	0.09	0.01	0.12	0	0	0	1.67

Oxides (wt.%)											
BaO	La_2O_3	Ce_2O_3	Pr_2O_3	Nd_2O_3	SmO	Dy_2O_3	Ta_2O_5	PbO	UO_2	Total	Wolframite composition (Hb_x–Fb_y)
Wolframite (Type-I and II) from DPG											
0.12	0	0.78	0.24	0.21	0	0	0.20	0	0	95.05	$Hb_{57.8}$–$Fb_{45.2}$
0	0	0.87	0	0.55	0	0.11	0.17	0	0.09	91.07	$Hb_{55.5}$–$Fb_{44.5}$
0.13	0	0.57	0	0	0.35	0.56	0.06	0.04	0.09	92.77	$Hb_{56.9}$–$Fb_{63.1}$
0	0	0.92	0.26	0.19	0	0	0	0	0	94.46	$Hb_{51.3}$–$Fb_{48.7}$
0.08	0	0.85	0	0	0	0	0.07	0	0	95.13	$Hb_{53.6}$–$Fb_{46.4}$
0.12	0.04	1.10	0.34	0	0.39	0	0.06	0.09	0	95.34	$Hb_{33.7}$–$Fb_{66.3}$
0	0	0.76	0.16	0	0	0	0.34	0	0	93.49	$Hb_{29.2}$–$Fb_{70.8}$

Hb = Huebnerite, Fb = Ferberite, x and y are molecular proportion in %.

cross-hatched twinning. The plagioclase is albite in composition; micas include muscovite and zinnwaldite (Pandian and Verma 2001). Wolframite occurs as major and minor inclusions within quartz and near the grain boundary of mica and feldspar (figures 3D, 4A and B).

6. Geochemistry

6.1 *Degana peraluminous granite*

6.1.1 *Major oxides*

The whole rock geochemistry of 10 samples of Type-III DPG from Rewat Hill is presented in table 4. Samples show high loss-on-ignition (LOI) values (1.30–5.93 wt.%), which might be due to the introduction of mica on greisenization of these granites associated with tungsten mineralization. All samples show some geochemical variation between them and are comparable in terms of major oxides because of post-magmatic alteration. The concentration of SiO_2 varies from 62.52 to 74.80 wt.%, Al_2O_3 (12.99–20.75 wt.%), Fe_2O_3 (0.52–4.67 wt.%), MnO (0.01–0.19 wt.%), MgO (0.10–2.33 wt.%), CaO (0.20–2.88 wt.%), Na_2O (1.38–4.19 wt.%), K_2O (4.35–6.07 wt.%), TiO_2 (0.01–0.68 wt.%) and P_2O_5 (0.01–0.17 wt.%) and the samples are confined to peraluminous granite field (figure 4A). Notable incidences of K_2O and Na_2O imply their potassic and sodic character.

6.1.2 *Trace elements*

Elevated values of Rb (up to 1080 ppm), Ba (up to 715 ppm) Zn (up to 1–21 ppm) and Zr (up to 324 ppm) are indicating highly evolved nature of felsic magma with the influence of fluid-assisted alteration and metasomatism. Primary differentiation index is determined by immobility of Zr (figure 5) and its behaviour to monitor the mobility of other major and trace elements during post-magmatic hydrothermal alteration (Pearce *et al.* 1992; Polat and Kerrich 2000). Tungsten concentration in fertile DPG under soil cover ranges between 402.98 and 5025.45 ppm with higher LREE (58.36–288.67 ppm) and relatively lower HREE (14.64–92.48 ppm). The elements Nb, Ta, Sc, Sn, Zn, Cr, V, Mo, Cu, Pb, Zn, Zr, U and Th are depleted in fertile DPG and show lower concentrations of Nb (8–76 ppm), Ta (1.43–56.21 ppm), Sc (3.5–27.0 ppm), Sn (8.20–105.33 ppm), Cr (16–685 ppm), V (20–237 ppm), Mo (5.78–100.46 ppm), Cu (1–472 ppm), Pb (2–56 ppm), Zn (35–528 ppm), Zr (35–321 ppm), U

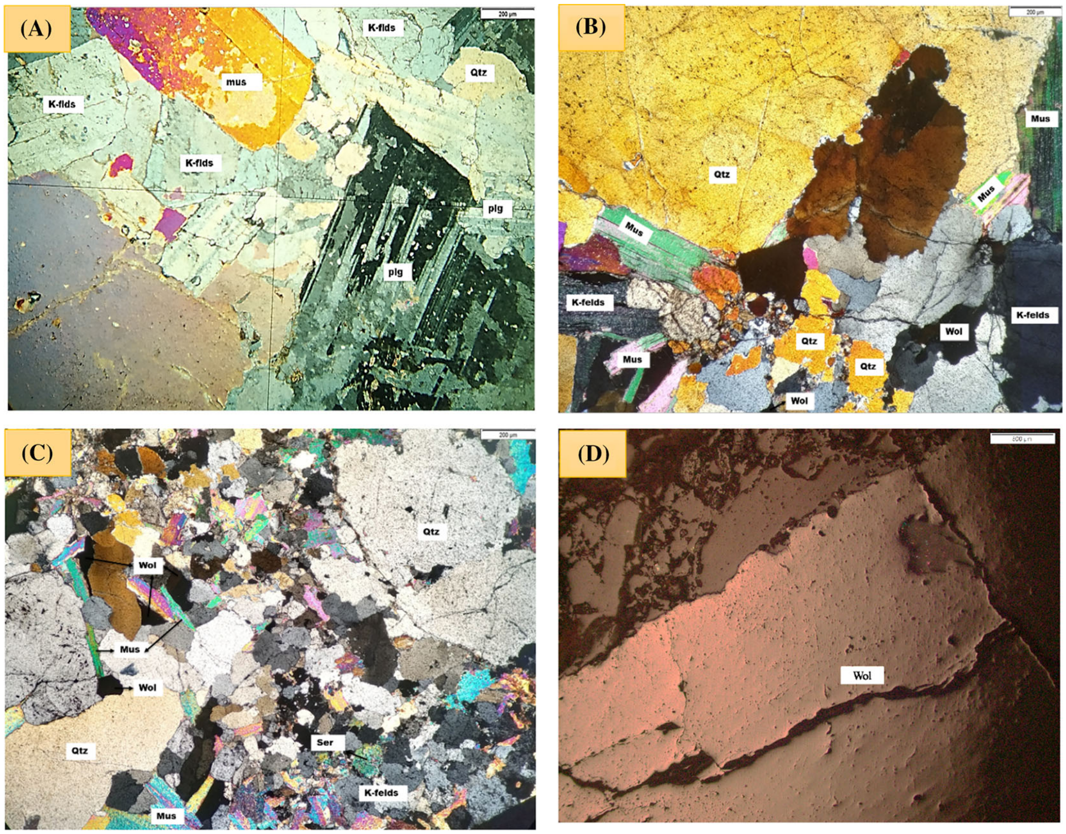

Figure 3. (**A**) Photomicrograph of Phase-I, (**B**) Phase-II and (**C**) Phase-III DPG granite from Rewat Hill, Degana. (**D**) Wolframite of Type-II mineralization in reflected light. Wol: wolframite; Mus: muscovite; Qtz: quartz; Ser: sericite; K-felds and Akf= K-feldspar.

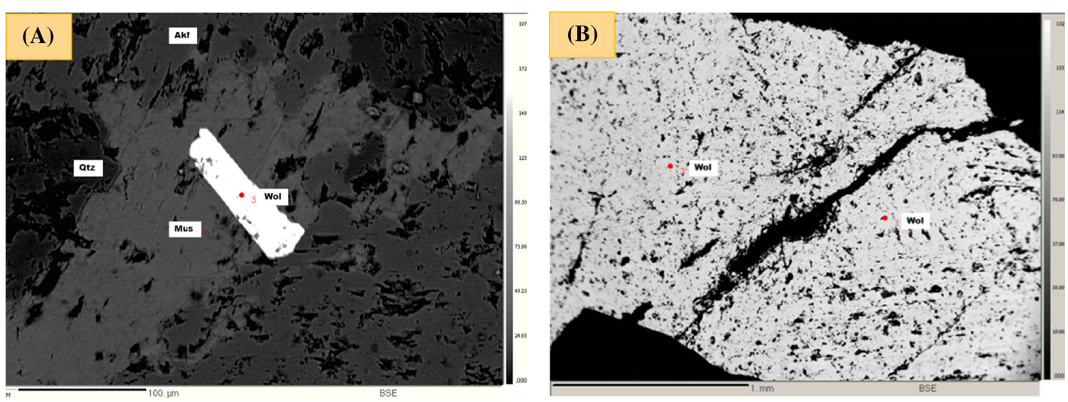

Figure 4. (**A** and **B**) BSE image showing wolframite grain with quartz, muscovite and alkali feldspar. Wol: wolframite; Mus: muscovite; Qtz: quartz; and Akf: K-feldspar.

