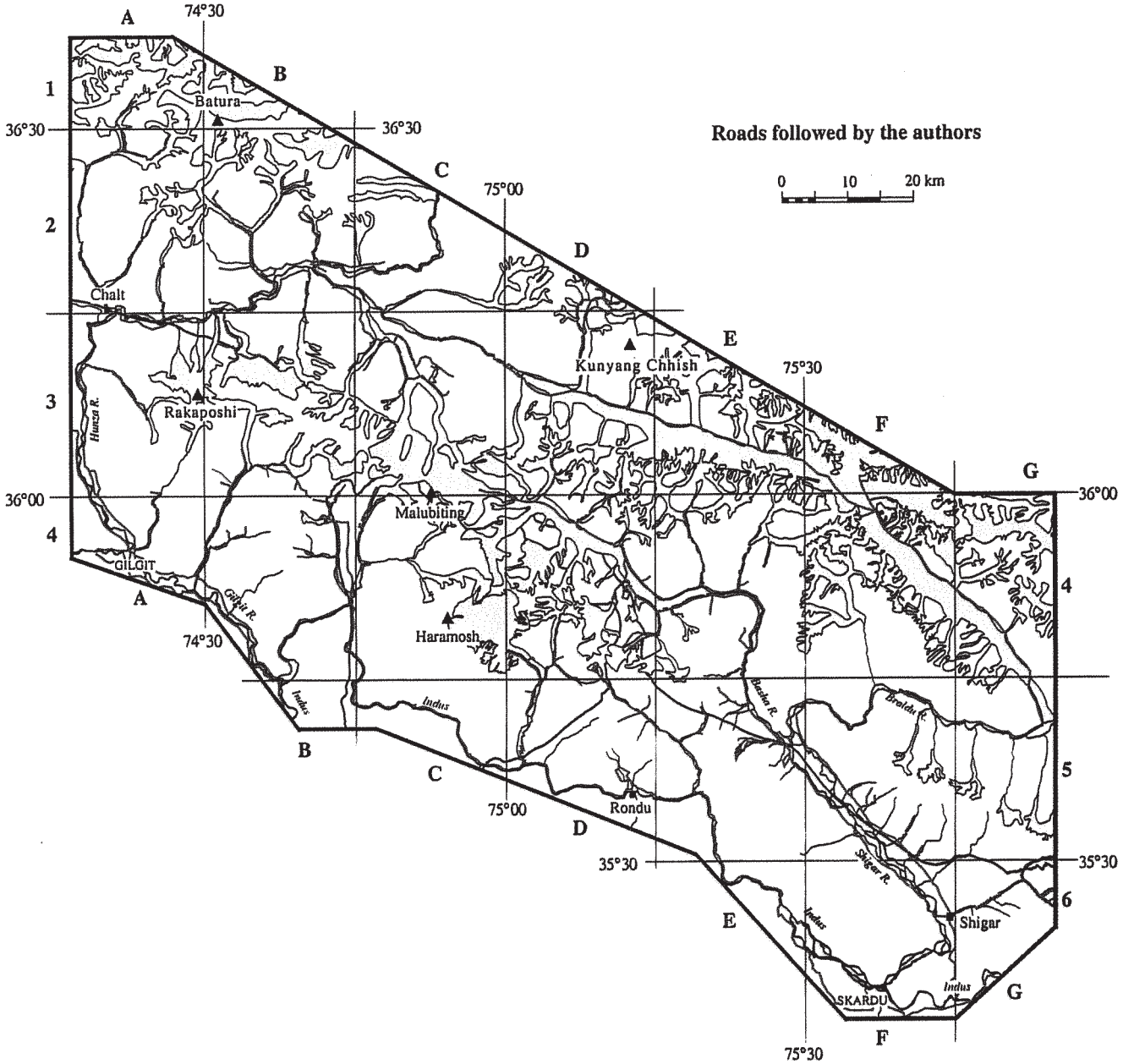
ANNEX 1 – ITINERARIES, ROADS AND PATHS FOLLOWED BY THE AUTHOURS



ANNEX 2 - ABBREVIATIONS USED FOR MINERALS

	English	français
Ab	albite	albite
Act	actinolite	actinote
Am	amphibole	amphibole
An	anorthite	anorthite
Be	beryl	béryl
Bi	biotite	biotite
Cc	calcite	calcite
Cd	cordierite	cordiérite
Chl	chlorite	chlorite
Cpx	clinopyroxene	clinopyroxène
Czo	clinozoisite	clinozoïsite
Ep	epidote	épidote
Gr	garnet	grenat
Hb	hornblende	hornblende
Kf	potash feldspar	feldspath potassique
Ky	kyanite	disthène
M	mica	mica
Mu	muscovite	muscovite
Olg	oligoclase	oligoclase
Opx	orthopyroxene	orthopyroxène
Pl	plagioclase	plagioclase
Px	pyroxene	pyroxène
Q	quartz	quartz
Rt	rutile	rutile
Scp	scapolite	scapolite
Sil	sillimanite	sillimanite
St	staurolite	staurotide
Sph	sphene	sphène
T	tourmaline	tourmaline
Wo	wollastonite	wollastonite

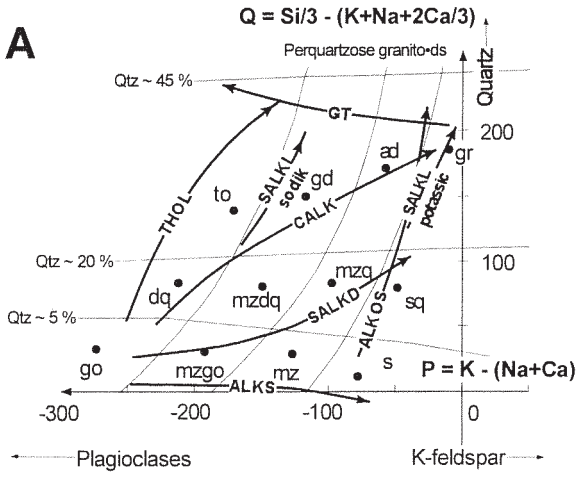


Diagram A

Q-P or "nomenclature " diagram. In granitoïd rocks, the Q parameter is proportional to the weight content of quartz. "Qtz%" = estimate of quartz/('quartz + feldspars + muscovite) proportions, in volume Typical trends corresponding to cafemic and alumino-cafemic associations: THOL, tholeiitic; CALK, calc-alkaline; SALKD, SALKL, dark- and light-coloured subalkaline (monzonitic); ALKS, dark-coloured alkaline saturated; ALKOS, light-coloured alkaline oversaturated; GT, granitic-trondhjemitic.

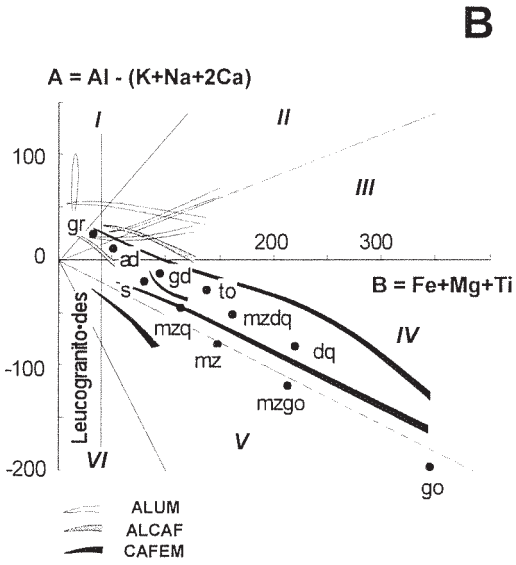


Diagram B

A-B or "characteristic minerals " diagram. A is an "alumina index" and B is proportional to the weight content of dark minerals in granitic rocks. The diagram separates the peraluminous rocks (positive A value) from the metaluminous ones (negative A values). The six sectors numbered I to VI correspond to a specific mineral composition. I, II, III = sectors of peraluminous rocks with : I muscovite > biotite; II biotit > muscovite; III biotite; IV, V, VI = sectors of metaluminous rocks with: IV biotite + amphibole ± pyroxene; V clinopyroxene ± amphibole ± biotite; VI unusual rocks (e.g. carbonatites). This diagram distinguish three main types of associations: ALUM aluminous, ALCAF alumino-cafemic, CAFEM cafemic.

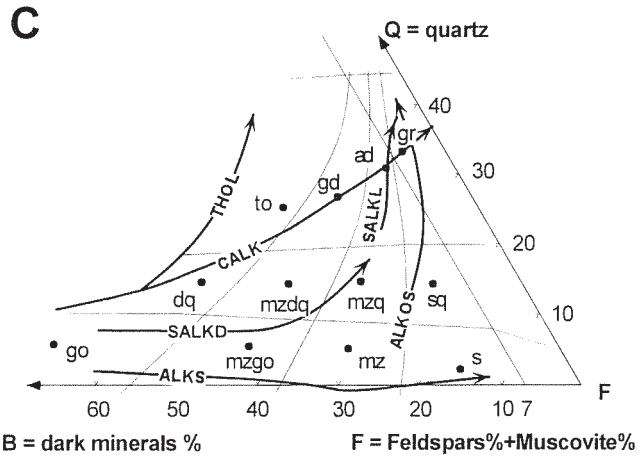


Diagram C

Q-B-F or "quartz - dark mineral - feldspars + muscovite" diagram. This diagram, combined with the Q-P diagram (diagram A) enables us to distinguish subtypes among the cafemic and alumino-cafemic associations: THOL, tholeiitic, CALK, calc-alkaline; SALKD, SALKL, dark- and light-coloured subalkaline (monzonitic); ALKS, dark-coloured alkaline saturated; ALKOS, light-coloured alkaline oversaturated.

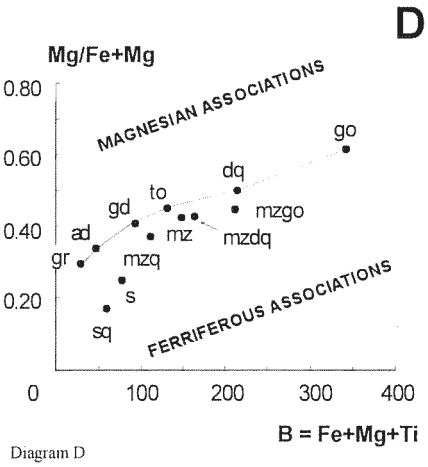


Diagram D

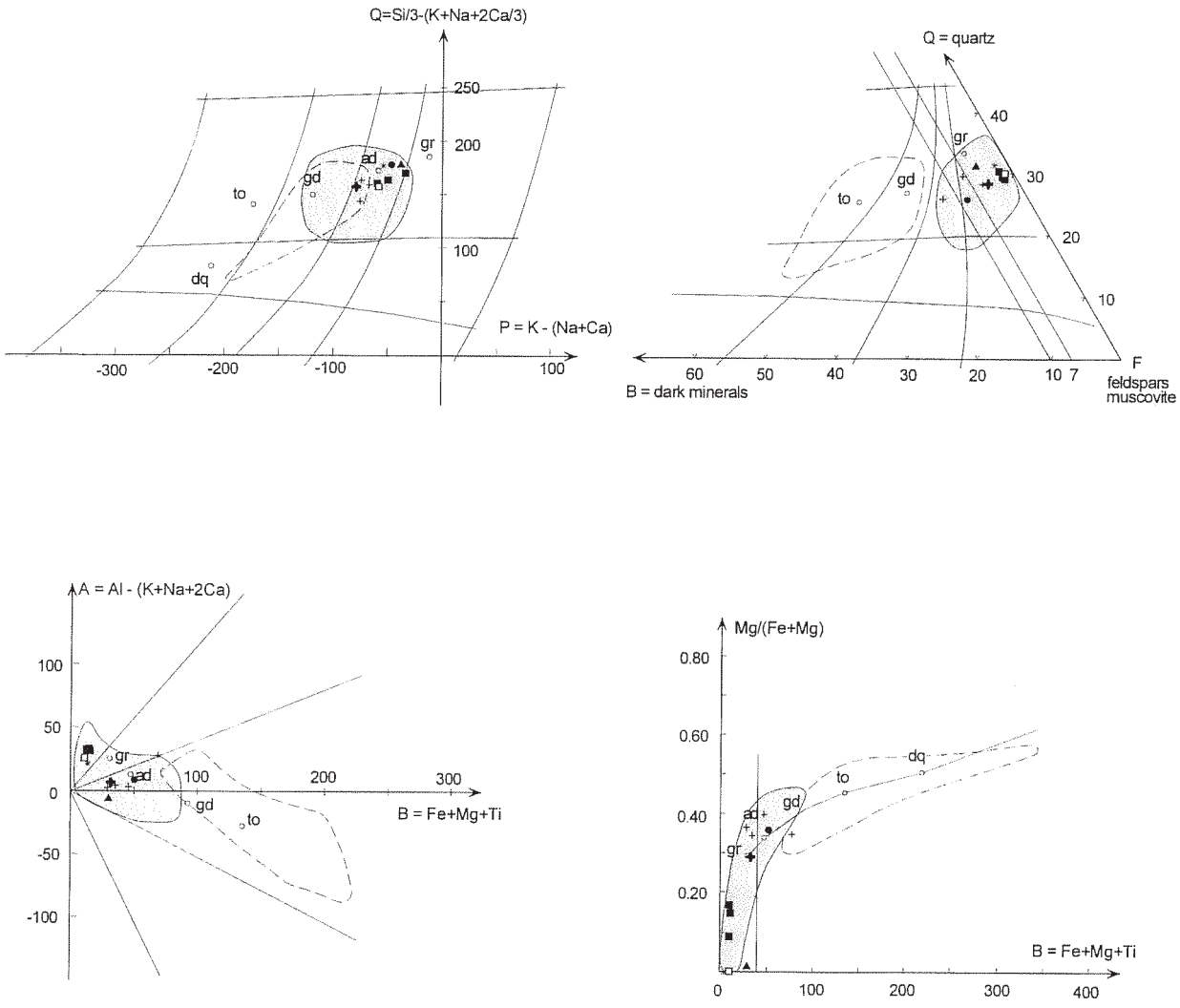
Mg/(Fe + Mg) againstB = Fe + Mg + Ti diagram. The line passing through the granite, adamellite, granodiorite, tonalite, quartz diorite and gabbro reference points separates magnesian, common, and ferriferous associations.

ANNEXURE 3. Classification of Plutonic Rocks

Annex ure 3 gives the chemical analysis of the various plutonic rocks and orthogneisses which appear on the map (analysis done either at the Geoscience Laboratory, Islamabad, Pakistan, by XRF, and then referred as "Geolab", or at the CRPG-CNRS, Nancy, France, by ICP). Rocks have been named following the classification of Debon & Le Fort (1983, 1988). Based on cationic calculations from major element data, it allows the characterisation of individual samples and evidences the magmatic associations. Rock type abbreviations and parameters of the tables and diagrams 3-1 to 3-8 as in diagrams 3-A to 3-B.

L'annexe 3 donne les analyses chimiques des diverses roches plutoniques ou des orthogneiss cartographiés (analyses faites soit au Geoscience Laboratory d'Islamabad, Pakistan, par XRF, et alors indiquées par "Geolab" en tête de colonne, soit au CRPG, CNRS, Nancy, France, par ICP. Les roches ont été classées en utilisant la classification de Debon & Le Fort (1983, 1988). Basée sur les éléments majeurs, elle permet la caractérisation d'un échantillon donné, ou met en évidence l'éventuelle suite magmatique formées par un groupe d'échantillon. Les abréviations des tableaux et diagrammes 6-1 à 6-8 les mêmes que celles des diagrammes d'introduction 6-A à 6-C.

Parameters of the chemical -mineralogical classification diagrams are in millications for 100 g of rock mineral (an example of calculation of the different parameters is given in Debon & Le Fort, 1988). Rock types are: ad adamellite, dq quartz diorite, go gabbro, gr granite, mz monzonite, mzdq quartz monzodiorite, mzgo monzogabbro, mzq quartz monzonite, s syenite, sq quartz syenite, to tonalite.



ANNEXURE 3-1 (Table 3-1, Diagrams 3-1)

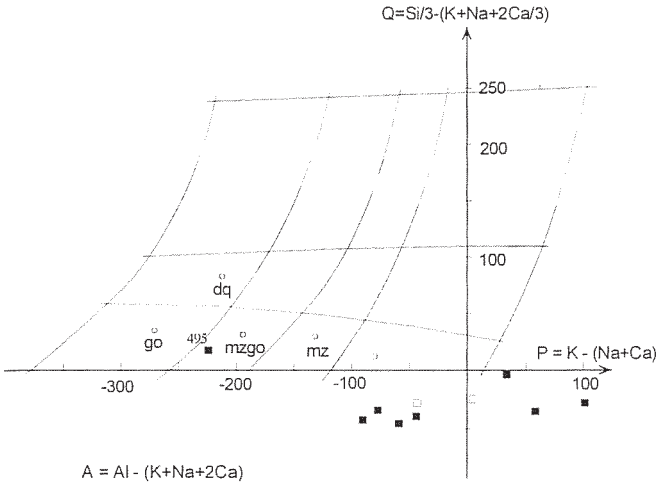
Karakorum intrusive rocks, isolated young bodies and Baltoro granite.