(2.44–31.86 ppm) and Th (10–168 ppm). Variation of different major oxides, large ion lithophile elements (LILEs) and HFSE are plotted against Zr to understand their relative mobility (figure 6). The variation plot indicates highly evolved nature of DPG. Phase-I, porphyritic granite shows relatively lower ratio of Zr with major oxides, trace elements (LILEs and HFSEs) indicating unaltered nature of phase-I DPG granite. Whereas, more evolved phase-II and phase-III DPG show higher ratio of Zr against them indicate more interaction of hydrothermal fluid and alteration within them. A/CNK–A/NK plot (Shand 1943) for DPG indicates its peraluminous nature (figure 5A). Chondrite-normalized REE patterns (figure 5B) of the DPG show an enormous negative Eu-anomaly indicating presence of plagioclase in the residual phase and crystal fractionation and enrichment of

Table 4. *Whole rock geochemistry of DPG, Rewat Hill, Degana.*

Sample no.	SiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	Ba	Co	Cr	Cu	Ga	Nb	Pb	Rb	Sc	Sr	Th	V	Zn	Zr	Ni
	(in %)										(in ppm)														
SK/PCS/1	62.52	20.75	3.5	0.06	2.33	0.22	1.54	5.3	0.68	0.04	715	<1	72	195	28	27	23	852	10	60	20	77	89	286	6
SK/PCS/2	63.01	19.1	4.67	0.07	<50	0.2	1.57	4.6	0.68	0.17	684	9	89	237	21	17	13	669	20	329	17	118	134	324	14
SK/PCS/3	72.82	12.99	3.94	0.11	0.1	0.73	1.87	4.49	0.04	0.02	81	3	74	45	41	45	39	1038	6	<5	40	<20	212	64	7
SK/PCS/4	71.45	13.94	4.2	0.17	0.11	0.93	2	4.68	0.04	0.03	119	6	106	31	39	48	36	1080	4	7	39	<20	101	56	8
SK/PCS/5	73.51	13.88	1.52	0.06	<0.1	0.43	4.19	4.35	0.01	0.01	<50	2	79	1	53	54	42	1007	<3.5	<5	10	<20	62	28	3
SK/PCS/6	74.8	13.24	1.04	0.04	<0.1	0.32	4.09	4.56	0.01	0.01	<50	<1	103	<1	48	44	44	976	7	<5	6	<20	44	26	6
SK/PCS/7	71.87	15.34	1.09	0.03	0.1	0.89	3.71	4.99	0.02	0.01	71	<1	89	<1	47	46	34	1040	16	<5	15	<20	29	39	8
SK/PCS/8	72.14	15.8	0.52	0.01	0.18	1.16	3.84	5.03	0.01	0.01	<50	<1	78	1	45	46	25	900	<3.5	<5	21	<20	15	50	8
SK/PCS/9	65.38	18.41	2.37	0.19	0.77	1.88	1.38	6.07	0.19	0.09	488	<1	102	34	25	15	21	870	5	136	31	<20	447	144	18
SK/PCS/10	67.49	17.42	1.82	0.04	0.84	0.88	2.53	5.85	0.22	0.08	558	<1	93	37	21	15	35	392	<3.5	140	35	<20	1021	157	68

Sample no.	Be	Ge	Y	Mo	Sn	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	U
	(in ppm)																						
SK/PCS/1	24.14	2.60	36.40	3.68	49.20	56.69	111.85	12.54	49.54	8.70	1.51	7.32	1.30	6.94	1.27	3.96	0.62	4.19	0.63	6.52	10.48	109.27	3.68
SK/PCS/2	25.66	2.06	41.58	5.50	33.65	54.47	109.89	12.86	52.66	10.05	1.72	8.15	1.43	7.65	1.40	4.47	0.69	4.66	0.70	7.91	1.71	103.16	5.09
SK/PCS/3	2.64	4.69	154.12	48.07	11.88	37.23	89.63	11.27	42.92	15.51	0.09	14.98	4.25	28.13	5.10	16.46	2.89	19.72	2.92	3.30	10.88	313.20	29.01
SK/PCS/4	3.02	4.78	138.61	41.88	18.11	40.87	96.92	12.10	45.79	15.09	0.09	13.92	3.81	24.18	4.32	13.97	2.43	16.60	2.48	3.35	10.75	501.90	26.06
SK/PCS/5	3.93	3.49	15.51	8.11	9.59	20.57	42.75	6.11	18.19	5.60	0.01	3.65	1.00	6.72	1.15	4.00	0.91	7.66	1.12	2.53	29.54	4.44	2.88
SK/PCS/6	4.05	3.17	13.05	19.31	9.50	17.26	42.91	4.91	14.80	4.46	<0.006	2.95	0.80	5.24	0.89	3.18	0.68	5.67	0.82	2.50	28.72	6.74	2.59
SK/PCS/7	3.39	4.29	102.33	2.50	15.05	30.08	73.16	9.42	35.38	13.37	0.01	11.32	3.38	23.95	4.31	14.73	3.00	23.69	3.44	3.83	22.01	5.31	6.39
SK/PCS/8	3.22	3.66	101.52	2.58	6.99	31.43	77.19	9.96	37.00	14.04	0.02	11.54	3.50	25.55	4.74	16.41	3.38	26.47	3.90	4.13	31.40	4.97	6.54
SK/PCS/9	13.63	2.12	21.77	3.09	63.40	52.18	91.95	9.84	36.29	6.39	0.90	5.11	0.79	4.02	0.70	2.23	0.35	2.23	0.33	4.01	3.04	24.21	3.00
SK/PCS/10	9.32	1.37	20.77	3.44	42.01	53.43	94.98	10.14	37.17	6.27	0.93	4.96	0.77	3.90	0.68	2.16	0.34	2.13	0.31	4.39	1.97	10.15	2.95

Table 5. *Analytical results of fertile DPG beneath soil cover around Rewat Hill, Degana.*

Sample no.	Sample length (m) From	To	Be	Ge	Y	Mo	Sn	LREE (La–Eu)	HREE (Gd–Lu)	TREE+Y	Hf	Ta	W	U	SiO_2
			(in ppm)												(in %)
BHV-1/1	9	9.5	3.24	4.35	105.21	13.84	19.20	219.13	67.77	392.11	3.25	11.15	**916.91**	10.21	72.10
BHV-1/2	9.5	10	2.06	4.96	107.13	13.90	21.82	164.51	68.62	340.26	3.05	9.31	**843.21**	10.60	71.95
BHV-1/3	10	10.5	2.74	4.62	146.28	29.33	26.50	153.18	91.97	391.43	3.95	9.38	**440.89**	13.70	72.59
BHV-1/4	10.5	11	2.86	4.16	85.50	9.46	25.52	141.76	53.09	280.34	3.49	9.53	**449.07**	19.32	73.26
BHV-1/5	11	11.5	2.85	4.34	108.71	19.44	23.12	171.64	67.81	348.15	4.18	8.88	**817.90**	27.80	71.54
BHV-1/7	12	12.5	2.89	3.55	114.04	6.61	14.18	288.67	77.18	479.89	4.21	8.51	384.47	27.73	72.76
BHV-1/8	12.5	13	1.90	3.84	108.94	34.71	105.33	167.96	62.90	339.79	3.83	9.91	**1139.28**	19.63	73.88
BHV-1/9	13	13.5	2.91	3.26	106.98	7.89	22.81	143.25	63.24	313.47	3.70	9.41	**454.99**	12.85	72.60
BHV-1/10	13.5	14	2.94	3.74	103.38	14.73	21.74	196.48	63.89	363.75	4.08	10.78	335.04	14.48	73.32
BHV-1/11	14	14.5	2.71	4.51	100.68	30.39	65.36	180.68	62.10	343.46	4.02	10.85	**483.12**	13.98	71.99
BHV-1/12	14.5	15	2.80	4.05	114.60	26.13	13.50	151.47	68.32	334.40	4.08	10.01	**981.85**	18.22	71.75
BHV-1/13	15	15.5	2.23	3.97	113.26	18.02	27.40	153.56	70.90	337.71	3.05	8.79	**927.71**	12.88	72.65
BHV-1/14	15.5	16	2.68	4.88	113.31	21.42	25.56	159.44	67.08	339.84	4.54	8.94	**679.60**	16.29	70.18
BHV-1/15	16	16.5	2.69	4.17	115.14	17.81	96.52	174.02	69.76	358.92	3.68	10.14	**761.64**	16.02	71.30
BHV-1/19	18	18.5	3.60	3.28	100.33	15.08	15.83	193.98	61.95	356.26	4.93	10.00	349.47	17.59	73.26
BHV-1/20	18.5	19	3.21	3.76	98.88	44.86	12.96	194.49	62.13	355.50	3.57	9.06	**1440.00**	16.81	73.10
BHV-1/21	19	19.5	3.00	3.76	96.00	13.27	12.49	187.33	58.58	341.90	4.35	8.82	**913.23**	15.85	72.72
BHV-1/22	19.5	20	2.74	4.62	146.28	29.33	26.50	153.18	91.97	391.43	3.95	9.38	**440.89**	13.70	70.70
BHV-1/23	20	20.5	2.86	4.16	85.50	9.46	25.52	141.76	53.09	280.34	3.49	9.53	**449.07**	19.32	72.28
BHV-1/28	22.5	23	3.31	3.44	92.80	7.39	18.75	146.92	58.77	298.48	3.92	9.85	389.13	10.76	72.06
BHV-1/29	23	23.5	2.81	3.79	92.63	12.82	24.58	141.78	57.36	291.78	3.22	9.29	**625.93**	19.96	71.95
BHV-1/30	23.5	24	2.90	3.04	94.35	7.45	17.93	153.03	61.49	308.86	3.64	12.04	**553.79**	19.81	73.78
BHV-1/31	24	24.5	2.84	4.36	78.45	18.18	32.06	147.41	49.16	275.02	3.76	19.65	**889.85**	17.00	73.03
BHV-1/32	24.5	25	2.66	3.77	114.75	12.35	19.65	157.17	69.19	341.11	4.59	13.33	390.77	21.99	73.91
BHV-1/33	25	25.5	2.99	4.70	114.43	11.41	26.79	147.63	69.85	331.91	4.50	9.42	366.82	21.93	73.56
BHV-1/34	25.5	26	2.87	3.38	106.10	24.57	13.06	184.48	64.16	354.74	4.81	9.63	275.75	29.50	73.36
BHV-1/35	26	26.5	3.11	3.60	100.31	14.97	14.24	184.58	61.70	346.59	4.01	10.67	**705.11**	19.57	73.59
BHV-1/36	26.5	27	3.03	3.89	108.13	17.40	14.06	167.16	67.55	342.84	4.09	10.02	**466.93**	12.41	73.16
BHV-1/37	27	27.5	3.08	3.99	96.56	41.10	15.99	190.35	62.38	349.29	4.34	8.38	**587.79**	9.54	74.01
BHV-1/38	27.5	28	2.10	4.62	80.37	21.37	17.94	146.54	52.23	279.14	3.10	13.37	**3100.10**	10.95	71.58
BHV-1/39	28	28.5	2.89	3.72	95.00	10.00	14.28	170.00	60.00	324.99	4.09	9.71	387.19	10.99	73.91
BHV-1/40	28.5	29	2.83	3.81	98.19	29.92	14.88	163.18	58.70	320.07	3.06	9.67	**1350.92**	14.90	73.20
BHV-1/41	29	29.5	3.24	3.70	119.94	38.64	17.56	158.09	74.39	352.42	4.08	9.58	**808.76**	14.97	73.16
BHV-1/44	30.5	31	2.63	4.27	109.62	16.48	21.68	164.88	66.47	340.97	3.42	10.13	**705.34**	17.03	73.28
BHV-1/45	31	31.5	1.88	4.37	133.53	29.52	27.23	195.66	79.63	408.81	4.02	8.92	**564.96**	31.86	71.97
BHV-1/46	31.5	32	2.39	5.31	98.95	13.47	22.39	108.20	58.75	265.89	3.49	9.58	**788.40**	16.86	73.76
BHV-1/47	32	32.5	2.57	3.75	109.52	7.04	14.77	173.31	66.63	349.46	4.29	8.28	260.93	22.08	73.03
BHV-1/48	32.5	33	2.52	4.90	124.92	12.25	26.41	186.09	78.60	389.61	3.41	8.46	239.03	20.65	70.35
BHV-1/49	33	33.5	9.23	3.80	107.09	37.37	10.38	188.43	68.50	364.02	3.87	9.26	**1033.44**	18.99	72.14

Table 5. *(Continued.)*

	Sample length (m)		Be	Ge	Y	Mo	Sn	LREE (La–Eu)	HREE (Gd–Lu)	TREE+Y	Hf	Ta	W	U	SiO_2
Sample no.	From	To						(in ppm)							(in %)
BHV-1/50	33.5	34	2.75	4.45	138.16	16.30	32.94	219.70	92.48	450.35	4.54	10.97	239.35	23.42	74.01
BHV-1/51	34	34.5	3.85	3.18	131.16	71.28	28.50	220.48	83.07	434.71	5.53	9.19	**771.46**	22.71	72.73
BHV-1/52	34.5	35	3.88	3.73	92.83	33.09	14.72	182.46	57.62	332.91	3.41	8.77	**504.42**	17.26	72.57
BHV-1/53	35	35.5	3.22	3.78	104.65	15.16	19.60	180.03	63.94	348.62	3.69	9.03	397.88	18.69	74.66
BHV-1/57	37	37.5	3.34	4.40	109.27	24.88	28.79	268.20	71.98	449.45	4.81	9.59	**762.21**	16.46	72.56
BHV-1/58	37.5	38	2.93	4.15	109.06	24.06	13.35	177.83	73.26	360.15	3.06	9.09	**993.99**	15.66	72.44
BHV-1/59	38	38.5	3.04	3.63	112.54	19.81	15.75	183.39	67.86	363.79	3.65	9.20	346.02	18.82	73.14
BHV-1/60	38.5	39	3.21	4.01	129.35	38.24	19.02	191.42	78.76	399.53	4.24	10.33	350.05	18.68	72.69
BHV-1/61	39	39.5	3.42	4.20	113.50	22.19	21.97	157.85	68.50	339.85	4.15	10.27	**1604.94**	14.73	72.22
BHV-1/62	39.5	40	2.90	4.08	118.12	68.24	15.38	211.53	74.40	404.06	4.64	10.32	**545.96**	26.57	74.18
BHV-1/63	40	40.5	3.36	3.89	107.48	38.90	11.99	167.19	68.63	343.30	4.43	10.52	**849.65**	17.32	73.24
BHV-1/64	40.5	41	3.17	4.85	134.63	54.77	19.42	258.13	84.45	477.21	3.90	11.97	398.61	19.65	74.06
BHV-1/65	41	41.5	2.57	4.87	105.44	47.06	16.14	171.31	64.24	341.00	3.19	11.15	**1267.77**	17.53	71.65
BHV-1/66	41.5	42	2.60	4.60	101.32	40.77	28.69	156.01	64.53	321.85	2.42	26.96	**4924.37**	17.29	70.11
BHV-1/67	42	42.5	2.32	3.56	100.23	36.67	14.84	161.37	59.59	321.18	3.14	8.39	**1196.38**	18.93	72.14
BHV-1/70	43.5	44	2.56	4.09	125.80	30.20	23.38	200.87	81.11	407.77	4.22	13.10	374.88	23.20	72.93
BHV-1/71	44	44.5	2.40	3.74	108.62	30.88	16.67	184.76	66.87	360.25	2.82	9.47	**425.15**	23.39	71.15
BHV-1/72	44.5	45	2.32	3.66	108.00	33.20	12.00	187.84	67.31	363.15	2.32	8.77	**718.58**	21.35	72.15
BHV-1/73	45	45.5	1.99	4.18	108.42	25.07	12.99	173.64	66.40	348.45	2.20	8.45	**584.15**	21.38	68.99
BHV-1/74	45.5	46	2.38	3.69	119.70	14.51	16.80	182.64	72.89	375.23	3.17	11.05	**549.30**	25.87	72.13
BHV-1/75	46	46.5	2.41	4.03	110.66	22.02	15.31	174.69	67.25	352.60	2.72	9.04	**833.14**	23.63	72.19
BHV-1/76	46.5	47	2.41	3.76	122.96	20.33	22.25	194.49	77.23	394.67	2.38	8.63	334.37	22.58	70.86
BHV-1/77	47	47.5	3.08	4.88	116.77	49.03	22.20	182.77	71.68	371.21	3.17	9.02	**544.79**	23.50	70.87
BHV-1/78	47.5	48	2.45	3.91	120.03	73.46	13.24	186.16	70.18	376.37	1.88	10.89	**786.98**	21.83	69.97
BHV-1/79	48	48.5	3.49	4.66	146.04	100.46	17.71	242.41	88.97	477.42	2.97	11.53	**836.82**	24.53	71.78
BHV-1/80	48.5	49	1.97	4.92	113.90	38.85	19.00	166.82	66.37	347.08	2.69	12.45	**681.76**	23.12	70.7
BHV-1/81	49	49.5	2.11	4.23	115.59	51.40	8.84	187.61	71.46	374.67	1.69	9.44	372.43	23.78	71.25
BHV-1/82	49.5	50	2.53	4.18	121.49	43.19	15.63	182.59	72.32	376.41	2.28	9.61	**626.33**	23.70	70.98
BHV-2/27	44	44.5	6.82	4.40	25.34	13.87	17.70	142.74	29.46	197.53	4.10	23.23	318.96	5.51	65.73
BHV-2/28	47	47.5	12.14	4.64	24.28	13.72	20.20	120.05	17.30	161.62	4.54	4.99	**2419.96**	2.44	72.33
BHV-2/29	47.5	48	32.62	2.48	39.79	14.73	64.44	245.44	27.34	312.57	7.49	3.48	**588.35**	3.72	58.14
BHV-2/30	48	48.5	35.52	3.32	25.19	23.28	75.00	176.91	18.52	220.63	5.71	3.08	**767.08**	3.07	67.16
BHV-9/30	46.5	47	53.49	3.86	31.41	11.22	46.25	216.51	22.87	270.79	4.65	4.27	**847.00**	6.11	62.98
BHV-9/31	47	47.5	37.24	2.95	29.51	5.78	47.16	220.18	22.06	271.74	6.31	10.70	**828.44**	5.39	61.56
BHV-9/32	47.5	48	41.03	3.05	18.97	10.21	55.12	147.16	14.64	180.78	5.74	19.18	**1653.55**	7.45	69.4
BHV-9/33	48	48.5	40.55	2.53	27.18	9.49	52.71	174.35	19.36	220.89	4.58	5.31	340.90	5.41	66.39
BHV-9/35	49	49.5	56.20	3.84	30.73	17.55	60.81	181.06	20.98	232.77	4.08	8.61	**405.94**	11.28	64.11
BHV-9/36	49.5	50	85.11	4.41	36.79	17.44	54.94	209.11	24.98	270.88	4.65	10.24	**402.98**	11.87	62.71
BHV-9/37	50	50.5	53.86	3.55	24.07	5.79	57.49	150.66	15.82	190.55	5.67	3.80	270.79	2.49	69.58