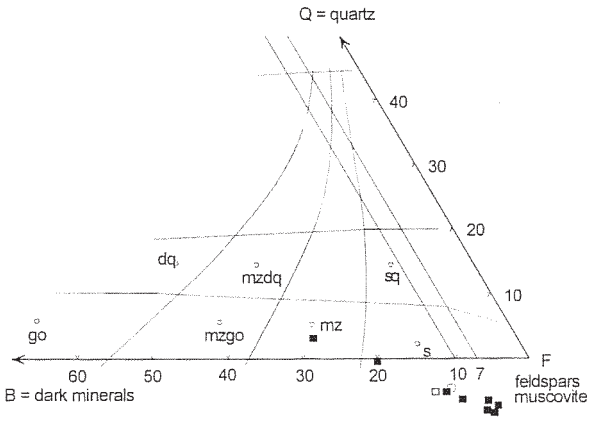
Chemical analysis and chemical -mineralogical classification of the isolated young bodies and the Baltoro granite. Black dot: Hasanabad granite (SK153); black squares: Sumayar granite (SK079, 081 et 083); white square: Sumayar granite (A: average of 5 analyses, in Crawford and Searle, 1993); stars : Nagar granite (B: average of 5 analyses, in Crawford and Searle, 1993); cross: Baltoro granite (TK402, 405, 437 et 438); thick cross: Baltoro granite (C: average of 20 analyses, in Crawford and Searle, 1993); black triangle: Alchori granite (SK307). Patterns of Baltoro granite (grey) and Hunza granodiorite (doted line) are from Debon et al (1987).

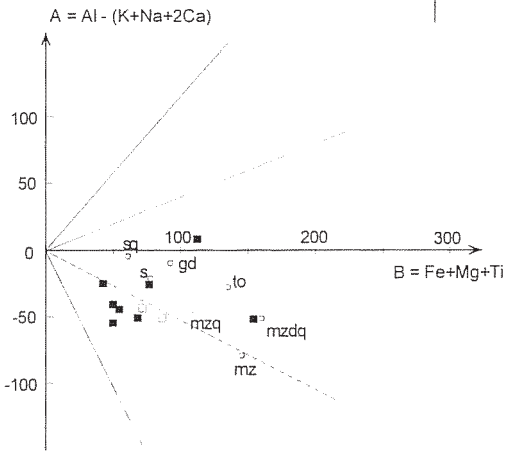
Roches intrusives du Karakorum , jeunes corps isolés et granite du Baltoro
Chimie et classification des jeunes corps isolés et du granite du Baltoro. Disques noirs: granite d'Hasanabad (SK153); carrés noirs: granite de Sumayar (SK079, 081 et 083); carré blanc: granite de Sumayar (A: moyenne de 5 analyses, in Crawford et Searle, 1993); étoile : granite de Nagar (B: moyenne de 5 analyses, in Crawford et Searle, 1993); croix: granite du Baltoro (TK402, 405, 437 et 438); croix épaisse: granite du Baltoro (C: moyenne de 20 analyses, in Crawford et Searle, 1993); triangle noir : granite d'Alchori (SK307). Champs du granite du Baltoro (en grisé) et de la granodiorite de Hunza (tireté) d'après Debon et al (1987).

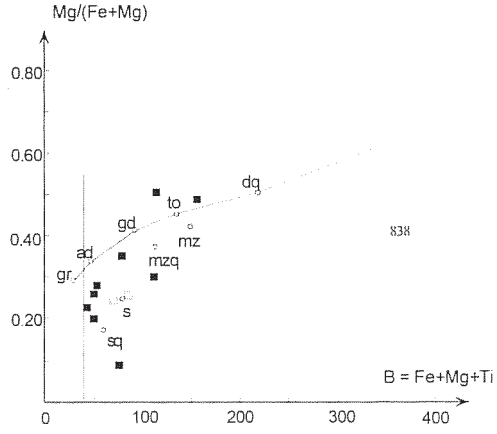
Annex 3-1

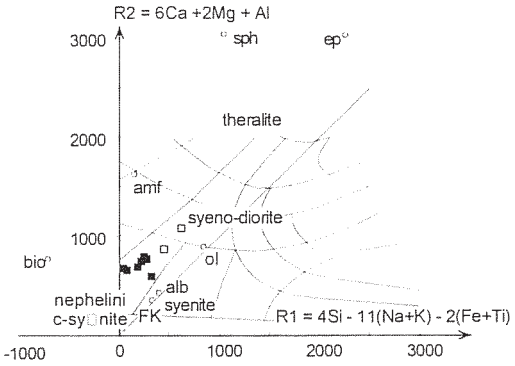
Sample	**SK079**	**SK081**	**SK083**	**A**	**SK153**	**B**	**SK307**	**TK402**	**TK405**	**TK437**	**TK438**	**C**
location	Sumayar 3110m	Sumayar 2840m	Sumayar 2705m	Sumayar	Hassanabad 2450m	Nagar	Alchori 2220m	Kero 3564m	Kero 3448m	Solu 3560m	Solu 3560m	Baltoro
formation	Sumayar	Sumayar	Sumayar	Sumayar	Hassanabad	Nagar	Alchori	Baltoro	Baltoro	Baltoro	Baltoro	Baltoro
mineralogy	Mu-T	Mu-T	Mu-T		Bi		Bi-Mu	Bi	Bi	Bi-Gr	Bi	
rock type	lad	lad	lad(gr)		ad(gr)		lad-gr	ad	ad	lad	lad	
							Geolab					
SiO2	73.08	73.29	73.60	74.09	70.07	73.50	73.39	68.09	72.31	72.34	72.05	71.43
Al2O3	15.25	15.11	14.76	14.83	15.05	14.30	13.73	16.51	14.01	14.66	14.58	14.61
Fe2O3tot	0.82	0.81	0.89	0.72	2.28	0.86	1.79	3.29	2.11	1.33	1.67	1.59
MnO	0.02	0.00	0.00	0.03		0.11	0.03	0.04	0.02	0.05	0.00	0.03
MgO	0.06	0.07	0.07	0.01	0.65	0.00	0.03	0.88	0.68	0.39	0.44	0.34
CaO	0.93	0.89	0.90	0.79	1.92	1.10	1.95	2.56	1.43	1.81	1.67	1.74
Na2O	4.30	4.13	3.80	4.37	3.56	3.90	3.23	3.59	4.19	3.97	4.01	3.96
K2O	4.44	4.68	4.91	4.54	4.83	4.40	4.92	4.12	4.12	4.44	4.37	4.25
TiO2	0.03	0.03	0.05	0.05	0.39	0.01	0.49	0.40	0.22	0.16	0.27	0.26
P2O5	0.06	0.08	0.07	0.08	0.13	0.08	0.00	0.12	0.08	0.11	0.08	0.11
L.I.	0.85	0.75	0.75	0.51	0.67	0.39	0.44	0.76	0.59	0.40	0.55	0.38
Total	99.84	99.84	99.80	100.02	99.55	98.63	100.00	100.36	99.76	99.66	99.69	98.70
Parameters												
P	-62	-50	-35	-59	-46	-53	-35	-75	-73	-66	-66	-69
Q	161	164	171	165	148	176	176	144	163	158	158	158
A	32	32	31	26	9	22	-9	29	3	2	4	7
B	11	12	14	10	50	11	29	68	46	29	35	31
Q %	29	29.5	30.8	29.7	26.7	31.7	31.7	25.9	29.4	28.5	28.5	28.5
B %	2	2.2	2.5	1.8	9	2	5.2	12.3	8.3	5.2	6.3	5.6
F %	69	68.3	66.7	68.5	64.3	66.3	63.1	61.8	62.3	66.3	65.2	65.9
Mg/(Fe+Mg	0.09	0.17	0.15	0	0.36	0	0.04	0.35	0.4	0.37	0.34	0.29
B	11	12	14	10	50	11	29	68	46	29	35	31

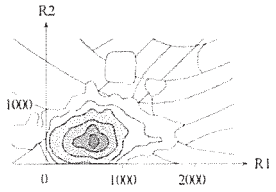












Distribution of reference syenites, in De La Roche et al. (1980)

ANNEXURE 3-2 (Table 3-2, Diagrams 3-2).

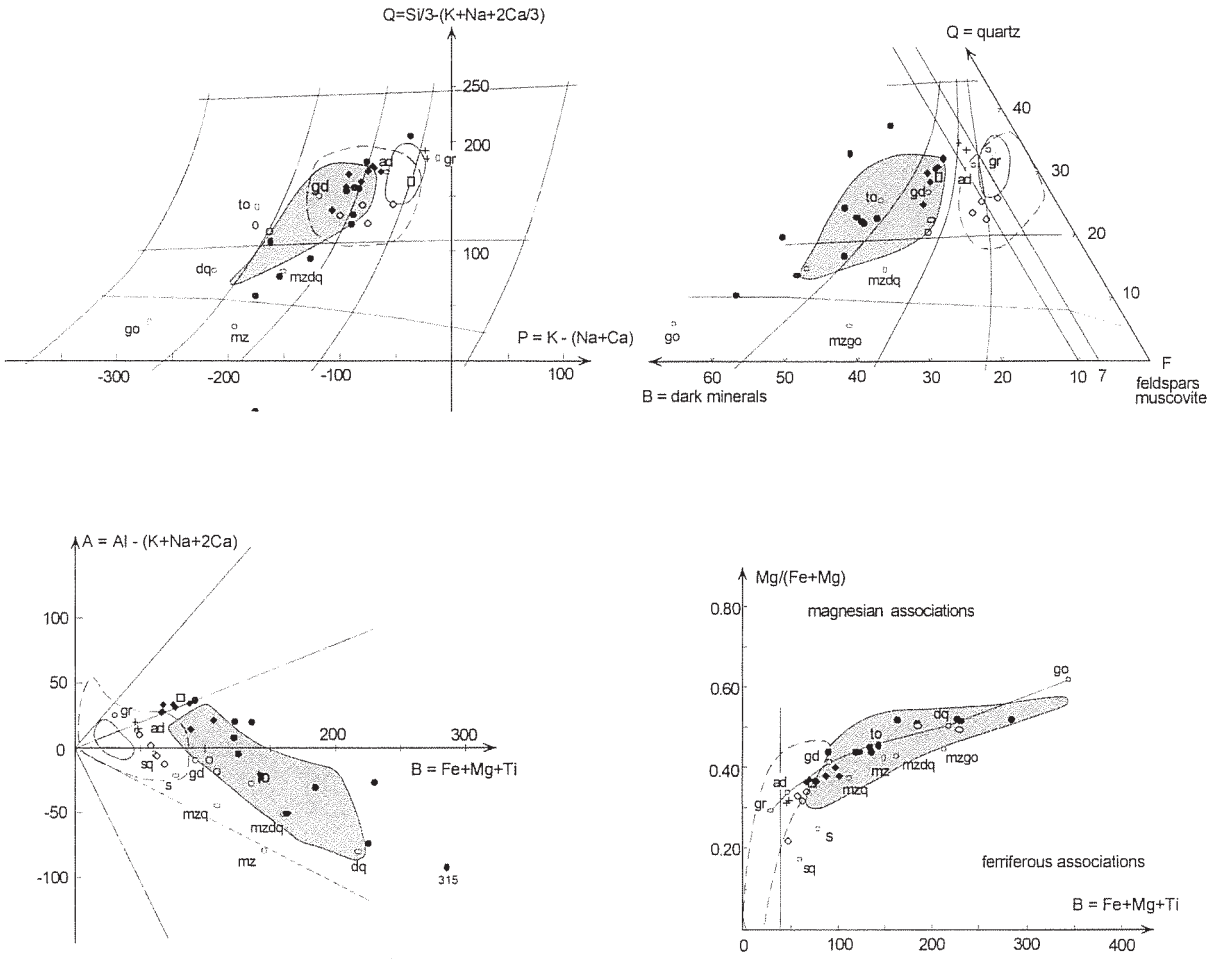
Karakorum intrusive rocks, Hemasil syenite

Chemical analysis and chemical -mineralogical classification of the Hemasil syenite (data from Lemennicier 1996).Plain squares: group 1 samples, bearing magmatic epidote (TK836 and 839); black squares : other samples (TK479, 480, 495, 506, 835, 837, 841 and 845). The additional R1-R2 (De La Roche et al., 1980) diagram is used to discriminate various syenitic rocks.

Roches intrusives du Karakorum: caractérisation chimique des syénites d'Hémasil à partir des majeurs (données in Lemennicier, 1996). Carrés blancs: syénites du groupe 1, contenant de l'épidote magmatique (TK836 et 839); carrés noirs: autres échantillons (TK479, 480, 495, 506, 835, 837, 841 et 845).Le diagramme R1-R2 (De La Roche et al., 1980) permet de séparer différents types de roches syénitiques.

Annex 3-2

Sample	**TK489**	**TK495**	**TK838**	**TK479**	**TK480**	**TK506**	**TK835**	**TK836**	**TK837**	**TK839**	**TK841**	**TK845**
location	Hemasil 2795m	Hemasil 2904m	Niesolo S 2640m	Basha 2593m	Basha 2562m	Hemasil 3080m	Niesolo 2640m	Niesolo .2640m	Niesolo 2640m	Niesolo 2640m	Hemasil 2630m	Hemasil 3580m
formation	Hemasil	Hemasil	Hemasil	Hemasil	Hemasil	Hemasil	Hemasil	Hemasil	Hemasil	Hemasil	Hemasil	Hemasil
mineralogy	am	bi	am-bi-ep	am-bi-ep	am-bi-ep-gr	am	bi	bi-sp-ep	bi	bi-sp-ep		
rock type	dq	mzd	mzd	s	s	s	s	s	s	s	s	s
SiO2	55.15	53.65	35.48	59.40	59.07	58.27	54.42	53.57	58.26	57.24	59.78	56.49
Al2O3	15.13	20.64	17.73	19.28	19.81	19.31	20.09	21.17	18.45	20.21	19.79	20.77
Fe2O3tot	8.66	6.04	15.96	2.65	2.58	3.08	4.95	4.25	4.13	3.41	2.74	2.39
MnO	0.13	0.08	0.51	0.15	0.22	0.30	0.24	0.23	0.16	0.15	0.22	0.54
MgO	4.94	2.66	5.61	0.34	0.45	0.85	0.25	0.76	2.19	0.55	0.54	0.35
CaO	9.46	7.33	13.71	2.70	2.33	3.00	3.38	5.85	1.14	4.12	2.35	3.36
Na2O	2.97	4.44	1.18	3.52	5.58	5.25	2.03	3.04	4.03	3.38	6.13	4.61
K2O	0.96	2.40	2.41	10.44	7.79	7.25	10.64	7.42	8.62	8.77	7.03	7.74
TiO2	0.88	0.88	2.75	0.65	0.44	0.63	0.45	0.99	0.50	1.00	0.50	0.34
P2O5	0.25	0.44	1.47	0.13	0.13	0.15	0.09	0.21	0.29	0.16	0.13	0.07
L.I.	1.29	1.12	1.51	0.50	0.47	1.63	3.10	1.05	0.81	0.98	0.57	2.42
Total	99.82	99.68	98.32	99.76	98.87	99.72	99.64	98.54	98.58	99.97	99.78	99.08
Parameters												
P	-245	-223	-231	60	-57	-68	101	-44	33	4	-91	-45
Q	77	16	-55	-38	-45	-35	-29	-28	-3	-26	-43	-39
A	-157	-51	-229	-54	-40	-50	-17	-49	9	-44	-43	-26
B	242	153	373	49	49	68	74	84	112	70	53	43
Q %	13.9	2.9	-9.9	-6.8	-8.1	-6.3	-5.2	-5	-0.5	-4.7	-7.7	-7
B %	43.6	27.6	67.2	8.8	8.8	12.3	13.3	15.1	20.2	12.6	9.5	7.7
F %	42.5	69.5	42.7	98	99.3	94.1	91.9	89.9	80.4	92.1	98.2	99.3
Mg/(Fe+Mg)	0.53	0.46	0.41	0.2	0.26	0.35	0.09	0.26	0.51	0.25	0.28	0.23
B	242	153	373	49	49	68	74	84	112	70	53	43



ANNEXURE 3-3 (Tables 3-3a, 3-3b and 3-3c, Diagrams 3-3).

Karakorum intrusive rocks, Central batholith

Chemical analysis and chemical -mineralogical classification of the granites of the Central batholith. Black dots: Hunza granodiorite (BH129, SK088, 196, 219, 224, 226, 227, 315, 321, 325, 328); plain dots: Hunza granodiorite (boulders in Chogo Lungma moraines, unknown outcrops, TK371, 743); black square: Hunza pluton (A: average of 3 samples of quartz-diorite and quartz-monzodiorite with Bio-Amf±Pyr, in Debon et al, 1987); thick cross: Hunza pluton (B: average of 22 samples of granodiorite with Bio-Amf±Pyr, in Debon et al, 1987); black triangle: Hunza pluton (C: average of 3 samples of granodiorite with Bio, in Debon et al, 1987); black diamonds: adamellites and granodiorites from southern slopes of the Distaghil (on the road to Yasgil Dome, samples KY5, 6, 10, 24, 32, 33, 34 and 36); plain diamonds: adamellites from Trivor SE, similar to the Batura adamellites (KY15, 16, 26 29); thin crosses: granite of Bubli Motin (SK327, 339); plain square: Bubli Motin type granite, from Baltar (SK233). Fields of Hunza granodiorite (medium grey), Batura adamellite (light grey) and Baltoro granite (dotted line) from Debon et al., 1987.

Roches intrusives du Karakorum: classification des granitoïdes du batholite central. Disques noirs: granodiorite de Hunza (BH129, SK088, 196, 219, 224, 226, 227, 315, 321, 325, 328); disques vides: blocs dans les moraines du Chogo Lungma, provenance inconnue, TK371, 743); carré noir: pluton de Hunza (A: moyenne de 3 échantillons de quartz-diorite et quartz-monzodiorite à Bio-Amf±Pyr, in Debon et al, 1987); croix épaisse: pluton de Hunza (B: moyenne de 22 échantillons de granodiorite à Bio-Amf±Pyr, in Debon et al, 1987); triangle noir: pluton de Hunza (C: moyenne de 3 échantillons de granodiorite à Bio, in Debon et al, 1987); losanges noirs: adamellites et granodiorites des pentes sud du Distaghil (en montant au Yasgil Dome, échantillons KY5, 6, 10, 24, 32, 33, 34 et 36); losanges vides: adamellites du Trivor SE, semblables aux adamellites du Batura (KY15, 16, 26 29); croix minces: granite de Bubli Motin (SK327, 339); carré vide: granite de type Bubli Motin, Baltar (SK233). Champs du granite du Baltoro (gris clair), de la granodiorite de Hunza (gris sombre) et du granite du Batura (cerclé d'un tireté) d'après Debon et al (1987).

Annex 3-3-a

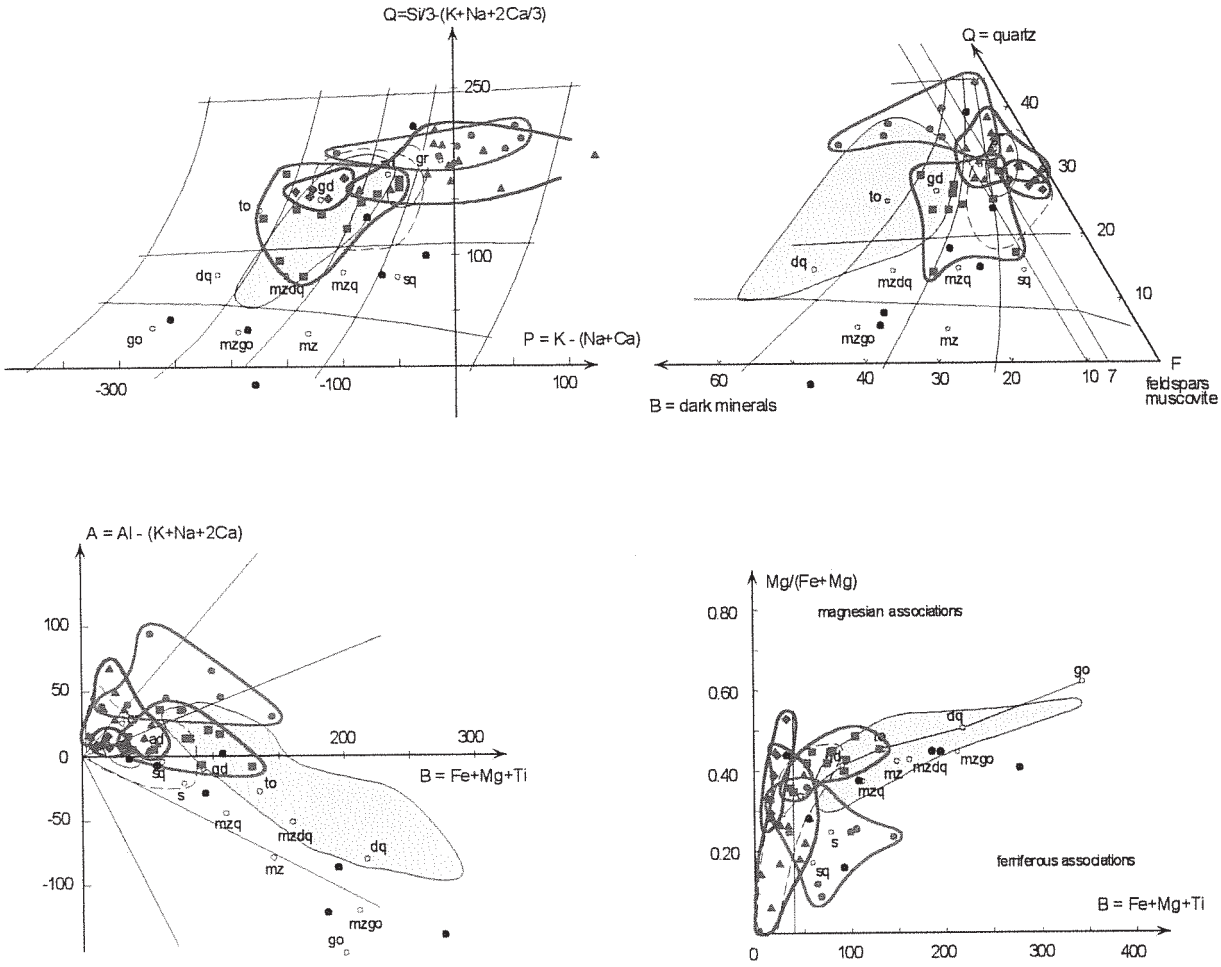
Sample	**BH129**	**SK088**	**SK196**	**SK219**	**SK224**	**SK226**	**SK227**	**SK315**	**SK321**	**SK325**	**SK328**	**TK371**	**TK743**
location	Hispar 3190m	Tashot 2070m	Mayon 1900m	Toltar gl 4010m	Toltar gl 3895m	Toltar gl 3855m	Toltar gl 3840m	Shispar 3785m	Shispar 3830m	Shispar 3645m	Shispar 3670m	Chogo 3625m	Remendok 3365m
formation	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza
mineralogy	bi	bi-gr	am-bi	bi-am						bi	am		
rock type	mzdq	mzdq	ad(gd)	gd(ad)	gd	ad(gd)	gd	mzdq	gd	ad	gd(ad)	gd(to)	ad
				Geolab	Geolab	Geolab	Geolab	Geolab	Geolab	Geolab	Geolab		
SiO2	56.64	53.21	62.68	64.34	64.37	62.68	64.95	51.33	57.29	69.91	65.52	63.90	64.94
Al2O3	17.28	18.22	15.39	16.79	16.64	15.20	15.72	17.22	16.27	14.85	15.73	16.48	16.49
Fe2O3tot	6.83	8.63	5.80	5.03	5.12	5.91	5.31	10.32	8.14	3.76	5.66	4.80	4.50
MnO	0.10	0.11	0.09	0.09	0.09	0.10	0.09	0.18	0.14	0.06	0.10	0.10	0.09
MgO	3.54	4.26	2.45	2.02	2.04	3.22	2.12	5.72	4.46	1.48	2.26	1.77	1.64
CaO	6.19	6.81	4.29	4.49	4.87	5.60	4.58	8.57	7.66	3.07	4.53	4.44	4.11
Na2O	2.58	2.67	2.89	2.32	2.33	2.12	2.35	2.15	2.21	1.92	1.90	4.12	4.51
K2O	3.12	2.54	3.73	3.37	3.21	3.79	3.38	2.57	2.23	3.87	3.09	2.41	1.97
TiO2	0.86	1.28	0.69	0.61	0.60	0.63	0.64	1.15	0.92	0.54	0.69	0.45	0.47
P2O5	0.30	0.43	0.25	0.13	0.13	0.14	0.13	0.28	0.22	0.11	0.15	0.24	0.20
L.I.	2.21	1.55	1.43	0.51	0.59	0.62	0.72	0.52	0.48	0.44	0.38	1.02	0.89
Total	99.65	99.71	99.69	99.70	99.99	100.01	99.99	100.01	100.02	100.01	100.01	99.73	99.81
parameters													
P	-127	-153	-90	-83	-94	-88	-86	-167	-161	-35	-76	-161	-176
Q	92	75	125	157	156	133	158	59	109	207	183	118	125
A	-30	-25	-22	22	9	-50	-4	-92	-73	37	20	-19	-9
B	185	230	143	121	123	162	127	285	225	91	136	110	103
Q %	16.6	13.5	22.5	28.3	28.1	24	28.5	10.6	19.6	37.3	33	21.3	22.5
B %	33.3	41.4	25.8	21.8	22.2	29.2	22.9	51.4	40.5	16.4	24.5	19.8	18.6
F %	50.1	45	51.7	49.9	49.7	46.8	48.6	38	39.8	46.3	42.5	58.9	58.9
Mg/(Fe+Mg)	0.51	0.5	0.46	0.44	0.44	0.52	0.45	0.52	0.52	0.44	0.44	0.42	0.42
B	185	230	143	121	123	162	127	285	225	91	136	110	103

Karakorum: Central batholith, Hunza granodiorite

Sample	**BH 64**	**BH 96**	**BH107**	**BH112**	**BH113**	**BH128**	**A**	**B**	**C**	**SK233**	**SK327**	**SK339**
location	Baintha	Khani Basa	Khani Basa	Pumarikish	Pumarikish	Hispar				Bar	Shispar	Ultar
	4090m	4550m	4330m	4155m	4155m	3750m				2570m	3835m	3290m
formation	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza	Hunza	Baltar	Bubli M.	Bubli M.
mineralogy	am	bi-am	bi	bi	bi-sp	bi	am-bi±py	am-bi±py	bi		am-bi	bi-am-ep
rock type	gd	ad	ad	gd(ad)	gd	gd				gr(ad)	gr	gr
										Geolab	Geolab	Geolab
SiO2	63.57	67.34	69.18	71.18	67.43	68.56	57.19	62.38	66.11	67.20	72.50	73.08
Al2O3	15.38	14.88	15.11	14.67	15.75	15.33	17.69	16.00	15.48	16.48	14.32	13.83
Fe2O3tot	6.00	4.12	3.08	2.24	3.17	3.06	7.30	5.78	4.72	3.74	2.35	2.40
MnO	0.10	0.09	0.05	0.02	0.04	0.04	0.16	0.11	0.08	0.05	0.05	0.05
MgO	2.91	1.67	0.83	0.60	1.06	0.96	3.57	2.53	1.54	1.07	0.54	0.55
CaO	4.84	3.76	2.50	1.97	2.92	2.40	6.46	5.12	3.69	3.07	1.80	1.69
Na2O	2.65	2.62	3.24	4.00	4.37	4.25	3.18	2.79	2.96	2.41	2.87	2.92
K2O	2.16	3.92	4.29	3.84	3.37	3.77	2.33	2.94	2.83	4.58	4.88	4.78
TiO2	0.68	0.46	0.44	0.32	0.48	0.48	0.99	0.74	0.66	0.54	0.36	0.38
P2O5	0.22	0.14	0.22	0.08	0.20	0.16	0.24	0.14	0.12	0.19	0.09	0.08
L.I.	1.00	0.78	0.74	0.38	0.55	0.44	0.87	0.85	1.20	0.71	0.27	0.23
Total	99.51	99.78	99.68	99.30	99.34	99.45	99.98	99.38	99.39	100.04	100.03	99.99
parameters												
P	-35	-260	-258	-277	-289	-227	-169	-119	-101	-36	-21	-23
Q	121	165	147	150	138	130	89	134	168	161	184	191
A	24	-211	-208	-244	-202	-49	-35	-20	17	38	20	16
B	82	391	243	214	231	332	192	144	105	81	47	49
Q %	21.8	29.7	26.5	27	24.9	23.4	24.1	30.3	29	29	33.2	34.4
B %	14.8	70.5	43.8	38.6	41.6	59.8	25.9	18.9	14.6	14.6	8.5	8.8
F %	63.4	-0.2	29.7	34.4	33.5	16.8	49.9	50.8	56.4	56.4	58.4	56.8
Mg/(Fe+Mg	0.01	0.85	0.82	0.86	0.81	0.74	0.47	0.39	0.36	0.36	0.31	0.32
B	82	391	243	214	231	332	192	144	105	81	47	49

Annex 3-3-c

Sample	**KY 5**	**KY 6**	**KY 10**	**KY 24**	**KY 32**	**KY 33**	**KY 34**	**KY 36**	**KY 15**	**KY 16**	**KY 26**	**KY 29**
location	Kunyang	Kunyang 5100m	Kunyang 5700m	Kunyang 4560m	Kunyang 4610m	Kunyang 5800m	Kunyang 7200m	Kunyang 4400m	Kunyang 4400m	Kunyang 4300m	Kunyang 4310m	Kunyang 4410m
formation	Distaghil S	Distaghil S	Distaghil S	Distaghil S	Distaghil S	Distaghil S	Distaghil S	Distaghil S	Trivor SE	Trivor SE	Trivor SE	Trivor SE
mineralogy	bi-mu	bi	bi	bi-mu	bi-mu	bi-mu	bi	bi-am	bi-sp-t	bi-sp-am	bi-sp-am	bi-sp
rock type	ad	gd	ad	gd	gd	ad	ad	gd	ad	ad	gr	ad
SiO2	68.28	68.43	69.31	67.05	64.43	69.09	69.81	67.18	70.77	69.71	68.80	68.77
Al2O3	15.38	15.76	15.30	15.86	16.70	15.38	15.16	15.61	14.36	14.83	14.86	15.31
Fe2O3tot	3.54	3.52	3.15	3.99	4.72	3.17	3.15	3.95	2.81	2.77	3.25	3.02
MnO	0.05	0.06	0.05	0.06	0.05	0.05	0.06	0.06	0.04	0.04	0.05	0.05
MgO	1.04	1.06	0.93	1.20	1.45	0.91	0.91	1.29	0.40	0.69	0.86	0.72
CaO	2.54	2.87	2.45	2.83	3.64	2.58	2.41	3.20	0.97	1.87	2.22	2.12
Na2O	3.08	3.37	3.15	3.22	3.39	3.25	3.24	3.34	4.25	4.19	4.41	4.16
K2O	3.74	3.17	3.62	3.40	3.16	3.57	3.64	3.29	4.75	4.19	3.87	4.57
TiO2	0.51	0.54	0.44	0.60	0.72	0.44	0.45	0.59	0.30	0.40	0.52	0.48
P2O5	0.20	0.20	0.16	0.24	0.29	0.19	0.20	0.26	0.11	0.16	0.22	0.20
L.I.	0.98	0.77	0.74	1.27	0.75	0.73	0.84	0.54	0.64	0.50	0.40	0.45
Total	99.34	99.75	99.30	99.72	99.30	99.36	99.87	99.31	99.40	99.35	99.46	99.85
parameters												
P	-65	-93	-69	-82	-107	-75	-71	-95	-53	-79	-100	-75
Q	171	170	176	163	138	172	177	157	143	141	131	125
A	34	31	33	35	22	29	29	14	10	1	-12	-7
B	76	77	68	88	104	69	68	88	49	57	69	62
Q %	30.8	30.6	31.7	29.4	24.9	31	31.9	28.3	25.8	25.4	23.6	22.5
B %	13.7	13.9	12.3	15.9	18.7	12.4	12.3	15.9	8.8	10.3	12.4	11.2
F %	55.5	55.5	56	54.8	56.4	56.6	55.9	55.9	65.4	64.3	64	66.3
Mg/(Fe+Mg)	0.37	0.37	0.37	0.38	0.38	0.37	0.37	0.4	0.22	0.33	0.34	0.32
B	76	77	68	88	104	69	68	88	49	57	69	62



ANNEXURE 3-4 (tables 3-4a, 3-4b, 3-4c and 3-4d, Diagrams 3-4)

Karakorum orthogneiss

Chemical analysis and chemical -mineralogical classification of the Karakorum orthogneiss. Blue dots: Dassu orthogneiss (TK897, SK290, 291, 292, 293, 295, 296, 306); red triangles: Mangol Bluk orthogneiss (TK443, 453, 459, 462, 464, 523, 524, 764, 776, 779, 821, 827); green squares: Bukpun orthogneiss (TK373, 380, 386, 387, 391, 573, 574, 609, 613, 618, 696); purple diamonds: Arelter orthogneiss, western part (TK801, 804, 805, 811, 812); black dots: Bolocho orthogneiss(TK642, 643, 654, 655, 656, 661, 665). Light grey field: Hunza granodiorite, from Debon et al. (1987), extended with our new analyses; field bounded by the dotted line: Baltoro granite, from Debon et al. (1987).