Table 5. *(Continued.)*

	Sample length (m)		Be	Ge	Y	Mo	Sn	LREE (La–Eu)	HREE (Gd–Lu)	TREE+Y	Hf	Ta	W	U	SiO_2
Sample no.	From	To	(in ppm)												(in %)
BHV-9/38	50.5	51	41.86	4.14	23.95	7.10	51.78	148.77	15.84	188.56	4.56	6.73	**708.73**	3.98	67.7
BHV-9/39	51	51.5	45.10	4.72	25.46	9.06	54.54	177.60	17.03	220.09	5.37	7.29	**629.72**	3.78	67
BHV-9/40	51.5	52	62.58	4.35	28.74	8.74	38.09	170.87	18.38	217.99	5.67	7.99	**777.24**	4.15	67.12
BHI-31/1	41	41.5	73.28	3.05	50.46	41.67	69.52	181.31	30.20	261.98	5.37	20.32	343.28	8.17	65.72
BHI-31/2	41.5	42	32.10	2.19	50.08	25.62	26.60	116.83	30.11	197.02	2.41	5.61	261.02	5.62	77.2
BHI-31/3	42	43	42.25	4.55	30.79	43.70	38.31	125.07	22.87	178.72	4.11	22.78	**825.73**	5.18	75.92
BHI-31/4	43	43.5	24.15	3.11	45.56	42.28	38.31	139.32	32.64	217.52	2.28	6.59	**1348.29**	6.51	75.88
BHI-31/5	43.5	44	25.86	3.53	45.53	48.23	25.93	147.76	35.06	228.36	2.39	12.91	**2120.00**	9.32	76.26
BHI-31/6	47.5	48	50.19	4.96	43.50	45.27	62.89	139.12	28.97	211.60	3.16	18.60	**779.33**	5.09	73.3
BHI-31/7	46	48.5	18.56	5.03	25.96	12.43	31.63	188.05	20.69	234.70	5.33	36.50	**743.75**	3.88	66.15
BHI-31/8	44.5	49	17.27	3.18	37.63	43.25	25.78	239.53	28.87	306.03	6.13	3.17	**544.02**	4.05	65.09
BHI-31/9	43	49.5	15.24	2.16	46.15	17.93	22.74	115.28	28.17	189.59	2.84	2.83	198.64	4.70	78.13
BHI-31/10	41.5	50	15.08	3.02	38.72	35.25	11.74	94.24	24.14	157.10	1.81	1.43	**5025.45**	5.65	77.57
BHI-31/11	51	51.5	13.40	3.43	37.97	31.97	52.76	129.44	25.11	192.51	4.14	15.57	**529.58**	4.72	75.3
BHI-31/12	51.5	52	22.84	3.72	57.83	43.78	61.18	130.58	34.59	223.00	2.29	1.77	**894.29**	4.95	73.14
BHI-31/13	52	52.5	29.32	3.41	53.43	33.02	49.95	156.82	34.52	244.77	3.30	11.42	**440.10**	5.52	71.91
BHI-31/14	52.5	53	32.71	3.88	38.04	59.78	23.39	103.65	22.95	164.63	3.05	56.21	**605.60**	8.40	75.56
BHI-31/18	54.5	55	30.81	3.07	36.06	81.34	20.29	138.31	23.72	198.10	2.65	3.61	**573.28**	5.92	72.53
BHI-31/19	55	55.5	29.99	2.50	30.88	36.85	14.63	103.44	19.77	154.08	1.89	3.80	56.96	7.28	73.67
BHI-31/20	55.5	56	37.75	4.47	29.61	59.93	35.00	125.20	21.64	176.45	2.60	15.73	**495.46**	4.45	72.06
BHI-31/21	56	56.5	23.61	4.18	31.64	69.84	26.06	101.33	22.11	155.08	2.22	22.67	**916.74**	3.83	69.47
BHI-31/25	58	58.5	51.82	3.06	48.91	23.17	58.27	116.27	32.45	197.63	1.77	2.40	234.12	6.65	71.76
BHI-31/26	58.5	59	9.72	4.56	27.40	37.90	28.72	58.36	19.45	105.21	1.00	6.33	**914.04**	3.46	74.25
BHI-31/27	59	59.5	19.57	4.19	35.09	55.12	51.11	87.44	26.06	148.59	2.48	14.92	343.28	3.50	77.71
BHI-31/28	59.5	60	3.52	10.65	31.82	98.60	8.20	135.71	38.35	205.87	2.14	21.13	**4099.15**	2.87	68.37
BHI-32/5	50.5	51	13.89	2.84	35.80	8.69	44.11	210.70	25.16	271.66	4.12	1.72	**769.14**	5.56	61.45
BHI-32/6	51	51.5	14.30	2.60	24.83	6.53	23.03	145.18	17.40	187.41	5.58	1.75	**527.63**	3.36	63.46
BHI-32/7	51.5	52	25.57	4.05	35.49	10.22	43.54	212.44	24.59	272.52	4.06	1.95	164.30	5.98	71.34
BHI-32/8	52	52.5	45.75	3.13	34.02	7.72	67.62	223.74	24.95	282.70	3.88	2.31	214.79	5.41	65.18
BHI-32/9	52.5	53	19.27	6.71	29.48	29.87	20.04	209.74	25.36	264.58	3.66	3.41	**1324.97**	6.13	62.92
BHI-32/10	53	53.5	24.51	3.36	31.29	10.57	56.62	180.60	22.18	234.06	4.52	2.59	**807.38**	4.84	65.05
BHI-32/16	57	57.5	18.72	3.12	32.13	13.25	34.10	198.42	22.85	253.40	4.31	3.77	**883.88**	5.53	65.68
BHI-32/17	57.5	58	14.03	14.21	26.70	27.22	19.70	186.16	24.17	237.03	2.47	4.86	**1576.55**	6.11	64.04
BHI-32/18	58	58.5	15.40	12.52	22.30	23.66	13.46	180.71	20.36	223.37	2.43	3.72	**1601.57**	5.51	67.38
BHI-32/19	58.5	59	15.03	13.21	23.70	24.22	14.70	182.06	22.87	228.63	3.47	4.86	**1586.55**	6.11	63.71