Orthogneiss du Karakorum: classification chimico-minéralogique. Disques bleus: orthogneiss de Dassu (TK897, SK290, 291, 292, 293, 295, 296, 306); triangles rouges: orthogneiss de Mangol Bluk (TK443, 453, 459, 462, 464, 523, 524, 764, 776, 779, 821, 827); carrés verts: orthogneiss de Bukpun (TK373, 380, 386, 387, 391, 573, 574, 609, 613, 618, 696); losanges violets: orthogneiss d'Arelter, partie ouest (TK801, 804, 805, 811, 812); disques noirs: orthogneiss de Bolocho (TK642, 643, 654, 655, 656, 661, 665). Champ gris: granodiorite de Hunza, d'après Debon et al. (1987), étendu avec nos nouvelles analyses; champ limité par le tireté: granite du Baltoro, d'après Debon et al. (1987).

Annex 3-4-a

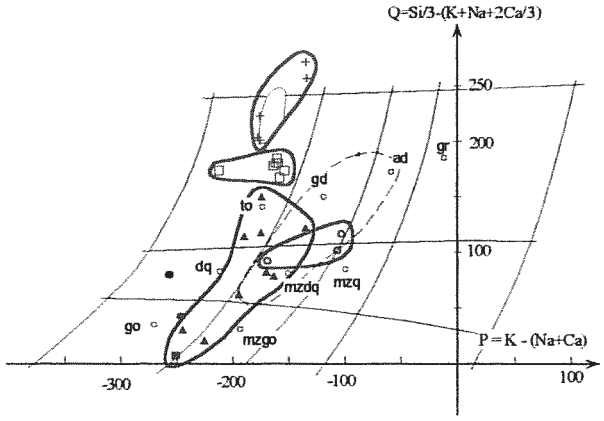
Sample	**SK290**	**SK291**	**SK292**	**SK293**	**SK295**	**SK296**	**SK306**	**TK897**
location	Mungol	Mungol	Mungol	Mungol	Mungol	Mungol	Dassu E	Braldu
	2275m	2280m	2280m	2360m	2410m	2410m	2335m	2460m
formation	Dassu	Dassu	Dassu	Dassu	Dassu	Dassu	Dassu	Dassu
mineralogy	mu-bi	bi-am-gr		mu-bi-t-si	bi-am	bi-gr		bi-mu-gr
	lgd	gr	gr	gr	gr	gr	gr	gr
	Geolab	Geolab	Geolab	Geolab	Geolab	Geolab	Geolab	
SiO2	77.61	66.70	68.98	72.30	71.76	71.50	69.56	72.78
Al2O3	13.43	13.69	14.28	15.03	13.24	14.06	14.20	14.33
Fe2O3tot	0.76	7.93	5.63	2.37	4.64	4.21	5.47	1.94
MnO	0.02	0.09	0.07	0.02	0.04	0.04	0.07	0.03
MgO	0.22	1.28	1.00	0.67	0.25	0.27	0.94	0.32
CaO	1.53	2.39	1.96	0.71	1.24	1.28	1.86	0.80
Na2O	3.88	1.89	1.93	1.71	1.51	1.81	1.68	3.07
K2O	2.12	4.27	4.78	5.73	6.18	5.96	4.80	5.36
TiO2	0.05	1.23	0.81	0.46	0.36	0.32	0.67	0.23
P2O5	0.03	0.12	0.19	0.21	0.17	0.19	0.15	0.18
L.I.	0.36	0.42	0.37	0.80	0.62	0.38	0.62	0.78
Total	100.01	100.01	100.00	100.01	100.01	100.02	100.02	99.82
parameters								
P	-107	-13	4	54	60	45	15	1
Q	242	190	196	216	204	197	208	182
A	39	32	47	93	36	45	56	40
B	16	146	105	52	69	63	100	35
Q %	43.7	34.3	35.3	38.9	36.7	35.4	37.4	32.7
B %	2.8	26.4	19.0	9.4	12.4	11.4	18.1	6.3
F %	53.5	39.4	45.7	51.7	50.9	53.1	44.5	61.0
Mg/(Fe+Mg	0.36	0.24	0.26	0.36	0.10	0.11	0.25	0.25
B	16	146	105	52	69	63	100	35

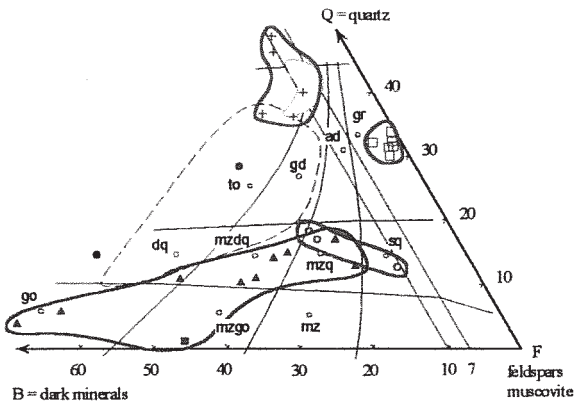
Karakorum: Dassu orthogneiss

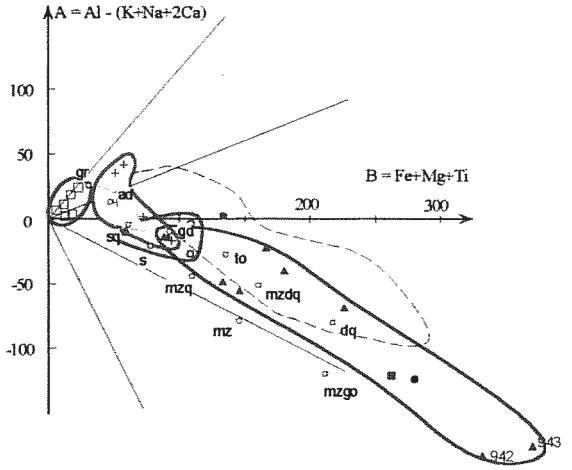
Sample	**TK443**	**TK453**	**TK459**	**TK462**	**TK464**	**TK523**	**TK524**	**TK764**	**TK776**	**TK779**	**TK821**	**TK827**
location	Bisil 2953m	Basha 2845m	Basha 2839m	Basha 2848m	Basha 2760m	Arandu 2665m	Arandu 2670m	Niamur 4000m	Arandu 3170m	Arandu 3230	Doko 3790m	Doko 2755
formation	Basha	Basha	Basha	Basha	Basha	Basha	Basha	Basha	Basha	Basha	Basha	Basha
mineralogy			bi-gr				bi-cd-gr	bi-mu	bi-mu-t	bi-mu-gr	Bi	bi-mu-gr-t
rock type	gr	lgr	lgr	gr	lgr	gr	lgr	lgr	lgr	lgd	ad	lgr
						Geolab						
SiO2	71.40	74.68	75.40	70.81	73.25	73.23	74.77	73.32	74.06	73.46	70.98	73.22
Al2O3	13.25	14.03	12.75	14.11	13.91	12.40	13.46	14.01	14.23	15.08	14.24	14.67
Fe2O3tot	2.95	0.34	1.31	3.06	1.33	2.26	1.63	1.80	0.89	0.49	3.04	1.06
MnO	0.04	0.00	0.02	0.02	0.02	0.03	0.00	0.00	0.00	0.03	0.03	0.00
MgO	0.34	0.00	0.06	0.45	0.34	0.74	0.15	0.34	0.38	0.03	0.61	0.19
CaO	1.28	0.39	0.83	0.78	0.45	0.86	0.80	0.66	0.61	1.30	1.44	0.74
Na2O	2.83	3.70	3.27	2.62	2.67	1.10	3.17	3.06	3.05	4.59	3.87	3.64
K2O	5.19	5.91	4.80	6.65	5.69	8.26	4.99	5.45	4.39	4.11	4.38	5.14
TiO2	0.34	0.00	0.07	0.35	0.08	0.37	0.09	0.19	0.05	0.00	0.38	0.08
P2O5	0.11	0.32	0.02	0.32	0.14	0.23	0.10	0.18	0.19	0.00	0.17	0.29
L.I.	0.78	0.46	0.40	0.57	0.74	0.53	0.61	0.84	1.33	0.75	0.64	0.77
Total	98.51	99.83	98.93	99.74	98.62	100.00	99.77	99.85	99.18	99.84	99.78	99.80
parameters												
P	-4	-1	-18	43	27	125	-11	5	-16	-84	-58	-21
Q	180	165	201	158	194	185	197	185	212	157	159	171
A	13	17	13	23	50	2	27	37	66	14	10	35
B	50	4	19	54	26	51	25	33	21	7	58	19
Q %	32.4	29.7	36.3	28.5	35.0	33.4	35.5	33.3	38.2	28.3	28.6	30.8
B %	8.9	0.8	3.4	9.7	4.7	9.2	4.6	6.0	3.8	1.2	10.4	3.4
F %	58.7	69.5	60.4	61.8	60.3	57.4	59.9	60.7	57.9	70.5	60.9	65.8
Mg/(Fe+Mg	0.19	0.00	0.08	0.23	0.34	0.39	0.15	0.27	0.46	0.11	0.28	0.26
B	50	4	19	54	26	51	25	33	21	7	58	19

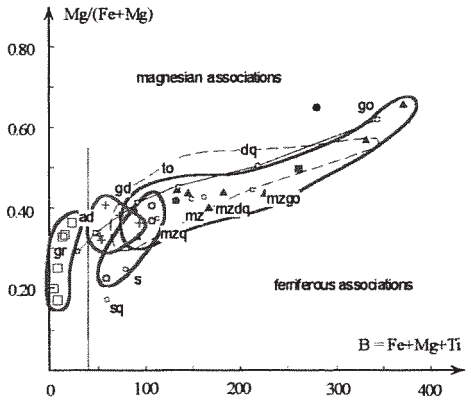
Sample	**TK373**	**TK380**	**TK386**	**TK387**	**TK391**	**TK573**	**TK574**	**TK609**	**TK613**	**TK618**	**TK696**
location	Chogo 3609m	Chogo 3711m	Chogo 3607m	Chogo 3684m	Chogo 3233m	Chogo 3670	Chogo 3655	Moraine gl 4175m	Moraine gl 4215m	Moraine gl 4215m	Chogo 4360m
formation	Bukpun	Bukpun	Bukpun	Bukpun	Bukpun	Bukpun	Bukpun	Bukpun	Bukpun	Bukpun	Bukpun
mineralogy								bi			bi
rock type	ad	ad	gd	lad	to	mzdq	ad	gd	mzdq	to	gd(ad)
SiO2	67.56	67.64	66.55	71.09	65.43	60.74	67.41	70.05	65.68	72.20	65.09
Al2O3	15.93	14.88	15.92	13.91	16.28	17.29	15.42	15.23	18.34	14.52	16.41
Fe2O3tot	3.34	4.04	3.39	1.70	3.97	5.35	3.34	2.33	2.49	1.89	3.98
MnO	0.04	0.03	0.05	0.04	0.07	0.07	0.03	0.03	0.03	0.03	0.04
MgO	1.27	1.54	1.29	0.48	1.36	2.28	1.40	0.86	1.00	0.54	1.95
CaO	2.41	2.40	2.82	1.61	4.04	3.83	2.66	1.94	2.24	2.20	3.22
Na2O	3.34	2.99	4.16	3.54	4.33	4.31	3.58	5.10	5.59	4.88	3.52
K2O	3.89	4.25	3.04	4.44	1.97	3.44	3.80	2.77	2.97	2.18	3.57
TiO2	0.34	0.60	0.48	0.20	0.60	0.51	0.43	0.33	0.31	0.23	0.52
P2O5	0.27	0.30	0.20	0.10	0.20	0.69	0.27	0.10	0.13	0.07	0.24
L.I.	1.09	1.00	1.56	1.48	0.66	1.05	1.34	0.91	0.92	0.49	1.13
Total	99.48	99.67	99.46	98.59	98.91	99.56	99.68	99.65	99.70	99.23	99.67
parameters											
P	-68	-49	-120	-49	-170	-134	-82	-140	-157	-150	-95
Q	156	160	137	167	134	80	146	142	95	171	134
A	36	20	13	7	-6	-9	12	6	37	3	18
B	78	96	80	36	91	130	82	55	60	40	105
Q %	28.1	28.9	24.7	30.1	24.1	14.3	26.4	25.7	17.0	30.8	24.1
B %	14.0	17.4	14.5	6.4	16.4	23.4	14.8	9.8	10.8	7.2	18.9
F %	57.9	53.8	60.8	63.5	59.5	62.3	58.9	64.5	72.2	62.0	57.1
Mg/(Fe+Mg)	0.43	0.43	0.43	0.36	0.40	0.46	0.45	0.42	0.44	0.36	0.49
B	78	96	80	36	91	130	82	55	60	40	105

Sample	**TK801**	**TK804**	**TK805**	**TK811**	**TK812**	**TK642**	**TK643**	**TK654**	**TK655**	**TK656**	**TK661**	**TK665**
location	Aralter 3410m	Aralter 3515m	Aralter 3515m	Aralter 3775m	Aralter 3775m	Bolocho 4330m	Bolocho 4330m	Bolocho 4260m	Bolocho 4260m	Bolocho 4260m	Bolocho 4450m	Bolocho 4450m
formation	Aralter	Aralter	Aralter	Aralter	Aralter	Bolocho	Bolocho	Bolocho	Bolocho	Bolocho	Bolocho	Bolocho
mineralogy	bi-mu	bi	bi	bi-mu±gr	2M	bi	bi-mu-ep	Bi	am-bi	bi-am	bi-mu-gr	bi-mu-ep
rock type	lgd	lgd	lgd	lgd	lgd	sq	mzd	lad	mz	sq	d	ad
SiO2	72.31	73.06	72.99	73.18	71.69	65.35	55.28	77.39	48.22	65.12	55.97	70.77
Al2O3	14.82	15.11	15.00	14.60	14.78	15.30	16.31	11.42	16.08	15.35	16.70	14.07
Fe2O3tot	0.87	0.66	0.77	0.86	1.32	4.90	7.58	1.40	11.64	5.72	7.53	3.01
MnO	0.00	0.02	0.02	0.02	0.02	0.04	0.08	0.00	0.17	0.11	0.11	0.03
MgO	0.33	0.16	0.18	0.27	0.53	1.54	3.18	0.58	4.17	0.55	3.09	0.62
CaO	1.53	1.34	1.59	1.44	1.76	1.49	5.53	0.50	7.11	2.20	7.60	1.01
Na2O	5.14	5.06	5.31	4.50	5.01	3.75	4.56	3.62	3.74	4.30	4.59	4.59
K2O	3.01	3.57	2.75	3.47	2.69	5.83	2.91	4.22	3.74	5.32	1.37	4.66
TiO2	0.13	0.07	0.08	0.12	0.19	0.68	1.63	0.14	2.25	0.58	1.19	0.31
P2O5	0.05	0.06	0.07	0.05	0.09	0.17	1.14	0.00	0.94	0.13	0.77	0.06
L.I.	0.37	0.37	0.37	0.57	0.42	0.63	1.38	0.52	1.05	0.37	0.68	0.58
Total	98.56	99.48	99.13	99.08	98.50	99.68	99.58	99.79	99.11	99.75	99.60	99.71
parameters												
P	-129	-111	-141	-97	-136	-24	-184	-36	-168	-65	-254	-67
Q	153	151	157	170	158	100	32	217	-17	84	43	134
A	6	10	8	16	8	2	-86	0	-138	-29	-121	-7
B	21	13	15	19	32	108	194	34	277	93	186	57
Q %	27.6	27.1	28.2	30.7	28.5	18.1	5.8	39.1	-3.1	15.1	7.8	24.1
B %	3.7	2.4	2.7	3.4	5.8	19.5	35.0	6.1	50.0	16.7	33.5	10.3
F %	68.6	70.5	69.1	65.9	65.7	62.5	59.2	54.8	53.1	68.3	58.7	65.6
Mg/(Fe+Mg	0.43	0.32	0.32	0.38	0.44	0.38	0.45	0.45	0.42	0.16	0.45	0.29
B	21	13	15	19	32	108	194	34	277	93	186	57









ANNEXURE 3-5 (Tables 3-5a and 3-5b, Diagrams 3-5)

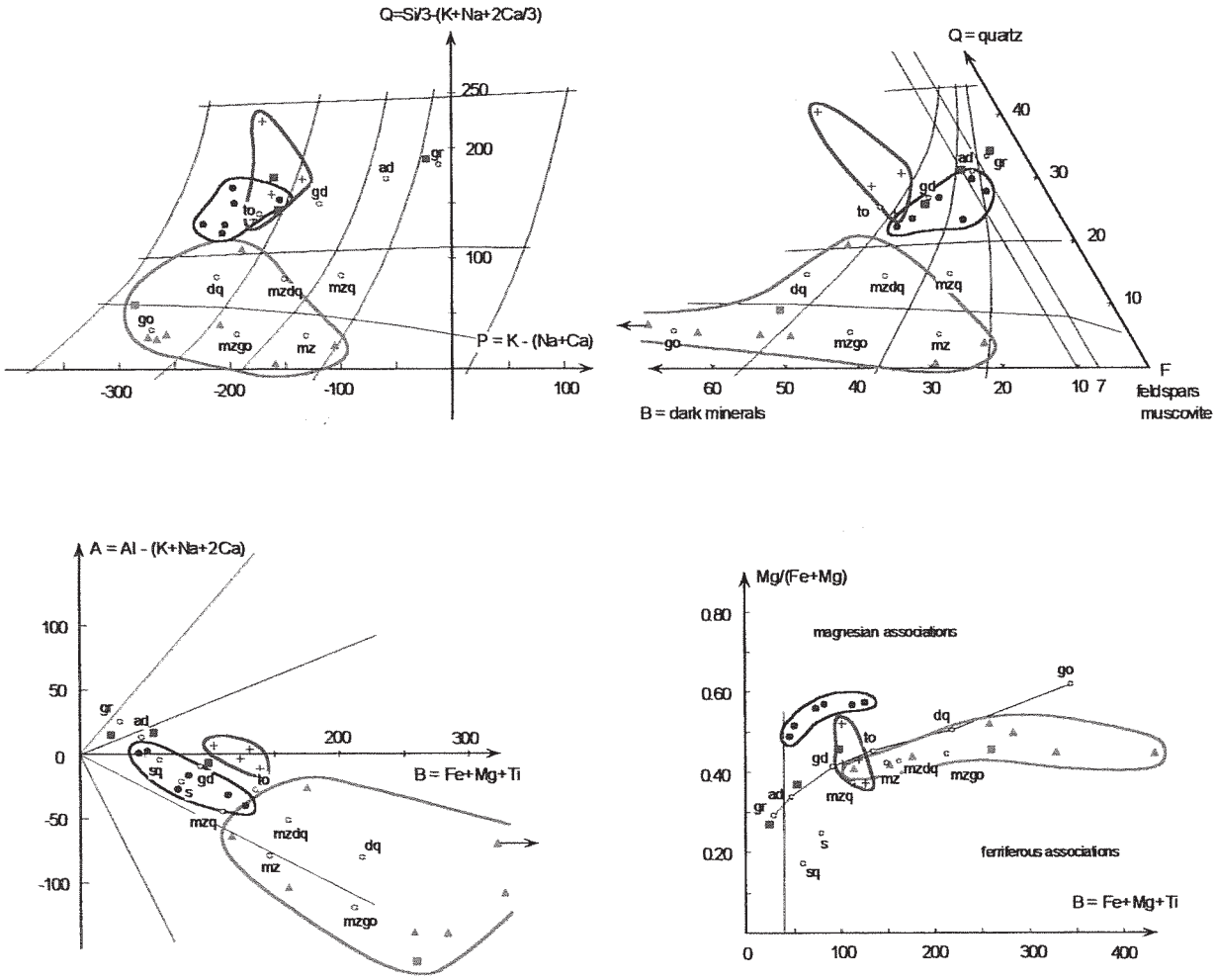
Kohistan - Ladakh intrusive rocks, plutons North of the Dobani-Dasu lineament

Chemical analysis and chemical -mineralogical classification of the plutons North of the Dobani-Dasu lineament. Black dot: Joring quartz diorite (KL254), purple circles: N-Bagrot quartz monzodiorite (KL239, 240, SK381); green dot: N-Barti tonalite to granodiorite (SK412); purple crosses: Nomal trondhjemite (KL201, 203, 250, SK348, 531); green triangles: Shigar complex (TK781, 782, 935, 936, 939, 940, 941, 942, 943); red squares: Remendok trondhjemite (TK725, 727, 728,729,730,737). Analysis columns A (average of 2 samples of tonalite) and B (average of 8 samples of trondhjemite), table 3-5a, and purple colored field (Nomal trondhjemite, diagrams 3-5) from Debon et al.(1987).

Roches intrusives du Kohistan-Ladakh, plutons au nord du linéament de Dobani-Dasu: classification chimico-minéralogique. Disque noir: quartz diorite de Joring (KL254), cercles violets: quartz monzodiorite de N-Bagrot (KL239, 240, SK381; disques verts: tonalite à granodiorite de N-Barti (SK412); croix violettes: trondhjemite de Nomal (SK201, 203, 250, 348, 531); triangles verts: complexe de Shigar (TK781, 782, 935, 936, 939, 940, 941, 942, 943); carrés rouges: trondhjemite de Remendok (TK725, 727, 728,729,730,737). Analyses A (moyenne de 3 échantillons de tonalite) et B (moyenne de 8 échantillons de trondhjémite) du tableau 3-5b et champ coloré en violet (trondhjémite de Nomal diagramme 3-5) d'après Debon et al.(1987).

Sample	KL254	KL239	KL240	SK381	SK412	SK348	KL201	KL203	KL250	SK531	A	B
location	KKH	Bari 2460m	Bari 2685m	Bagrot 2295m	Barti 2640m	Naltar 1740m	Bartar 2230m	Bartar 2590m	Jaglot Gur 3160m	Nomal 1925m	Nomal	Nomal
formation	Joring	Datocha	Datocha	Datocha	Barti	Nomal	Nomal	Nomal	Nomal	Nomal	Nomal	Nomal
mineralogy	am	bi(mu)	am-bi	ep	am-epAEp				chl			
rock type	dq	mzdq	trdj	mzdq(ad)	to	trdj	trdj	trdj	trdj	trdj		
				Geolab	Geolab	Geolab				Geolab		
SiO2	54.57	68.76	63.98	63.51	63.52	76.10	69.40	73.08	71.45	75.51	71.78	74.87
Al2O3	16.07	15.31	16.65	16.77	17.00	13.14	14.54	13.95	14.09	13.29	13.89	13.37
Fe2O3tot	7.69	3.25	4.61	4.92	5.71	2.62	4.60	2.69	3.36	2.63	3.27	2.53
MnO	0.14	0.09	0.08	0.10	0.12	0.09	0.09	0.07	0.07	0.06	0.09	0.06
MgO	7.30	0.49	1.60	1.51	2.10	0.63	1.29	0.63	1.04	0.92	0.88	0.46
CaO	9.09	1.89	3.92	3.41	5.83	3.04	5.01	3.32	3.31	2.37	3.75	2.53
Na2O	3.25	4.79	4.87	3.97	2.81	3.05	3.29	4.04	4.26	3.50	3.85	4.24
K2O	0.46	4.08	2.74	3.88	1.55	0.78	0.87	0.68	0.95	1.05	0.93	0.87
TiO2	0.22	0.36	0.72	0.79	0.57	0.21	0.30	0.21	0.27	0.23	0.25	0.23
P2O5	0.15	0.17	0.28	0.22	0.18	0.03	0.12	0.09	0.14	0.03	0.00	0.00
L.I.	1.00	0.76	0.49	0.93	0.63	0.32	0.44	0.57	1.01	0.32	0.46	0.56
Total	99.94	99.95	99.94	100.01	100.02	100.01	99.95	99.33	99.95	99.91	99.15	99.72
parameters												
P	-257	-102	-169	-107	-162	-135	-177	-175	-176	-133	-171	-164
Q	80	117	93	102	159	271	202	222	200	256	210	231
A	-124	-10	-28	-3	2	35	-17	12	1	42	-5	17
B	280	58	107	109	131	52	94	53	71	59	66	46
Q %	14.4	21.1	16.8	18.4	28.6	48.8	36.4	40	36	46.1	37.8	41.6
B %	50.5	10.5	19.3	19.6	23.6	9.4	16.9	9.5	12.8	10.6	11.9	8.3
F %	35.1	68.5	64	62	47.7	41.8	46.7	50.5	51.2	43.2	50.3	50.1
Mg/(Fe+Mg)	0.65	0.23	0.41	0.37	0.42	0.33	0.36	0.32	0.38	0.41	0.35	0.26
B	280	58	107	109	131	52	94	53	71	59	66	46

Sample	**TK781**	**TK782**	**TK935**	**TK936**	**TK939**	**TK940**	**TK941**	**TK942**	**TK943**	**TK725**	**TK727**	**TK728**	**TK729**	**TK730**	**TK737**
location	Shigar	Shigar	Khomara 2730m	Khomara 2730	Khomara 2670	Khomara 2670	Khomara 2670	Khomara 2670	Khomara 2670	Remendok 3785	Remendok 3820	Remendok 4080	Remendok 4080	Remendok 4080	Remendok 3990
formation	Shigar	Shigar	Shigar	Shigar	Shigar	Shigar	Shigar	Shigar	Shigar	Remendok	Remendok	Remendok	Remendok	Remendok	Remendok
mineralogy			am-ep	am-py	bi-ep	am-ep-sp	am		Py-am	mu-gr	mu				
rock type	mzdq	mzdq	to	to	gd	mzdq	to	d	mzd	ltrdj	ltrdj	ltrdj	ltrdj	ltrdj	ltrdj
SiO2	59.57	59.94	58.95	58.16	65.61	54.71	66.40	47.71	47.28	74.71	73.71	73.85	75.05	72.47	72.82
Al2O3	17.13	16.66	16.49	16.45	16.22	16.68	15.47	15.74	15.32	14.72	15.26	15.43	14.58	15.18	15.61
Fe2O3tot	6.19	5.62	7.76	8.03	4.02	9.37	4.71	11.20	9.52	0.34	0.64	0.42	0.50	1.06	0.80
MnO	0.13	0.13	0.16	0.15	0.09	0.15	0.09	0.18	0.12	0.02	0.02	0.04	0.00	0.03	0.02
MgO	2.51	2.28	2.59	2.91	1.32	3.73	1.17	7.43	9.34	0.05	0.15	0.05	0.07	0.31	0.22
CaO	5.71	5.20	5.68	6.42	3.68	6.46	4.14	10.87	9.88	2.12	2.16	2.70	1.93	2.12	2.25
Na2O	3.81	4.13	3.34	3.26	4.15	3.81	4.15	2.40	2.71	5.08	5.03	5.69	5.29	4.87	5.04
K2O	2.97	2.62	1.68	1.43	3.11	2.03	1.71	1.31	1.74	1.95	2.23	1.01	2.07	2.00	2.15
TiO2	0.54	0.48	0.62	0.61	0.45	1.27	0.39	0.65	1.57	0.00	0.02	0.00	0.02	0.08	0.06
P2O5	0.25	0.23	0.19	0.16	0.20	0.35	0.12	0.20	0.23	0.04	0.04	0.05	0.00	0.05	0.03
L.I.	0.88	2.40	2.34	2.23	0.87	1.21	1.46	2.08	2.05	0.44	0.48	0.54	0.30	0.78	0.39
Total	99.69	99.69	99.80	99.81	99.72	99.77	99.81	99.77	99.76	99.47	99.74	99.78	99.81	98.95	99.39
parameters															
P	-162	-170	-173	-189	-134	-195	-172	-243	-226	-161	-154	-211	-161	-153	-157
Q	77	82	116	112	120	61	149	30	21	184	174	173	179	178	168
A	-54	-48	-22	-40	-14	-69	-14	-184	-175	8	12	2	3	23	17
B	147	133	169	181	89	226	93	332	371	5	12	6	8	22	16
Q %	13.9	14.8	20.9	20.2	21.6	11	26.8	5.4	3.8	33.2	31.4	31.2	32.3	32.1	30.3
B %	26.5	24	30.5	32.6	16	40.7	16.8	59.8	66.8	0.9	2.2	1.1	1.4	4	2.9
F %	59.6	61.3	48.6	47.2	62.3	48.3	56.4	34.8	29.4	65.9	66.5	67.7	66.3	64	66.8
Mg/(Fe+Mg	0.44	0.45	0.4	0.42	0.4	0.44	0.33	0.57	0.66	0.2	0.33	0.17	0.25	0.38	0.33
B	147	133	169	181	89	226	93	332	371	5	12	6	8	22	16



ANNEXURE 3-6 (Tables 3-6a and 3-6b, Diagrams 3-6)

Kohistan - Ladakh intrusive rocks, plutons South of the Dobani-Dasu lineament

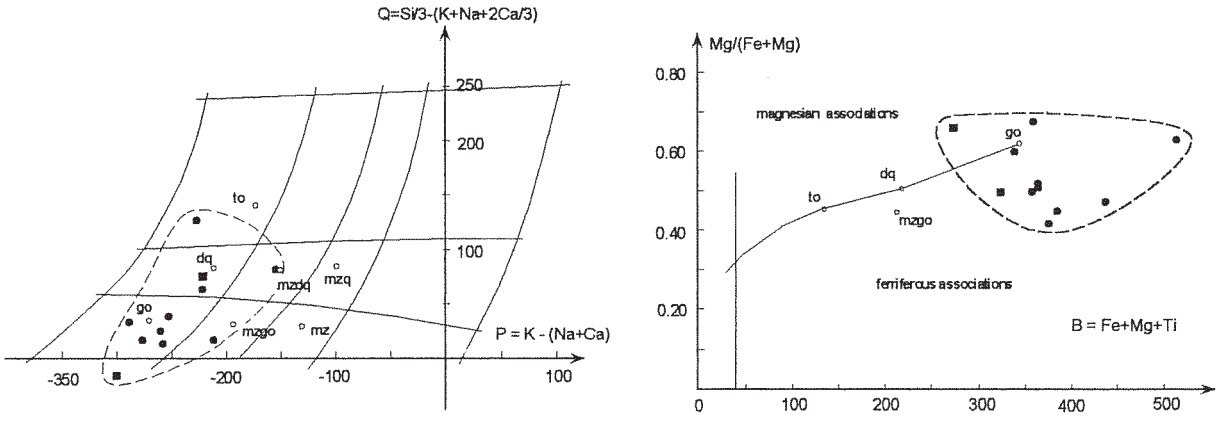
Chemical analysis and chemical -mineralogical classification of the plutons South of the Dobani-Dasu lineament.). Pink crosses: Barti (SK467) and Bilchar (SK365, 370) tonalites; green triangles: Dainyor diorite (KL237, SK287, 371, 372, 382, 419, 422); purple dots: Skoyo tonalite (TK01, 02, 915, 916, 917, 951); green square: Thhwar diorite (SK538); red square: Satpara complex (BD 04, 03, BH03).

Roches intrusives du Kohistan-Ladakh, plutons au sud du linéament de Dobani-Dasu: classification chimico-minéralogique. Croix roses: tonalites de Barti (SK467) et Bilchar (SK365, 370); triangles verts: diorite de Dainyor (KL237, SK287, 371, 372, 382, 419, 422); disques violets: tonalite de Skoyo (TK01, 02, 915, 916, 917, 951); carré vert: diorite de Thhwar (SK538); carré rouge: complexe de Satpara (BD 04, 03, BH03).