Table 5. *(Continued.)*

Sample no.	Sample length (m) From	Sample length (m) To	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	Ba	Co	Cr
			(in %)									(in ppm)		
BHV-1/1	9	9.5	13.64	5.12	0.15	<0.1	0.76	1.78	3.64	0.03	0.02	81	6	48
BHV-1/2	9.5	10	13.72	6.72	0.19	<0.1	1.00	1.05	3.01	0.03	0.02	116	12	198
BHV-1/3	10	10.5	13.72	3.82	0.15	<0.1	0.81	2.17	4.34	0.03	0.02	82	1	77
BHV-1/4	10.5	11	13.34	3.42	0.15	<0.1	0.72	2.41	4.12	0.03	0.02	55	3	94
BHV-1/5	11	11.5	13.42	5.94	0.18	<0.1	0.80	1.29	4.21	0.03	0.02	81	7	100
BHV-1/7	12	12.5	13.99	3.01	0.07	<0.1	0.73	2.60	4.85	0.03	0.02	<50	2	56
BHV-1/8	12.5	13	13.13	4.75	0.10	<0.1	0.56	1.81	3.46	0.04	0.02	60	9	112
BHV-1/9	13	13.5	13.21	3.56	0.11	<0.1	0.64	2.37	4.93	0.03	0.02	<50	6	74
BHV-1/10	13.5	14	13.89	3.93	0.11	<0.1	0.79	2.40	4.62	0.03	0.02	122	5	104
BHV-1/11	14	14.5	13.70	5.57	0.16	<0.1	0.80	1.52	3.88	0.03	0.02	63	4	74
BHV-1/12	14.5	15	14.48	4.46	0.12	<0.1	0.85	2.22	4.03	0.03	0.02	85	2	80
BHV-1/13	15	15.5	13.33	4.88	0.12	<0.1	0.79	1.59	4.20	0.04	0.02	57	5	94
BHV-1/14	15.5	16	13.30	8.99	0.15	0.10	1.26	0.39	2.58	0.04	0.02	101	17	166
BHV-1/15	16	16.5	13.50	6.22	0.15	<0.1	0.84	1.38	4.03	0.03	0.02	<50	11	112
BHV-1/19	18	18.5	13.19	3.01	0.09	<0.1	0.73	2.62	4.82	0.03	0.02	80	<1	56
BHV-1/20	18.5	19	13.54	3.93	0.10	<0.1	0.74	2.08	4.49	0.05	0.02	254	<1	62
BHV-1/21	19	19.5	13.28	4.01	0.14	<0.1	0.77	2.23	4.46	0.04	0.02	184	4	73
BHV-1/22	19.5	20	13.83	7.05	0.18	<0.1	0.86	1.19	3.89	0.04	0.02	108	12	103
BHV-1/23	20	20.5	12.76	6.92	0.16	<0.1	0.74	1.20	3.79	0.04	0.02	108	9	82
BHV-1/28	22.5	23	14.60	2.66	0.10	0.14	0.90	2.19	4.81	0.03	0.02	111	<1	39
BHV-1/29	23	23.5	13.59	3.64	0.18	<0.1	0.68	2.19	4.40	0.04	0.02	104	6	51
BHV-1/30	23.5	24	13.45	2.76	0.08	0.10	0.65	2.70	4.58	0.03	0.02	74	<1	113
BHV-1/31	24	24.5	14.03	4.70	0.15	<0.1	0.72	2.24	4.06	0.03	0.02	134	5	378
BHV-1/32	24.5	25	13.77	3.15	0.11	<0.1	0.78	2.89	4.60	0.03	0.02	108	<1	292
BHV-1/33	25	25.5	13.82	4.97	0.19	<0.1	0.81	1.98	3.93	0.03	0.02	89	10	293
BHV-1/34	25.5	26	13.74	2.80	0.08	<0.1	0.72	2.79	4.67	0.04	0.02	120	<1	109
BHV-1/35	26	26.5	14.09	3.23	0.09	<0.1	0.79	2.66	4.63	0.03	0.02	147	<1	382
BHV-1/36	26.5	27	14.10	3.65	0.18	<0.1	0.80	2.07	4.92	0.04	0.02	94	7	158
BHV-1/37	27	27.5	13.37	3.94	0.09	<0.1	0.58	2.50	4.51	0.03	0.02	114	1	358
BHV-1/38	27.5	28	13.71	8.48	0.18	<0.1	0.75	0.72	2.78	0.03	0.02	201	15	685
BHV-1/39	28	28.5	13.88	3.79	0.08	<0.1	0.49	2.65	4.38	0.03	0.02	113	7	395
BHV-1/40	28.5	29	13.33	5.57	0.17	<0.1	0.84	1.75	3.60	0.03	0.02	161	11	435
BHV-1/41	29	29.5	14.48	3.21	0.11	<0.1	0.80	2.18	4.99	0.03	0.02	120	<1	198
BHV-1/44	30.5	31	13.76	5.02	0.12	<0.1	0.69	1.96	4.07	0.03	0.02	115	7	160
BHV-1/45	31	31.5	13.87	5.68	0.13	<0.1	0.88	1.12	3.45	0.04	0.02	119	10	294

Table 5. *(Continued.)*

Sample no.	Sample length (m) From	To	Al_2O_3 (in %)	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	Ba (in ppm)	Co	Cr
BHV-1/46	31.5	32	12.73	7.21	0.11	0.39	0.98	0.20	2.16	0.05	0.02	67	13	88
BHV-1/47	32	32.5	13.59	4.48	0.10	0.96	0.72	1.84	4.42	0.05	0.02	67	6	142
BHV-1/48	32.5	33	13.38	8.48	0.22	0.11	0.75	0.86	3.80	0.04	0.02	71	21	75
BHV-1/49	33	33.5	13.96	4.12	0.10	<0.1	0.81	2.52	4.44	0.04	0.02	107	3	75
BHV-1/50	33.5	34	13.39	4.51	0.15	<0.1	0.83	2.45	3.98	0.04	0.02	115	11	493
BHV-1/51	34	34.5	13.38	4.17	0.11	0.11	0.69	2.31	4.50	0.05	0.02	68	<1	69
BHV-1/52	34.5	35	13.46	4.30	0.12	<0.1	0.84	2.31	4.50	0.04	0.02	76	<1	86
BHV-1/53	35	35.5	13.09	4.02	0.12	<0.1	0.77	2.43	4.30	0.04	0.02	89	3	352
BHV-1/57	37	37.5	13.44	4.64	0.17	<0.1	0.81	2.01	4.29	0.03	0.02	85	9	100
BHV-1/58	37.5	38	14.07	4.39	0.14	<0.1	0.81	2.25	4.41	0.03	0.02	91	5	145
BHV-1/59	38	38.5	13.66	3.77	0.10	<0.1	0.74	2.39	4.55	0.03	0.02	<50	8	112
BHV-1/60	38.5	39	13.76	3.81	0.11	<0.1	0.74	2.37	4.37	0.04	0.02	55	2	128
BHV-1/61	39	39.5	13.53	4.64	0.20	<0.1	0.75	2.08	4.47	0.03	0.02	111	<1	103
BHV-1/62	39.5	40	13.79	3.55	0.13	<0.1	0.78	2.40	4.32	0.03	0.02	62	5	216
BHV-1/63	40	40.5	13.57	3.38	0.13	<0.1	0.81	2.24	4.60	0.03	0.02	54	<1	75
BHV-1/64	40.5	41	13.55	3.96	0.15	<0.1	0.76	2.16	3.92	0.03	0.02	68	7	165
BHV-1/65	41	41.5	13.20	5.85	0.15	<0.1	0.71	1.56	4.29	0.03	0.02	95	3	116
BHV-1/66	41.5	42	13.81	6.93	0.23	<0.1	0.74	1.53	4.35	0.03	0.02	167	10	76
BHV-1/67	42	42.5	13.88	3.85	0.14	<0.1	0.65	2.36	4.62	0.03	0.02	102	4	119
BHV-1/70	43.5	44	13.90	3.49	0.13	<0.1	0.73	2.60	4.58	0.03	0.02	63	3	146
BHV-1/71	44	44.5	13.99	3.87	0.11	<0.1	0.84	2.79	4.69	0.04	0.02	57	33	42
BHV-1/72	44.5	45	13.48	3.98	0.11	<0.1	0.8	2.74	4.66	0.03	0.03	79	25	311
BHV-1/73	45	45.5	13.94	5.64	0.13	<0.1	0.82	1.96	4.23	0.04	0.02	88	37	16
BHV-1/74	45.5	46	13.93	3.48	0.12	<0.1	0.74	2.93	4.78	0.04	0.02	<50	40	41
BHV-1/75	46	46.5	13.75	3.53	0.12	<0.1	0.69	2.59	4.56	0.03	0.02	<50	78	133
BHV-1/76	46.5	47	13.61	3.73	0.13	<0.1	0.73	2.69	4.72	0.03	0.02	<50	36	45
BHV-1/77	47	47.5	13.98	5.04	0.23	<0.1	0.83	1.47	4.38	0.03	0.03	116	8	126
BHV-1/78	47.5	48	14.12	4.92	0.14	<0.1	0.82	2.19	4.84	0.03	0.03	110	<1	285
BHV-1/79	48	48.5	13.42	4.54	0.18	0.11	0.8	1.69	4.42	0.03	0.04	118	2	405
BHV-1/80	48.5	49	13.32	7.81	0.19	<0.1	0.74	1.35	2.83	0.03	0.02	<50	13	646
BHV-1/81	49	49.5	13.82	4.74	0.11	<0.1	0.72	1.99	4.57	0.03	0.02	65	3	169
BHV-1/82	49.5	50	13.71	4.34	0.17	<0.1	0.79	2.22	4.51	0.03	0.03	100	1	343
BHV-2/27	44	44.5	16.24	5.83	0.15	1.21	0.58	2.64	2.95	0.38	0.04	318	5	417
BHV-2/28	47	47.5	13.2	5.1	0.1	1.54	0.99	0.88	1.97	0.39	0.06	304	12	375
BHV-2/29	47.5	48	21.11	5.17	0.12	2.51	0.24	1.55	5.38	0.81	0.06	779	8	116
BHV-2/30	48	48.5	14.96	4.6	0.1	1.79	0.7	0.64	3.72	0.55	0.06	456	7	326
BHV-9/30	46.5	47	18.97	4.9	0.06	2.88	0.56	0.6	4.55	0.73	0.22	580	11	181
BHV-9/31	47	47.5	17.79	7.18	0.08	3.88	0.15	0.61	4.82	0.76	0.07	478	16	136
BHV-9/32	47.5	48	14.05	5.75	0.07	3.32	0.34	0.44	3.51	0.56	0.09	309	15	232
BHV-9/33	48	48.5	16.62	4.55	0.05	2.82	0.38	0.61	4.2	0.64	0.17	572	10	167