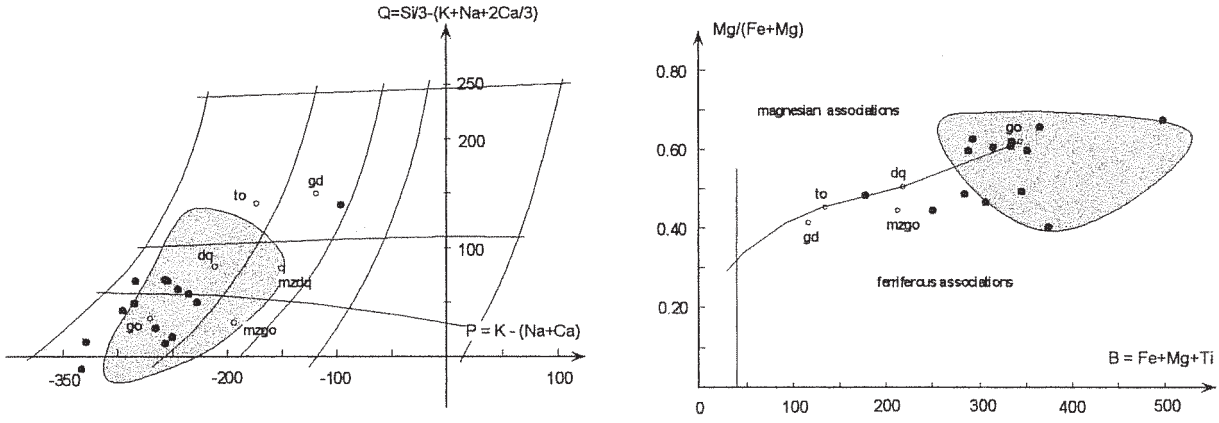
Annex 3-6-a

Sample	**SK467**	**SK365**	**SK370**	**KL237**	**SK287**	**SK364**	**SK371**	**SK372**	**SK382**	**SK419**	**SK422**	**SK423**
location	Hunza 1800m	Bilchar 3445m	Bilchar 2160m	Dainyor 1435m	Hanuchal 1355m	Bilchar 3445	Bilchar 1980m	Bilchar 1975m	Bagrot 1995m	Manu Gah 2210m	Dainyor 2010m	Dainyor 1515m
formation	Barti	Bilchar	Bilchar	Dainyor	Dainyor	Barti-S	Dainyor	Dainyor	Dainyor	Dainyor	Dainyor	S-Barti
mineralogy	bi-am-ep			am		bi	am	am	am		am	bi-am-ep
rock type	ad	gd(to)	to	d	d	lgr	mzd	d	mzdq(ad)	to(dq)	mz(s)	ad
	Geolab	Geolab	Geolab		Geolab	Geolab	Geolab	Geolab	Geolab	Geolab	Geolab	Geolab
SiO2	66.55	67.22	63.08	51.24	48.90	75.12	40.85	44.48	58.90	53.83	59.33	66.33
Al2O3	14.92	15.79	17.61	17.44	18.40	13.97	18.20	19.03	17.77	18.73	18.03	14.81
Fe2O3tot	6.67	3.72	5.33	9.62	10.87	1.41	17.91	13.71	7.42	7.21	5.13	5.15
MnO	0.14	0.07	0.11	0.18	0.18	0.09	0.16	0.21	0.14	0.19	0.12	0.10
MgO	2.03	2.03	2.01	5.20	5.49	0.10	7.52	5.62	2.92	2.58	1.82	1.48
CaO	6.62	4.28	5.55	9.38	10.81	0.78	10.32	11.10	6.49	7.34	4.56	3.42
Na2O	1.87	3.27	3.53	3.77	3.03	3.22	1.37	2.22	3.34	3.66	4.32	2.82
K2O	0.36	2.20	1.64	1.12	0.82	4.91	0.92	0.63	1.66	4.23	5.48	4.56
TiO2	0.43	0.42	0.54	0.77	0.88	0.05	1.78	1.48	0.82	0.56	0.41	0.80
P2O5	0.05	0.14	0.19	0.45	0.12	0.01	0.20	0.97	0.27	0.42	0.25	0.21
L.I.	0.37	0.88	0.42	0.77	0.51	0.34	0.76	0.57	0.28	1.24	0.55	0.33
Total	100.01	100.02	100.00	99.94	100.01	100.00	99.99	100.02	100.01	99.99	100.00	100.01
parameters												
P	-170	-134	-178	-265	-274	-14	-208	-257	-189	-159	-104	-55
Q	223	170	135	27	28	200	40	30	107	3	20	139
A	-11	6	-2	-138	-140	38	-75	-108	-26	-103	-63	-19
B	139	102	124	259	283	21	433	329	175	161	114	111
Q %	40.2	30.6	24.3	4.9	5	36	7.2	5.4	19.3	0.5	3.6	25.0
B %	25	18.4	22.3	46.7	51	3.8	78	59.3	31.5	29	20.5	20.0
F %	34.8	51	53.3	48.5	44	60.2	14.8	35.3	49.2	70.5	75.9	55.0
Mg/(Fe+Mg	0.37	0.52	0.43	0.52	0.5	0.1	0.45	0.45	0.44	0.42	0.41	0.37
B	139	102	124	259	283	21	433	329	175	161	114	111

Sample	**TK 01**	**TK 02**	**TK915**	**TK916**	**TK917**	**TK951**	**SK538**	**BD 03**	**BD 04**	**BH 03**
location	Turmik 2186m	Turmik 2186m	Turmik 2150m	Turmik 2150m	Turmik 2150m	Baricha 2100m	Stak 1920m	Skardu SE	Skardu SE	Skardu SE 2360m
formation	Skoyo	Skoyo	Skoyo	Skoyo	Skoyo	Skoyo	Thowar	Satpara	Satpara	Satpara
mineralogy	bi-am	bi-mu	bi-sp	sp	sp	bi-sp	am-gr			bi-gr
rock type	to	to	to	to	to	to	d	gr	gd(to)	to
SiO2	63.70	70.40	64.97	67.98	67.25	70.20	52.61	73.67	66.24	69.29
Al2O3	16.32	15.82	16.29	15.79	16.51	15.18	16.33	13.49	16.14	16.28
Fe2O3tot	4.19	1.82	3.74	2.69	2.48	1.77	10.65	1.27	4.03	2.66
MnO	0.07	0.00	0.05	0.03	0.03	0.03	0.16	0.04	0.07	0.08
MgO	2.91	1.00	2.51	1.81	1.62	0.84	4.63	0.24	1.72	0.77
CaO	5.44	3.45	5.05	4.14	4.53	2.56	9.97	1.33	4.32	3.77
Na2O	4.25	4.94	4.39	4.64	5.16	4.88	3.63	3.11	3.79	4.00
K2O	1.36	1.16	1.36	1.30	1.07	2.30	0.40	4.87	2.27	1.77
TiO2	0.34	0.22	0.34	0.30	0.30	0.20	0.96	0.14	0.44	0.27
P2O5	0.16	0.11	0.14	0.11	0.12	0.08	0.11	0.00	0.10	0.13
L.I.	0.98	0.86	0.94	0.97	0.70	0.77	0.56	0.61	0.46	0.64
Total	99.72	99.78	99.78	99.76	99.77	98.81	100.01	98.77	99.58	99.66
parameters										
P	-205	-196	-203	-196	-224	-154	-287	-21	-151	-158
Q	123	165	130	150	130	153	48	190	146	173
A	-40	2	-31	-16	-27	0	-161	14	-7	18
B	128	51	113	83	75	46	260	24	99	55
Q %	22.2	29.7	23.4	27	23.4	27.6	8.6	34.2	26.3	31.2
B %	23.1	9.2	20.4	15	13.5	8.3	46.8	4.3	17.8	9.9
F %	54.8	61.1	56.2	58	63.1	64.1	44.5	61.4	55.9	58.9
Mg/(Fe+Mg	0.58	0.52	0.57	0.57	0.56	0.49	0.46	0.27	0.46	0.37
B	128	51	113	83	75	46	260	24	99	55



Karakorum amphibolites



Askor amphibolites

ANNEXURE 3-7 (Tables 3-7a and 3-7b, Diagrams 3-7)

Amphibolites in the Karakorumand Askor amphibolites

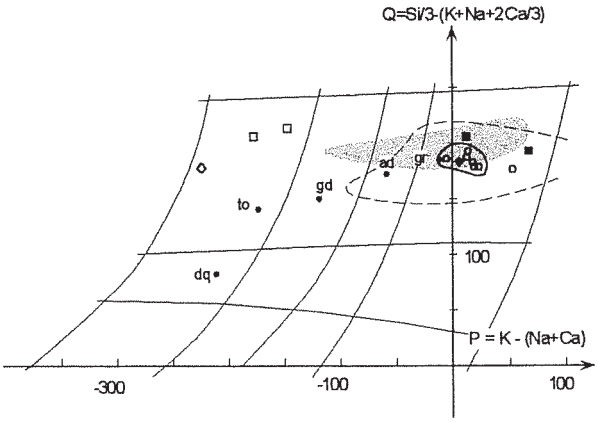
A - Amphibolites in the Karakorum Metamorphic Complex. Black dots: amphibolites of the Chogo Lungma area, usually interbedded in marbles (KK135, TK456, 594, 596, 602, 610, 614, 784, 799); black squares: samples from the Tasarpa Harel valley, amphibolites in the Khusomik formation (samples L167, L168, Y. Rolland).
B - Askor amphibolites. Samples TK54, 62, 66, 715, 750, 756, 770, 772, 824, 926, 931, 945, 946, 962. In gray: field of the Karakorum Metamorphic Complex amphibolites.

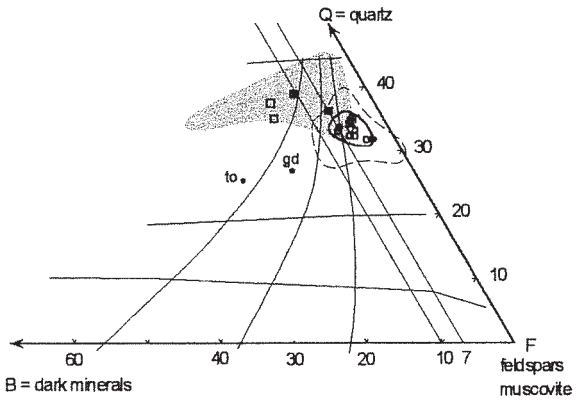
A - Amphibolites du Complexe Métamorphique du Karakorum. Disques noirs: amphibolites de la région du Chogo Lungma, en général interlitées dans les marbres (KK135, TK456, 594, 596, 602, 610, 614, 784, 799); carrés noirs: échantillons Y. Rolland provenant de la vallée de Tasarpa Harel, amphibolites dans la formation de Khusomik (L167, L168).
B- Amphibolites d'Askor. Echantillons TK54, 62, 66, 715, 750, 756, 770, 772, 824, 926, 931, 945, 946, 962. En gris, champ correspondant aux amphibolites du Complexe Métamorphique du Karakorum.

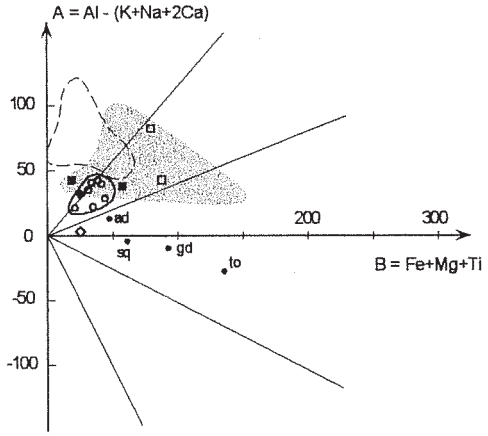
Sample	**KK135**	**TK456**	**TK602**	**TK610**	**TK784**	**TK594**	**TK614**	**TK596**	**TK799**	**L167**	**L168**
location	KKH 2350m	Basha 2866m	Moraine 4255m	Moraine 4175m	Basha 2670m	Moraine 4125m	Moraine 4215m	Moraine 4125m	Aralter 3280m	Tusarpo	Tusarpo
nature	amphib	amphib	amphib	amphib	amphib	amphib	amphib	amphib	amphib	amphib	amphib
mineralogy	am		am	am	am-gr	am	am	am	am		
rock type	d	d	d	d	d	dq	mzd	mzdq	to		
SiO2	42.05	45.02	47.13	48.37	46.27	46.41	48.43	46.79	55.98	53.84	43.19
Al2O3	11.28	14.88	14.24	14.01	13.92	11.93	16.24	15.54	11.85	16.14	17.19
Fe2O3tot	13.91	12.71	13.56	13.15	15.35	13.51	10.27	15.41	9.12	7.15	12.10
MnO	0.20	0.17	0.21	0.20	0.23	0.16	0.18	0.25	0.15	0.13	0.21
MgO	12.12	7.05	6.78	7.00	6.31	9.14	7.94	5.67	9.81	7.00	6.19
CaO	12.42	11.19	12.07	11.58	10.51	9.36	8.79	7.94	8.60	7.35	13.54
Na2O	1.55	2.50	2.54	2.83	2.46	2.14	3.13	1.45	2.41	2.74	2.35
K2O	0.51	1.08	0.95	0.40	0.70	0.65	2.18	1.63	0.19	2.25	0.79
TiO2	3.05	2.32	1.44	1.36	2.98	3.25	1.12	3.34	0.26	0.73	1.67
P2O5	0.35	0.63	0.13	0.18	0.41	0.52	0.22	0.39	0.07	0.11	0.81
L.I.	1.11	1.11	0.82	0.74	0.63	1.19	1.30	1.32	1.42	2.30	1.86
Total	98.55	98.66	99.87	99.82	99.77	98.26	99.80	99.73	99.86	99.74	99.91
parameters											
P	-261	-257	-277	-289	-252	-222	-211	-154	-227	-172	-300
Q	25	13	16	31	38	63	17	84	127	75	-14
A	-282	-211	-253	-238	-196	-183	-142	-60	-156	-82	-238
B	513	363	356	355	386	437	340	375	361	272	326
Q %	4.5	2.4	2.9	5.6	6.8	11.4	3.1	15.1	22.8	13.6	-2.5
B %	92.4	65.4	64.1	64.0	69.6	78.7	61.2	67.6	65.0	49.1	58.7
F %	3.1	32.2	33.0	30.4	23.7	9.9	35.7	17.2	12.2	37.4	43.8
Mg/(Fe+Mg)	0.63	0.52	0.50	0.51	0.45	0.57	0.60	0.42	0.68	0.66	0.50
B	513	363	356	355	386	437	340	375	361	272	326

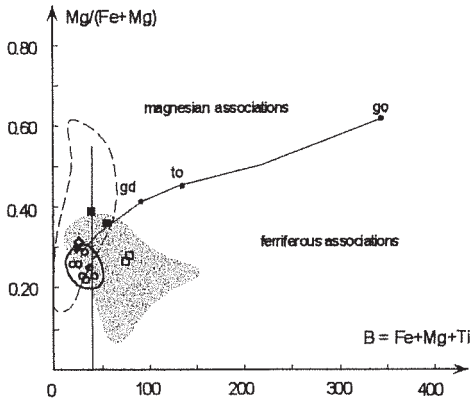
Annex 3-7-b

Sample	**TK 54**	**TK 62**	**TK 66**	**TK715**	**TK750**	**TK756**	**TK770**	**TK772**	**TK924**	**TK926**	**TK931**	**TK945**	**TK946**	**TK962**
location	Askober 4070m	Askober 4149m	Askober 4302m	Remendok 3570m	W Niamur 4115m	W Niamur 4390m	Niamur 3220m	Niamur 3175m	Khomara 2270m	Khomara 2350m	Khomara 2730m	Baricha 2320m	Baricha 2320m	Tungus 2220m
nature	amphib	gabbro	volc.br.	amphib	amphib	amphi	µ-gabbro	amphib	gabbro	amphib	amphib	amphib	amphib	amphib
mineralogy	am				am-bi	bi-am	am-bi		am	am	am	am	am	am
rock type	dq	d	d	d	d	d	dq	gd	d	dq	d	dq(d)	d	dq
SiO2	49.71	47.03	45.96	50.83	44.04	49.34	53.12	49.00	48.23	47.90	49.26	50.15	48.10	46.44
Al2O3	13.18	12.21	13.98	16.14	14.18	14.95	19.25	18.66	17.17	15.17	14.98	14.08	19.05	11.79
Fe2O3tot	13.91	10.00	8.89	9.47	12.40	10.86	6.97	13.51	11.02	9.66	10.02	8.50	10.45	12.19
MnO	0.19	0.17	0.22	0.14	0.15	0.16	0.09	0.32	0.18	0.14	0.11	0.14	0.24	0.16
MgO	7.41	8.25	6.83	7.49	5.57	8.12	3.31	6.77	5.45	9.63	7.86	7.26	4.35	12.89
CaO	9.73	15.96	16.26	8.24	8.99	11.43	10.30	4.95	11.31	13.42	11.89	12.36	10.42	10.15
Na2O	2.62	1.58	1.87	3.31	3.36	2.61	2.64	1.28	3.51	1.07	2.67	1.32	2.91	2.11
K2O	0.16	0.30	0.64	1.21	0.15	0.18	0.73	1.55	0.36	0.04	0.13	1.44	1.43	0.34
TiO2	1.41	0.50	0.51	0.87	1.23	0.84	0.91	0.73	0.79	0.49	1.06	0.44	0.81	2.08
P2O5	0.16	0.11	0.14	0.21	0.39	0.13	0.43	0.15	0.28	0.11	0.16	0.28	0.26	0.27
L.I.	1.38	3.65	4.43	1.85	9.39	1.24	1.98	2.90	1.45	1.71	1.69	3.78	1.80	1.32
Total	99.86	99.76	99.73	99.76	99.85	99.86	99.73	99.82	99.75	99.34	99.83	99.75	99.82	99.74
parameters														
P	-256	-330	-336	-228	-265	-284	-254	-96	-307	-273	-295	-232	-250	-242
Q	72	14	-12	51	27	50	72	139	12	71	43	58	19	62
A	-177	-387	-380	-110	-153	-203	-90	116	-188	-216	-219	-238	-122	-206
B	376	336	286	316	308	348	180	346	283	366	333	292	249	499
Q %	13	2.5	-2.2	9.2	4.9	9	13	25	2.2	12.8	7.7	10.5	3.4	11.2
B %	67.7	60.5	51.5	56.9	55.5	62.7	32.4	62.3	51	65.9	60	52.6	44.9	89.9
F %	19.3	36.9	50.6	33.9	39.6	28.3	54.6	12.6	46.8	21.3	32.3	36.9	51.7	-1.1
Mg/(Fe+Mg	0.51	0.62	0.6	0.61	0.47	0.6	0.49	0.5	0.49	0.66	0.61	0.63	0.45	0.68
B	376	336	286	316	308	348	180	346	283	366	333	292	249	499









ANNEXURE 3-8 (Table 3-8, Diagrams 3-8)

Orthogneiss from the Nanga Parbat-Haramosh massif

Chemical analysis and chemical -mineralogical classification of the orthogneiss from the Nanga Parbat-Haramosh massif. Plain circles: Range Blok orthogneiss, very homogeneous (TK145, 147a, 147b, 148, 149, 150, 156); black squares: Iskere orthogneiss, granitic composition (SK274,280); plain squares: Iskere orthogneiss, leucotonalites (SK272, 395); black and plain diamonds: orthogneiss in the Stak La gneiss, close to the Iskere tonalite type (TK95) or granite type (TK164). For comparison, field of the Karakorum Mangol Bluk orthogneiss (dotted line) and Dassu orthogneiss (gray), from annex 3-4.