Table 5. *(Continued.)*

	Sample length (m)		Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	Ba	Co	Cr
Sample no.	From	To	(in %)									(in ppm)		
BHV-9/35	49	49.5	17.82	4.9	0.05	2.57	0.7	0.52	3.92	0.84	0.41	503	18	191
BHV-9/36	49.5	50	19.03	5.03	0.06	2.61	0.87	0.5	4.08	0.77	0.46	535	11	199
BHV-9/37	50	50.5	13.77	5.76	0.07	3.01	0.41	0.46	3.56	0.58	0.07	346	13	156
BHV-9/38	50.5	51	14.45	6.91	0.07	3.37	0.56	0.43	3.42	0.63	0.11	325	25	196
BHV-9/39	51	51.5	16.8	5.31	0.06	3.1	0.37	0.52	3.77	0.65	0.08	383	15	192
BHV-9/40	51.5	52	14.33	6.67	0.07	3.29	0.36	0.46	3.63	0.65	0.08	343	15	131
BHI-31/1	41	41.5	16.12	4.03	0.1	2.34	0.54	0.49	5.03	0.51	0.35	578	3	109
BHI-31/2	41.5	42	9.29	2.63	0.05	1.45	1.06	0.21	2.78	0.3	0.88	326	8	70
BHI-31/3	42	43	11.91	3	0.1	1.39	0.58	0.19	2.73	0.34	0.36	352	2	97
BHI-31/4	43	43.5	9.95	3.79	0.14	1.31	1.13	0.17	2.8	0.3	0.7	342	5	165
BHI-31/5	43.5	44	9.79	4.29	0.1	1.41	0.95	0.13	2.69	0.3	0.72	331	11	143
BHI-31/6	47.5	48	12.42	3.84	0.19	1.89	1.19	0.15	3.19	0.35	0.47	320	8	152
BHI-31/7	46	48.5	18.26	4.1	0.11	2.25	0.14	0.73	4.32	0.56	0.07	597	12	175
BHI-31/8	44.5	49	18.37	3.49	0.08	2.82	0.37	0.82	4.96	0.65	0.18	714	10	137
BHI-31/9	43	49.5	6.94	3.99	0.13	2.19	1.53	0.23	2.3	0.27	0.81	196	6	138
BHI-31/10	41.5	50	8.49	3.08	0.08	1.46	1.4	0.62	1.9	0.26	0.46	465	8	87
BHI-31/11	51	51.5	10.63	2.55	0.08	2.14	0.97	0.48	2.77	0.32	0.48	322	2	112
BHI-31/12	51.5	52	9.42	3.46	0.14	3.07	2.31	0.24	2.88	0.27	0.87	252	5	160
BHI-31/13	52	52.5	10.94	3.87	0.12	2.66	1.51	0.34	2.89	0.35	0.67	312	6	86
BHI-31/14	52.5	53	9.91	2.87	0.09	2.39	1.14	0.21	2.78	0.26	0.59	237	<1	123
BHI-31/18	54.5	55	11.84	3.03	0.07	3.03	0.54	0.8	3.59	0.41	0.3	430	6	262
BHI-31/19	55	55.5	11.56	3.97	0.14	2.55	0.79	0.27	3.38	0.4	0.38	322	16	150
BHI-31/20	55.5	56	11.63	3.86	0.09	2.94	0.63	0.44	3.79	0.42	0.38	297	3	104
BHI-31/21	56	56.5	13.55	5.34	0.18	2.53	0.69	0.26	3.91	0.43	0.28	314	6	163
BHI-31/25	58	58.5	11.82	3.21	0.1	2.85	0.93	0.8	3.72	0.38	0.61	404	8	111
BHI-31/26	58.5	59	9.56	3.69	0.14	2.61	1.77	0.15	3.24	0.24	0.89	195	6	110
BHI-31/27	59	59.5	8.84	4.42	0.15	1.49	1.28	0.22	2.22	0.16	0.51	146	3	106
BHI-31/28	59.5	60	11.74	8.58	0.27	1.9	1.35	0.27	3.69	0.21	0.54	154	11	157
BHI-32/5	50.5	51	20.01	4.3	0.08	2.54	0.32	1.08	5.03	0.78	0.17	709	10	123
BHI-32/6	51	51.5	16.91	5.2	0.08	2.7	0.38	0.86	4.51	0.74	0.25	561	8	116
BHI-32/7	51.5	52	11.3	4.52	0.07	2.82	0.41	1.15	2.93	0.71	0.12	313	7	105
BHI-32/8	52	52.5	17.01	5.28	0.08	2.78	0.45	0.81	3.95	0.73	0.29	519	17	157
BHI-32/9	52.5	53	18.03	5.01	0.1	2.84	0.41	0.84	4.7	0.79	0.26	607	10	144
BHI-32/10	53	53.5	18.5	4.13	0.08	2.5	0.54	1.05	3.97	0.75	0.18	624	10	109
BHI-32/16	57	57.5	16.24	5.54	0.1	2.66	0.57	0.94	4.45	0.7	0.21	502	14	107
BHI-32/17	57.5	58	17.27	5.3	0.08	2.57	0.42	1.29	4.84	0.68	0.21	607	6	120
BHI-32/18	58	58.5	18.34	4.41	0.1	1.63	1.28	0.35	2.27	0.55	0.31	332	7	102
BHI-32/19	58.5	59	17.03	5.66	0.12	2.62	0.75	0.58	5.14	0.71	0.28	487	13	115

Table 5. *(Continued.)*

Sample no.	Sample length (m) From	Sample length (m) To	Cu	Ga	Nb	Pb	Rb	Sc	Sr	Th	V	Zn	Zr	Ni
			(in ppm)											
BHV-1/1	9	9.5	7	41	56	19	1131	7	<5	37	<20	121	54	<2
BHV-1/2	9.5	10	14	45	48	19	1271	<3.5	<5	46	<20	210	52	3
BHV-1/3	10	10.5	20	41	43	29	1041	10	<5	35	<20	106	55	5
BHV-1/4	10.5	11	17	42	46	26	1052	5	<5	35	<20	107	59	8
BHV-1/5	11	11.5	34	44	45	21	1367	16	<5	30	<20	133	51	<2
BHV-1/7	12	12.5	28	40	47	32	958	6	<5	24	<20	66	58	<2
BHV-1/8	12.5	13	81	35	52	37	907	<3.5	<5	41	<20	79	57	<2
BHV-1/9	13	13.5	22	42	48	28	1121	9	<5	24	<20	76	58	9
BHV-1/10	13.5	14	30	42	47	30	1091	8	<5	37	<20	89	62	9
BHV-1/11	14	14.5	26	40	48	28	1234	<3.5	<5	33	<20	101	58	4
BHV-1/12	14.5	15	37	43	56	44	1005	8	<5	43	<20	82	59	<2
BHV-1/13	15	15.5	33	44	47	29	1150	4	<5	41	<20	101	52	5
BHV-1/14	15.5	16	135	53	47	20	1216	12	<5	29	<20	304	50	6
BHV-1/15	16	16.5	10	45	50	24	1309	10	<5	37	<20	149	54	<2
BHV-1/19	18	18.5	6	35	44	37	970	<3.5	<5	40	<20	74	61	<2
BHV-1/20	18.5	19	7	44	46	28	1067	5	<5	32	<20	91	56	2
BHV-1/21	19	19.5	6	39	45	31	1046	17	<5	34	<20	96	53	8
BHV-1/22	19.5	20	3	46	47	18	1356	<3.5	<5	36	<20	213	51	10
BHV-1/23	20	20.5	4	46	43	23	1217	13	<5	33	<20	195	50	6
BHV-1/28	22.5	23	51	42	47	34	1000	14	6	37	<20	105	60	5
BHV-1/29	23	23.5	48	43	45	32	1081	9	<5	28	<20	97	51	4
BHV-1/30	23.5	24	25	41	42	29	971	6	<5	27	<20	63	55	<2
BHV-1/31	24	24.5	34	41	49	25	1191	11	<5	39	<20	102	49	7
BHV-1/32	24.5	25	22	41	48	31	983	10	<5	44	<20	77	60	6
BHV-1/33	25	25.5	11	41	46	22	1231	6	<5	37	<20	138	58	9
BHV-1/34	25.5	26	24	37	42	34	946	13	<5	26	<20	67	54	5
BHV-1/35	26	26.5	12	39	44	32	968	5	<5	35	<20	86	58	9
BHV-1/36	26.5	27	22	44	47	31	1104	11	<5	38	<20	110	61	6
BHV-1/37	27	27.5	51	45	48	35	1067	7	<5	44	<20	92	70	7
BHV-1/38	27.5	28	81	47	76	26	1210	12	<5	51	<20	204	49	<2
BHV-1/39	28	28.5	41	43	44	30	1002	12	<5	39	<20	83	56	12
BHV-1/40	28.5	29	20	48	52	31	1082	17	8	42	<20	196	52	4
BHV-1/41	29	29.5	11	38	49	37	1055	7	9	46	<20	115	56	4
BHV-1/44	30.5	31	9	45	48	29	1183	7	<5	35	<20	129	54	6
BHV-1/45	31	31.5	472	44	43	38	1024	5	<5	48	<20	185	57	12
BHV-1/46	31.5	32	321	38	45	42	958	<3.5	<5	38	<20	254	55	7
BHV-1/47	32	32.5	59	40	43	26	1093	15	<5	29	<20	129	62	13
BHV-1/48	32.5	33	39	45	46	22	1326	22	<5	31	<20	217	51	<2
BHV-1/49	33	33.5	1	40	48	31	964	8	<5	42	<20	69	58	2
BHV-1/50	33.5	34	19	43	49	26	1170	13	<5	38	<20	91	65	7
BHV-1/51	34	34.5	3	40	49	30	1060	4	<5	49	<20	77	62	<2