Orthogneiss du massif du Nanga Parbat - Haramosh. Cercles vides: orthogneiss de Range Blok, très homogènes (TK145, 147a, 147b, 148, 149, 150, 156); carrés noirs: orthogneiss d'Iskere, composition granitique (SK274,280); carrés blancs: orthogneiss d'Iskere, leucotonalites (SK272, 395); losanges noirs et vides: orthogneissdans les gneiss du Stak La, proches des tonalites d'Iskere (TK95) ou du type granite (TK164Pour comparaison, chmps correspondant au orthogneiss du Karakorum de Mangol Bluk (contour en tiretés) et de Dassu (en gris), d'après la figure de l(annexe 3-4.

Sample	**TK145**	**TK147a**	**TK147b**	**TK148**	**TK149**	**TK150**	**TK156**	**SK274**	**SK280**	**SK272**	**SK395**	**TK 95**	**TK164**
location	Lecho 3705m	Goropha 3387m	Goropha 3387m	Goropha 3387m	Goropha 3387m	Goropha 3387m	Goropha 3647m	Tato 1470m	Dasso 2125m	Tato 1975m	Darchan 3485m	Turmik 4085m	Goropha 3950m
formation	Range B.	Range B.	Range B.	Range B.	Range B.	Range B.	Range B.	Iskere	Iskere	G Bi	Iskere	Stak La	Stak La
mineralogy	bi-mu-gr	bi-mu-gr-t	bi-mu-gr-t	gr		bi-mu-gr-t				bi	bi-gr	bi-gr	bi-mu
rock type	gr	gr	gr	lgr	lgr	gr	gr	gr	gr	lto	lto	to	lgr
								Geolab	Geolab	Geolab	Geolab		
SiO2	72.44	72.29	72.59	73.56	73.95	72.27	73.40	71.15	70.15	73.46	71.98	72.19	73.31
Al2O3	14.32	14.41	14.16	13.81	13.66	14.18	14.23	14.06	15.55	15.32	15.37	15.82	14.31
Fe2O3tot	2.16	2.02	1.86	1.79	1.10	2.37	1.56	4.13	4.13	1.72	2.66	1.37	1.43
MnO	0.03	0.03	0.02	0.05	0.00	0.03	0.02	0.05	0.03	0.02	0.07	0.04	0.00
MgO	0.38	0.30	0.30	0.35	0.22	0.38	0.30	0.77	0.81	0.55	0.79	0.30	0.32
CaO	1.04	0.88	0.91	1.11	0.58	0.88	0.86	1.88	1.04	2.46	3.34	3.59	1.06
Na2O	2.62	2.67	2.72	3.08	2.54	2.70	2.72	1.85	1.48	4.76	3.61	5.26	2.91
K2O	5.50	5.91	5.82	5.19	6.83	5.66	5.51	4.99	6.41	0.99	1.33	0.51	5.55
TiO2	0.27	0.20	0.17	0.17	0.12	0.22	0.13	0.57	0.67	0.22	0.29	0.10	0.17
P2O5	0.17	0.30	0.30	0.13	0.19	0.28	0.30	0.12	0.28	0.02	0.09	0.07	0.12
L.I.	0.83	0.75	0.94	0.55	0.61	0.82	0.76	0.45	0.45	0.48	0.47	0.52	0.57
Total	99.76	99.76	99.79	99.79	99.80	99.79	99.79	100.02	101.00	100.00	100.00	99.77	99.75
parameters													
P	13	23	20	-9	53	17	14	12	69	-177	-148	-223	5
Q	187	180	180	186	177	183	192	206	193	203	215	177	182
A	41	40	34	22	21	39	44	42	83	38	38	1	31
B	39	35	32	33	21	42	29	78	80	39	57	25	28
Q %	33.7	32.4	32.4	33.5	31.9	33	34.6	37.1	34.8	36.6	38.7	31.9	32.8
B %	7	6.3	5.8	5.9	3.8	7.6	5.2	14.1	14.4	7	10.3	4.5	5
F %	59.3	61.3	61.8	60.5	64.3	59.5	60.2	48.8	50.8	56.4	51	63.6	62.2
Mg/(Fe+Mg	0.25	0.22	0.23	0.29	0.26	0.23	0.26	0.27	0.28	0.39	0.38	0.29	0.31
B	39	35	32	33	21	42	29	78	80	39	57	25	28

Annex 4-A

KARAKORUM

					SiO2	Al203	Fe2O3	MnO	MgO	CaO	Na2O	K20	TiO2	P2O5	L.I.	Total
Acid dykes and pegmatites																
KK110	Hispar gl		aplite		74.60	14.21	0.78	0.11	0.03	0.99	3.79	4.57	0.01		0.55	99.64
SK021	Rash	4115m	pegmatite	bi	75.90	13.55	0.41	0.02	0.08	2.07	3.97	2.94	0.00	0.05	0.79	99.78
SK182	Garetsa	2740m	granite	bi-mu	72.82	14.79	1.00	0.02	0.26	1.52	4.15	4.36	0.11	0.04	0.70	99.77
SK225	Toltar gl	3855m	microgranite	am	72.02	13.75	2.64	0.03	0.82	2.04	1.87	5.79	0.35	0.05	0.62	99.98
TK806	Aralter	3515m	granite	bi	71.72	14.86	1.06	0.02	0.35	1.53	5.06	3.17	0.16	0.10	0.46	98.49
Basic dykes																
BH118	Hispar	4110m	quartz-diorite	am	49.21	14.26	13.78	0.24	6.85	11.38	1.85	0.22	1.01	0.17	0.84	99.81
BH120	Hispar	4110m	quartz-diorite	bi	48.84	14.91	12.25	0.20	7.91	12.39	0.64	0.71	0.83	0.14	0.92	99.74
TK619	Moraine	4215m	diorite		48.42	14.43	12.98	0.19	6.87	11.93	1.98	0.64	1.28	0.17	0.92	99.81
TK777	Arandu	3200m	lamprophyr		50.46	15.22	11.33	0.16	6.50	8.07	2.47	1.98	1.48	0.23	1.88	99.78
Enclaves																
KK 51	KKH	2485m	in Hunza	bi-gr	63.02	14.21	5.52	0.19	1.17	12.49	0.74	0.11	0.88	0.27	0.98	99.58
KK102	KKH	2550m	in Hunza	px-gr-ep	25.31	7.28	2.82	0.09	3.59	35.47	0.01	0.00	0.22	0.00	19.76	94.55
TK838	Niesolo	2640m	in Hemasil	am-bi-ep	35.48	17.73	15.96	0.51	5.61	13.71	1.18	2.41	2.75	1.47	1.51	98.32
Karakorum metamorphic complex, orthogneisses																
SK005	Bualtar	2850m	augen gn.	bi-gr	65.67	15.99	4.90	0.07	1.33	3.79	3.31	3.08	0.78	0.29	0.45	99.66
SK007	Barpu	3010m	orthogn	am-bi	49.26	17.47	10.76	0.14	6.36	8.62	2.79	1.43	1.55	0.23	1.15	99.76
SK008	Barpu	3025m	orthogn	bi-am-gr	61.08	16.72	5.61	0.08	2.86	4.82	4.00	2.69	0.84	0.28	0.73	99.71
SK012	N Rash	4635m	orthogn		70.72	14.99	1.62	0.00	0.65	1.84	3.32	5.27	0.19	0.14	0.79	99.53
SK013	N Rash	4535m	orthogn		65.64	15.53	4.58	0.02	1.86	2.83	3.52	3.37	0.75	0.25	0.76	99.11
SK014	S Rasht	4430m	orthogn		66.90	15.62	4.11	0.02	1.58	3.17	3.72	3.00	0.71	0.24	0.64	99.71
SK020	E Rasht	4210m	orthogn	bi-am-ep	62.75	16.06	5.67	0.05	2.41	4.44	3.91	2.26	0.83	0.27	1.12	99.77
SK023	Chukutens	3660m	augen gn.	bi-gr	72.19	13.81	2.36	0.03	0.48	1.10	2.13	6.25	0.21	0.12	1.03	99.71
TK600	Moraine	4255m	augen gn.	bi	71.16	14.03	3.12	0.04	0.42	1.22	4.07	4.73	0.32	0.07	0.56	99.74
TK787	Basha	2770m	orthogn	bi-mu-gr	74.57	13.62	0.85	0.00	0.15	0.93	3.78	5.06	0.04	0.13	0.73	99.86
TK785	Basha	2670m	gneiss	bi-am	55.53	18.02	6.15	0.13	2.51	6.66	3.91	4.23	0.99	0.59	0.84	99.56
BH115	Hispar	4200m	gneiss	bi	75.03	13.00	1.18	tr	0.38	1.26	3.02	5.04	0.13	0.08	0.64	99.76
Karakorum metamorphic complex, other rocks																
KK 88	KKH	3450m	Pasu schist		60.40	16.23	7.12	0.10	2.77	2.10	2.33	3.61	0.87	0.21	3.50	99.24
KK230	KKH	2640m	Pasu schist		63.07	13.96	5.10	0.08	2.92	4.35	2.77	5.26	0.57	0.44	1.12	99.64
SK059	HapaKund	3080m	schist	bi-mu-ky	46.36	26.93	8.02	0.03	2.54	1.14	1.90	7.93	1.20	0.15	3.39	99.59
SK061	Bualtar	2990m	marble	tr	60.13	8.16	1.60	0.03	8.50	12.55	0.66	5.80	0.20	0.11	1.91	99.65
TK489	Hemasil	2795m	shist amph	am	55.15	15.13	8.66	0.13	4.94	9.46	2.97	0.96	0.88	0.25	1.29	99.82
TK766	Niamur	4090m	amph.schist	am-bi	60.17	19.90	6.49	0.05	2.13	0.57	1.39	4.89	0.77	0.20	3.17	99.73

NANGA PARBAT - HARAMOSH

					SiO2	Al203	Fe2O3	MnO	MgO	CaO	Na2O	K20	TiO2	P2O5	L.I.	Total
Metamorphosed basic dykes																
TK165	Goropha	3835m			48.71	14.08	13.46	0.20	6.78	11.39	2.33	0.44	1.70	0.22	0.48	99.79
TK146	Lecho	3705m		Gr	49.56	14.23	13.80	0.20	6.55	10.91	0.91	0.68	1.81	0.22	0.93	99.80
TK166	Goropha	3731m		(A)	47.90	15.91	13.63	0.20	7.16	9.98	2.29	0.56	1.62	0.22	0.34	99.81
Stak La gneisses																
TK132	Stak La	4497m		BtGr	72.87	14.81	1.79	0.00	0.50	1.46	4.24	2.97	0.17	0.11	0.83	99.75
TK 84	Turmik	3919m		Gr	65.84	17.73	9.35	0.13	1.88	0.38	0.40	2.83	1.06	0.05	0.06	99.71
TK 92	Turmik	4136m			73.06	11.71	5.04	0.04	0.60	1.62	2.74	3.70	0.53	0.11	0.56	99.71
TK142	Lecho	4100m		Bi	69.70	13.96	3.74	0.04	2.67	1.85	3.16	3.04	0.52	0.08	0.90	99.66
TK162	Goropha	3837m		Gr	66.34	17.67	6.91	0.10	2.00	0.26	0.59	4.16	0.71	0.10	0.85	99.69

Table 4-A and 4-B give chemical analysis of various rocks which appears on the map, in Karakoram or Himalaya (Table 4-A) or in Kohistan-Ladakh (Table 4-B). Analyses mainly at the CRPG-CNRS, Nancy, France by ICP. Analysis SK225, 263, 264, 344, 385, 391 and 407 at the Geoscience Laboratory, GSP, Islamabad, Pakistan, by XRF. Analysis L140, 156, 157, 174 and 199 at LGCA-CNRS, Grenoble, France, by ICP.