Table 5. *(Continued.)*

	Sample length (m)		Cu	Ga	Nb	Pb	Rb	Sc	Sr	Th	V	Zn	Zr	Ni
Sample no.	From	To						(in ppm)						
BHV-1/52	34.5	35	3	41	47	29	1103	19	<5	27	<20	96	55	6
BHV-1/53	35	35.5	<1	41	42	32	1077	12	<5	28	<20	103	62	6
BHV-1/57	37	37.5	4	44	48	30	1116	<3.5	8	40	<20	118	57	<2
BHV-1/58	37.5	38	7	46	50	26	1133	11	<5	42	<20	113	53	3
BHV-1/59	38	38.5	3	40	44	29	1056	8	<5	36	<20	90	54	2
BHV-1/60	38.5	39	32	46	47	27	1029	4	<5	44	<20	80	58	<2
BHV-1/61	39	39.5	7	48	50	27	1207	14	<5	41	<20	112	54	8
BHV-1/62	39.5	40	13	41	46	27	974	10	<5	41	<20	84	60	<2
BHV-1/63	40	40.5	3	41	48	34	1004	11	13	44	<20	70	57	11
BHV-1/64	40.5	41	10	40	50	25	942	4	7	55	<20	70	52	4
BHV-1/65	41	41.5	24	46	54	31	1187	4	<5	46	<20	140	41	<2
BHV-1/66	41.5	42	4	49	68	27	1298	20	<5	36	<20	228	48	<2
BHV-1/67	42	42.5	<1	46	50	26	1080	13	<5	45	<20	68	59	8
BHV-1/70	43.5	44	3	41	44	34	1082	14	<5	35	<20	71	59	4
BHV-1/71	44	44.5	<1	46	52	50	1156	<3.5	11	32	<20	91	63	7
BHV-1/72	44.5	45	6	48	53	46	1066	4	13	38	<20	95	59	8
BHV-1/73	45	45.5	61	52	51	43	1142	4	9	40	<20	185	63	2
BHV-1/74	45.5	46	<1	52	55	47	1188	7	11	38	<20	99	69	<2
BHV-1/75	46	46.5	18	46	50	56	1137	<3.5	10	41	<20	121	63	2
BHV-1/76	46.5	47	1	47	49	50	1195	5	10	39	<20	105	63	4
BHV-1/77	47	47.5	87	52	53	35	1388	5	26	53	<20	84	62	4
BHV-1/78	47.5	48	10	54	57	52	1170	<3.5	13	50	<20	83	58	<2
BHV-1/79	48	48.5	26	52	51	39	1186	4	28	69	<20	42	62	6
BHV-1/80	48.5	49	251	54	61	53	1118	<3.5	11	43	<20	528	62	16
BHV-1/81	49	49.5	45	51	49	56	1120	7	10	50	<20	299	60	<2
BHV-1/82	49.5	50	28	52	61	54	1203	6	17	54	<20	149	67	9
BHV-2/27	44	44.5	113	51	62	19	1180	5	40	29	62	192	163	26
BHV-2/28	47	47.5	163	22	31	19	493	8	32	168	52	77	200	13
BHV-2/29	47.5	48	112	40	30	22	1045	9	57	26	121	137	321	15
BHV-2/30	48	48.5	120	30	23	7	786	7	33	17	74	113	259	14
BHV-9/30	46.5	47	127	32	19	18	689	23	28	27	113	100	172	25
BHV-9/31	47	47.5	174	32	39	13	825	23	26	18	158	151	233	<2
BHV-9/32	47.5	48	115	26	46	7	640	18	22	25	100	132	196	4
BHV-9/33	48	48.5	97	27	21	10	541	16	30	16	100	97	164	36
BHV-9/35	49	49.5	150	31	41	16	579	15	25	19	131	100	177	40
BHV-9/36	49.5	50	115	38	36	15	661	20	34	24	123	103	182	52
BHV-9/37	50	50.5	181	24	22	11	599	13	25	13	106	123	222	14
BHV-9/38	50.5	51	211	18	33	17	662	25	28	19	126	203	216	20
BHV-9/39	51	51.5	127	27	33	9	621	23	26	24	105	102	215	13
BHV-9/40	51.5	52	133	23	28	17	736	19	25	17	126	125	228	16

Table 5. *(Continued.)*

Sample no.	Sample length (m)		Cu	Ga	Nb	Pb	Rb	Sc	Sr	Th	V	Zn	Zr	Ni
	From	To	(in ppm)											
BHI-31/1	41	41.5	233	27	19	8	1250	15	361	22	160	51	134	18
BHI-31/2	41.5	42	127	19	10	2	583	13	374	16	164	35	84	8
BHI-31/3	42	43	124	27	29	11	826	22	158	33	120	56	124	12
BHI-31/4	43	43.5	228	20	18	6	895	18	402	29	136	53	79	12
BHI-31/5	43.5	44	175	28	34	10	873	27	535	30	136	70	77	17
BHI-31/6	47.5	48	286	21	22	2	1280	25	98	31	132	151	94	56
BHI-31/7	46	48.5	145	35	38	12	768	17	41	27	68	69	151	33
BHI-31/8	44.5	49	135	23	19	16	722	13	46	21	91	53	195	19
BHI-31/9	43	49.5	109	19	8	8	717	22	18	10	138	108	71	57
BHI-31/10	41.5	50	152	11	21	11	352	<3.5	44	20	109	70	72	71
BHI-31/11	51	51.5	135	19	18	7	524	10	30	20	150	136	103	39
BHI-31/12	51.5	52	220	17	14	<2	641	10	29	13	149	498	79	49
BHI-31/13	52	52.5	136	23	17	12	809	14	34	25	162	98	106	47
BHI-31/14	52.5	53	158	13	33	8	593	8	29	14	150	74	79	46
BHI-31/18	54.5	55	324	18	12	9	583	15	36	16	196	94	109	62
BHI-31/19	55	55.5	150	27	17	9	853	18	28	29	201	96	103	66
BHI-31/20	55.5	56	96	21	13	11	795	20	24	18	201	84	107	48
BHI-31/21	56	56.5	98	28	24	8	1352	14	25	33	158	132	109	44
BHI-31/25	58	58.5	122	15	8	13	698	17	27	11	237	144	99	66
BHI-31/26	58.5	59	138	18	13	7	962	17	23	15	182	245	73	49
BHI-31/27	59	59.5	142	25	12	<2	958	15	37	44	85	122	35	23
BHI-31/28	59.5	60	158	46	18	7	2103	27	37	56	108	259	56	33
BHI-32/5	50.5	51	121	27	16	19	522	8	38	19	138	166	178	23
BHI-32/6	51	51.5	114	27	20	18	600	19	26	11	136	149	169	29
BHI-32/7	51.5	52	110	16	15	15	404	16	46	11	79	124	226	18
BHI-32/8	52	52.5	176	24	20	17	530	17	24	14	141	123	168	33
BHI-32/9	52.5	53	156	25	22	14	739	11	28	16	149	125	172	33
BHI-32/10	53	53.5	112	28	22	14	515	27	34	27	122	97	181	20
BHI-32/16	57	57.5	131	32	24	12	988	13	35	14	140	108	189	22
BHI-32/17	57.5	58	147	26	18	10	857	19	40	13	157	95	161	26
BHI-32/18	58	58.5	146	26	20	7	611	9	26	25	84	63	119	25
BHI-32/19	58.5	59	246	26	28	12	1225	26	29	26	127	410	155	16

volatiles during hydrothermal alteration (Chattopadhyay and Chattopadhyay 1992; Chattopadhyay *et al.* 1994).

6.2 *Wolframite*

The mineral chemistry data of wolframite from studied samples are provided in table 3. Wolframite shows variation in its composition between Huebnerite (Hb) to Ferberite (Fb) and molecular proportion of these two end members are determined by the formula given below:

$$Hb = MnO/(FeO + MnO) \times 100, \quad (1)$$

$$Fb = FeO/(FeO + MnO) \times 100. \quad (2)$$

It is observed that molecular proportion of Huebnerite from the wolframite crystal of DPG varies between 29.2% and 57.8% and Ferberite between 44.5% and 70.8% indicating Ferberite as dominant phase. A slight enrichment of LREE together with Nb_2O_3 0.97–1.67 wt.%, Ta_2O_5 0.06–0.34 wt.%, BaO 0.08–0.13 wt.%, Y_2O_3 0.05–0.28 wt.% and F 0.06–0.31 wt.% was also reported from wolframite (figure 4A and B).

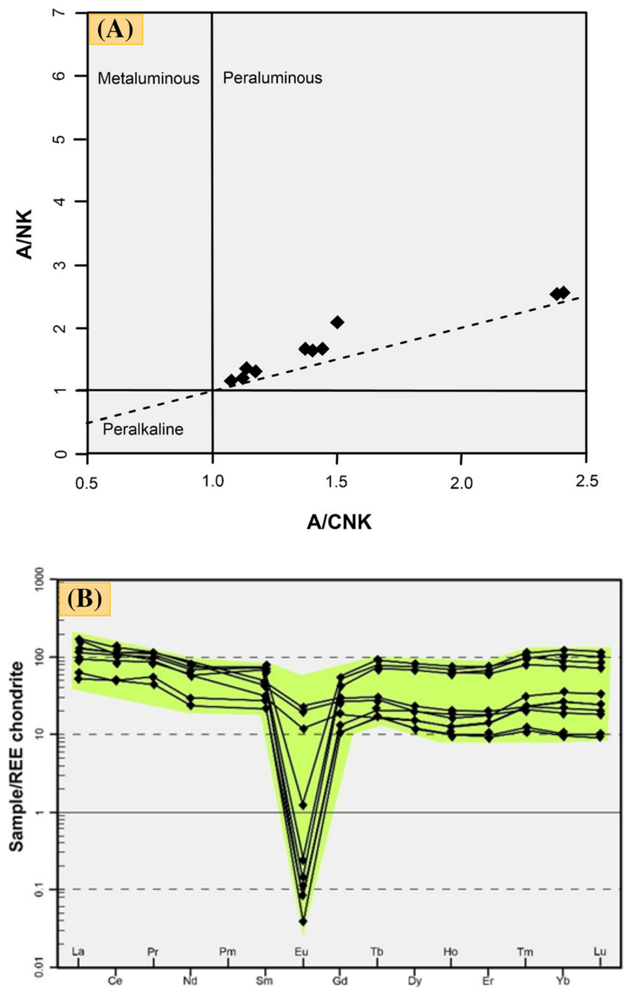

Figure 5. (**A**) A/CNK–A/NK plot showing peraluminous nature of DPG (after Shand 1943). (**B**) Spider plot showing huge negative Eu anomaly of DPG (after Nakamura 1974).

7. Discussion and conclusions

The peraluminous mineralized granites are mostly emplaced at shallow crustal level, enriched in volatile elements, viz., F, Li, B and having high Rb/Sr ratio (Neiva 1984; Zhao *et al.* 2001; Xie *et al.* 2009; Fogliata *et al.* 2012; Anand *et al.* 2018). Rb/Sr ratio of DPG is very high as it shows enriched Rb (352–2103 ppm) and depleted Sr (6–535 ppm). The high Rb/Sr ratio of DPG indicates post-magmatic alteration involving enriched K-phases and depleted Ca-phases (Imeokparia 1981; Ekwere 1985). This Rb/Sr ratio can also be used to determine the fertility of DPG (Nockolds and Allen 1953; Taylor and Heier 1960; Taylor 1965; Imeokparia 1981; Ekwere 1985). Higher Rb/Sr ratio indicates fertility of DPG for W and associated mineralization. The Rb/Sr ratio of DPG occurring beneath cover varies between 7.86 (BHI-31) and 91.02 (BHV-1). On the basis of field evidences, we classified tungsten mineralization in the study area into five types; Type I: quartz–wolframite vein (figure 2A and B), Type-II: quartz–muscovite–wolframite–polymetallic sulphide vein (figure 2C), Type-III: DPG hosted wolframite (figure 2D), Type-IV: stock-works hosted wolframite in phyllite (figure 2F) and Type-V: gravel bed hosted wolframite (figure 2G). Rewat Hill is entirely made up of fertile DPG (Type-I to III, Type-V at foothills) and Tikli hill is characterized as fertile DPG (Type-I to III, Type-V at foothills) with phyllite (Type-IV). The Phyllite Hill is entirely made up of phyllite with Type-IV tungsten mineralization. Wolframite occurrences of Type-I to Type-IV are genetically related to hydrothermal events associated with Neoproterozoic granite magmatism and Type-V is much younger weathering-related placer wolframite process.

Sub-surface data reveals the presence of fertile DPG with potential W-mineralization in soil

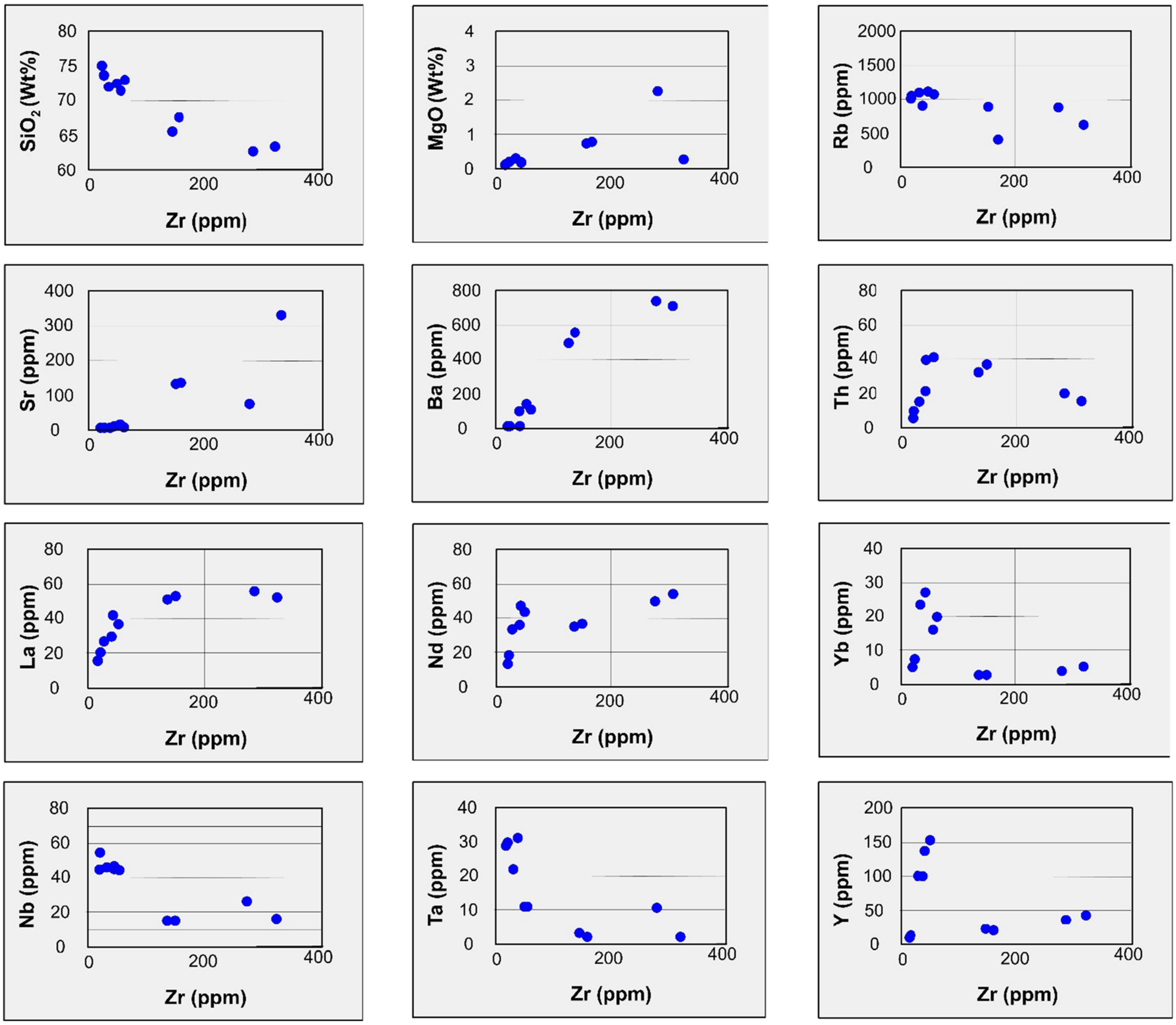

Figure 6. Major oxides and Trace element variations *vs.* Zr.

covered northern and north-western parts of Rewat Hill with W concentration in the range of 402.98–5025.45 ppm with higher LREE (58.36–288.67 ppm) and relatively lower HREE (14.64–92.48 ppm). The composition of wolframite from DPG varies between Huebnerite to Ferberite, among them, Ferberite is reported as the dominant phase. The elements Rb and Ba have strong positive correlation with W and range between Rb (352–2103 ppm) and Ba (54–779 ppm). Rb/Sr ratio of DPG granite is very high with enriched Rb and depleted Sr, indicating post-magmatic alteration. This Rb/Sr ratio can also be used to determine fertility of DPG, higher the Rb/Sr ratio indicates more fertile DPG granite for W and associated mineralization (Li, Rb, Ba).

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