Annex 4-B

KOHISTAN-LADAKH

					SiO2	Al203	Fe2O3	MnO	MgO	CaO	Na2O	K20	TiO2	P2O5	L.I.	Total
Shigar complex																
TK940	Khomara	2670m	diorite	am-ep-sp	54.71	16.68	9.37	0.15	3.73	6.46	3.81	2.03	1.27	0.35	1.21	99.77
TK941	Khomara	2670m	diorite	am	66.40	15.47	4.71	0.09	1.17	4.14	4.15	1.71	0.39	0.12	1.46	99.81
TK942	Khomara	2670m	gabbro		47.71	15.74	11.20	0.18	7.43	10.87	2.40	1.31	0.65	0.20	2.08	99.77
TK943	Khomara	2670m	gabbro	px-am	47.28	15.32	9.52	0.12	9.34	9.88	2.71	1.74	1.57	0.23	2.05	99.76
TK955	Tungus S	2200m	diorite qz	px-bi-am	53.57	17.56	9.53	0.15	4.25	8.21	2.61	1.70	0.91	0.22	1.10	99.81
TK958	Tungus	2400m	gr-diorite	bi-mu-gr	71.15	15.12	1.85	0.05	0.46	2.05	4.15	3.87	0.18	0.07	0.79	99.74
Other plutonic rocks																
SK344	Naltar	2490m	gr-diorite		61.14	16.97	6.76	0.15	1.52	4.00	4.15	3.36	0.89	0.41	0.64	99.99
TK 78	Matumber	3845m	gabbro		48.42	18.53	10.24	0.19	5.08	9.44	3.59	1.62	0.69	0.27	1.64	99.71
TK754	W Niamur	4310m	diorite	bi-am	54.97	18.19	7.87	0.14	3.75	7.51	4.05	1.26	0.73	0.31	1.02	99.80
TK755	W Niamur	4355m	diorite	am-bi	54.34	17.17	8.53	0.14	4.34	7.86	3.30	1.52	0.88	0.34	1.36	99.78
TK760	W Niamur	4390m	granite	gr-t-bi	75.33	13.63	1.33	0.06	0.09	0.68	4.53	3.56	0.04	0.13	0.48	99.86
Dobani-Dasu lineament																
SK385	Darchan	3340m	pyroxenite		41.31	0.61	8.55	0.10	44.31	0.06	0.00	0.00	0.02	0.00	5.03	99.99
TK 05	Turmik	2530m	UB		36.51	1.91	9.78	0.13	40.17	0.75	0.00	0.00	0.03	0.03	9.43	98.74
Dykes																
TK 68		4260m	tonalite		70.81	15.63	1.91	0.00	0.85	2.49	6.00	0.91	0.22	0.12	0.80	99.74
SK364	Bilchar	3445m	granite	bi	75.12	13.97	1.41	0.09	0.10	0.78	3.22	4.91	0.05	0.01	0.34	100.00
SK407	Khaltaro S	2210m	microdiorite		50.63	16.76	12.16	0.19	3.80	8.92	3.42	1.06	2.19	0.55	0.31	99.99
Volcanites																
KL253	Jaglot Gur	2675m	Chalt	am-bi	52.90	15.79	9.15	0.13	9.04	4.98	4.09	1.27	0.35	0.14	2.10	99.94
SK116	Minapin	3430m	Chalt	am	47.38	12.42	10.30	0.16	10.35	10.01	2.08	0.98	0.66	0.25	5.18	99.77
SK120	Minapin	3655m	Chalt		39.25	0.80	5.77	0.06	38.12	1.53				0.03	14.19	99.75
SK126	Minapin	3365m	Chalt	am	52.40	16.22	9.88	0.14	3.99	8.70	3.35	1.07	1.10	0.34	2.51	99.70
SK132	Minapin gl	3385m	Chalt	am	48.03	14.21	11.02	0.18	7.95	12.24	2.48	0.56	0.63	0.20	2.31	99.81
SK133	Minapin gl	3385m	Chalt	am	48.21	13.34	10.91	0.19	9.05	11.96	1.26	1.39	0.72	0.24	2.52	99.79
SK193	KKH Gulmit	1980m	Chalt	am-ep	45.84	14.53	12.91	0.16	7.14	12.08	2.61	0.96	1.07	0.15	2.38	99.83
SK263	Rakhan Gali	4205m	Chalt		71.51	14.23	2.61	0.06	0.51	4.05	2.69	1.52	0.26	0.04	2.51	99.99
SK264	Rakhan Gali	3605m	Chalt		52.84	9.80	9.74	0.20	11.72	10.27	2.37	0.09	0.35	0.02	2.73	100.13
SK391	Darchan	3650m	Chalt		46.76	17.60	5.57	0.10	10.11	17.24	0.07	0.07	0.11	bdl	2.38	100.01
L140	upper Thalle		vLK		48.71	14.56	11.60	0.19	7.87	10.35	2.19	0.99	1.34	0.12	1.78	99.74
L156	Bauma Harel		vLK		51.17	13.82	11.76	0.16	8.02	7.37	4.83	0.40	0.80	0.07	1.04	99.44
L157	Bauma Harel		vLK		57.04	14.04	7.57	0.13	6.80	6.85	3.91	0.13	0.44	0.05	2.01	99.02
L174	Bauma Harel		vLK		50.02	15.96	10.36	0.17	6.69	7.63	4.01	0.08	1.20	0.10	2.17	98.45
L199	Skoro gl		vLK		52.24	11.71	11.01	0.15	8.07	9.21	2.54	0.69	0.95	0.08	2.70	99.41
Greenstones																
TK 45	Turmik rg	2973	Turmik		61.62	15.58	5.50	0.08	3.90	3.45	5.41	1.63	0.60	0.20	1.78	99.75
TK 48	Askober	3704	Turmik		63.75	13.50	7.28	0.13	1.88	4.41	4.55	0.40	0.64	0.17	3.16	99.87
TK773	Niamur	3200	Turmik?	am-ep	51.65	17.21	8.11	0.14	4.49	9.08	2.74	0.14	0.68	0.15	5.43	99.82

ANNEXURE 5 - LEXICON OF GEOLOGICAL FORMATIONS, PLUTONS, AND MAIN TECTONIC LINES OF THE MAP

For each name, we give the unit to which it belongs, (reference to authors first describing it); the origin of the name; and a short geological description. We have listed all formations of the map as well as a number of names previously used but not retained by us.

* refers to a name mentioned in the lexicon.

Alchori glacier granite, Karakoram, (this work); after the name of the large village on the left bank of the Shigar; two mica oriented granite, locally orthogneissified close to the contacts, probably similar to the Mango Gusar* granite.

Aliabad: see **Hasanabad**

Arelter orthogneiss, Karakoram, (Lemennicier, 1996); after the name of the valley (also spelled Aralter) of a left bank tributary to the Basha valley at Bisil; a small dome (7 × 2 km) of two-micas orthogneiss with a composition of peraluminous granodiorite, sub-alkaline, sodic and magnesian.

Arendu - Bola Das felsic gneiss and migmatite, Karakoram, (Le Fort et al., 1995; this work), after the names (also spelled Arandu), of the large village at the front of the Chogo Lungma glacier, and of a right bank tributary of the Hunza river at the level of Chalt; masses of Bi-Gr + Sil felsic gneiss and migmatite containing rare pyroxeno-amphibolitic and quartzitic levels, seem to represent a basement for the Karakoram metamorphic complex (KMC)* (Fig. 16C).

Askor amphibolite or **Askor complex**, Ladakh, (Desio, 1963a); after the valley of Askor, right bank (north) tributary of the Indus valley between Turmik and Stak; a major meta-volcanic constituent of the Ladakh-Kohistan island arc, usually made up of Hb-Olg-Ep-Czo or Hb-And-Ep-Gr assemblages, with peak metamorphic conditions around 600-650 °C and 10 kbar (Rolfo, 1994). Amphiboles from Ladakh have yielded ^{40}Ar-^{39}Ar discordant age spectra with step ages ranging from 35 to 70 Ma (Villa et al., 1996b) (Fig. 35).

Badshish□porphyroid granite, Kohistan, (this work); after the name of a peak on the crest separating the lower Hunza from the Manu Gah valley; only known from boulders (Fig. 27B).

Baintha limestone group, Karakoram, (this work); after the name of a summer pasture on the left (NE) bank of the middle Biafo glacier; a group of folded limestone beds, part of the KMC*, and fringing the Baltoro* granite to the south

Baltar porphyritic granite, Karakoram, (this work); after the name of a summer settlement at the confluence of the Kukuar and Baltar glacial valleys; small circular pluton of little deformed porphyritic granite, essentially intrusive into the Hunza granodiorite* (cf Toltar*, Bubli Motin*, Kunyang* porphyritic granites).

Baltit group, Karakoram, (Tahirkheli, 1982), after the name of Hunza former capital; a group of varied metasedimentary formations of the Hunza valley, more or less equivalent to the Dumordo group defined by Desio (1963a) in Baltistan; part of our KMC*.

Baltoro granite, Karakoram, (Desio, 1963a); after the name of the very large Baltoro glacier (NE of the map); a large pluton (>150 km), mostly outcropping east of our map, of two-micas ± garnet granite that has yielded U-Pb Zr ages of 21 to 25 Ma (Parrish & Tirrul, 1989) (Fig. 9).

Barti tonalite, Kohistan, (this work); after the name of a small permanent settlement of the upper Manu Gah valley; a lensoid massif of usually foliated tonalite, biotite and amphibole-bearing with rounded quartz crystals, containing numerous enclaves of dioritic material; similar to Bilchar* tonalites (Fig. 27B).

N-Barti tonalite to granodiorite, Kohistan, (this work); after the name of a small summer settlement just north of Barti on the Manu Gah valley; a rather clear coloured heterogeneous tonalite to granodiorite, intruding the Sinakkar* volcano-sedimentary series to the south, and to the north, separated from the Nomal* trondjhemite by a screen of amphibolites (Fig. 33).

S-Barti monzonite, Kohistan, (this work); after the name of a small permanent settlement of the upper Manu Gah valley; small porphyroid massif outcropping at the bottom of the Manu Gah valley, criss-crossed by basic dykes.

Basha orthogneiss, Karakoram, (Lemennicier, 1996); also named **Mangol Bluk** orthogneiss, after the name of the river flowing from the Chogo Lungma glacier into the Braldu which then forms the Shigar; a large heterogeneous dome of 2M ± Gr orthogneiss with a dominant composition of peraluminous granite having a sub-alkaline affinity, and ferriferous. Some likeness with the Baltoro* granite.

Bauma Harel limestone, Karakoram, **(Hanson, 1989);** from the left bank tributary of the Shigar in which Hanson (1989) describes turitellid gastropod remains of Cretaceous age.

Bilchar north and south tonalite, Kohistan, (this work); after the name of a village (written Bichhar on the base map) and a valley, left bank tributary of the Bagrot river; two lensoid massifs of usually foliated tonalite, biotite and amphibole-bearing with rounded quartz crystals, containing numerous enclaves of dioritic material; similar to Barti* tonalite (Fig. 27E).

Bola Das felsic gneiss and migmatite (Fig. 16A): see **Arendu - Bola Das**

Bolocho orthogneiss, Karakoram, (Lemennicier, 1996); after the name of a glaciated valley, left bank tributary of the Chogo Lungma glacier; a group of lenticular folded levels of heterogeneous Bi, 2M, or Bi-Hb orthogneiss with a dominant composition of metaluminous quartz-monzonite, sub-alkaline, and ferriferous. Some likeness with the Cretaceous Koz Sar alkaline complex of Debon & Khan (1996) (Fig. 40A).

Boram marble, Ladakh, (Zanettin, 1964, and this study); after the name of a small river right bank tributary of the Indus; two large bands of crystalline limestone with a total thickness of 400-500 m.

Bubli Motin porphyritic granite, Karakoram, (this work); after the name of a sharp needle (around 6,000 m, spelled Bubuli Mating by Shaw & Shaw, 1993, and also called Lady Finger by many alpinists) on the crest between Shispar and Ultar glacier; a small rounded pluton of almost undeformed porphyritic granite, similar to several other small plutons (see Baltar*, Toltar*, and Kunyang* porphyritic granites) (Fig. 10).

Bukpun orthogneiss, Karakoram, (Lemennicier, 1996); after the name of a summit (5441 m) of the left bank of the Chogo Lungma glacier; a large and elongated (25×5 km) dome of Bi or Bi-Mu orthogneiss, with a tonalitic to adamellitic composition, mostly cafemic and calc-alkaline, resembling that of the Hunza* granodiorite (Figs. 13B and 15F).

Bunthang sequence, Ladakh, (Cronin et al., 1989); after the name of **a village on the right bank (north) of the Indus, downstream of the confluence with the Shigar**, a late Cenozoic molasse deposit, 1300 m thick, deposited by the Indus upstream from the uplifting NPHM, and only preserved on the right bank of the Indus; age poorly constrained by magneto-stratigraphy between 3.2 and 0.73 Ma.

Chalt volcanics, Kohistan, (Desio, 1964); after the name of a small city at the confluence of the Bola Das and the lower Hunza valleys; a thick formation of basaltic and andesitic submarine lavas with few limestones, of probable Cretaceous age, equivalent to the Turmik volcanics of Ladakh (Fig. 30).

Chogo Lungma limestone group, Karakoram, (this work); after the name of the major Chogo Lungma glacier; a spectacular (in particular near the confluence of the Bolocho glacier) group of limestone levels associated with dark amphibolites, part of the KMC* (Figs. 17A and B).

Chutrun limestone, Karakoram, (Le Fort et al, 1995); after the name of a village of the lower Basha valley; metamorphic unfossiliferous limestone, equivalent to the Matuntore limestone of Desio (**1963a**) and Zanettin (1964).

confluence: see Indus confluence.

Dainyor heterogeneous diorite, Kohistan, (this work); after the name of a village at the confluence of the Hunza with the Gilgit, and the summit (4358 m) between Manu Gah and Bagrot, (the eastern occurrences of the diorite have been called "Shuta gabbro" by Madin et al., 1989); a large complex and heterogeneous pluton made up of diorite to tonalite, intrusive into the Askor* amphibolite and the Gilgit* gneiss, equivalent to the Thhwar* diorite of Ladakh (Fig. 27D).

Dassu orthogneiss, Karakoram, (Desio, 1963a & 1985); after the village of Dassu right bank (north) of the lower Braldu valley; a two-micas ± garnet orthogneiss with a granitic composition, often partly migmatised, very similar petrographically and chemically to the Himalayan Iskere* orthogneiss (Fig. 15C).

Dassu pegmatites, Karakoram, (Middlemiss & Prashad, 1918); after the village of Dassu (spelt **Daso** by Middlemiss), right bank (north) of the lower Braldu valley; a dense set of pegmatitic dykes that have been mined for very long for gem crystals of topaz and aquamarine mainly.

Dasu: see **Dobani-Dasu**

Datocha monzodiorite, Kohistan, (this work); after the name of a village of the middle Bagrot valley; a pluton of monzodiorite with ill defined-limits, probably extending on both sides of the Bagrot valley, and quite similar in location and composition to other small plutons north of the Dobani-Dasu* ultramafic lineament.

Dobani-Dasu ultramafics: Kohistan & Ladakh, (this work); after the name of the Bilchhar Dobani summit (6134 m) between Bagrot and Darchan valleys of Kohistan, and that of the village of Dasu (different of Dassu on the Braldu) in the lower part of the Turmik valley in Ladakh; a discontinuous strip of serpentinised peridotite and pyroxenite traced on both sides of the NPHM, forming the limit between the northern Greenstone complex and the southern Askor* amphibolite and Gilgit-Katchura* gneiss (Fig. 27C).

Dumordo group, Karakoram, (Desio, 1963a); after the name of a right bank tributary of the Braldu river; a group of varied metasedimentary rocks including limestone and marble, calcschist, Gr and or Ky micaschists, plagioclasic biotitic and amphibolitic gneiss (Desio, 1963a); partly equivalent to the KMC*.

Ganchen Complex, Karakoram, (Desio, 1963a), after the name of the main summit (**9999m**) between the Basha and Braldu valleys; poorly defined group of formations dominantly orthogneissic but also including calcareous and schist metasediments; partly equivalent to our **Zil* gneiss**.

Ganto La group, Ladakh, (Desio, 1963a); after the name of the main pass between the Turmik and Basha valleys; "two thick layers of limestone separated by a prasinitic amphibolite" respectively called "Munbluk limestone, Blanzgo formation, and Matuntore limestone"(ibid); it is part of our Shyok* suture zone (MKT* zone).

Gilgit granite, Kohistan, (Petterson & Windley, 1985); left (north) bank of the Gilgit river opposite the town of Gilgit; a small leuco-adamellite undeformed pluton dated at 54 ± 4 Ma.

Gilgit-Katchura gneiss, Kohistan & Ladakh, (Khan, 1994 for Gilgit; Desio, 1963a and Tahirkheli, 1982 for Katchura); after the names of the town of Gilgit in Kohistan, and the village and bridge of Katchura (called Katzarah by Desio, Tahirkheli, and Hanson) along the Indus river; downstream of Skardu; aluminous paragneiss of kyanite to sillimanite grade often migmatised; also named Salkhala by Wadia (1932).

Goyungo gneiss, Karakoram, (this work); after the name of a small hamlet of the lower Braldu valley; augen gneiss with large K-feldspars ± garnet ± retrograded kyanite, in the core of the Dassu dome.

Greenstone complex, Ladakh & Kohistan, (Ivanac et al., 1956; Staufer, 1975); an heterogeneous sequence of volcanic and volcano-sedimentary formations with predominant greenish hue; age likely to be Cretaceous, or Jurassic-Cretaceous by comparison with the Dras volcanics of eastern Ladakh.

Hachindar granite (this work); a small granite pluton (after the name of a summer pasture of the left bank of the Hachindar valley).

Hapakund conglomerate, northern suture, (this work); after the name of a summer pasture of the left bank of the Minapin glacier; polygenic volcano-sedimentary conglomerate and breccia.

Haramosh schist, Himalaya, (Madin, 1986); after the name of the highest (7406 m) peak of the NPHM on the right bank (north) of the Indus; "a medium- to coarse-grained amphibolite-grade biotite schist and gneiss, with marble, calc-silicate gneiss, and subordinate amphibolite" of supposed Precambrian age (Madin et al., 1989); for us, part of the Stak La paragneiss formation.

Hasanabad granite, Karakoram, (this work); after the name of a valley, right bank tributary to the Hunza, downstream from Aliabad; a lenticular slab of two-micas ± garnet granite intrusive into the Karakoram metamorphic complex* (named Aliabad by Searle, 1991).

Hemasil syenite, Karakoram, (Le Fort et al., 1995); after the name of a village on the right bank (west) of the Basha valley, a small pluton (some 10 km^2) of syenite with Bi-Sph±Amf±CPx, intrusive into the Chutrun limestone, and having an outer rim of amphibolite and Bi-gneiss; deformation only occurs towards the edge of the pluton; one hornblende and two biotites have yielded cooling ages between 7.7 and 3.0 Ma (Villa et al., 1996a).

Hindi granodioritic band, Karakoram, (this work); after the name of a big village (also called Nasirabad) on the right-bank of the middle Hunza valley; a kilometre-thick slab of granodioritic material extending for more than 30 km from the Bar to the Hunza valleys and likely to extend discontinuously further east, probably representing a south-vergent isoclinally folded part of the Hunza* granodiorite.

Hispar Sar limestone group, Karakoram, (this work); after the name of a summit (circa 6400 m) on the right bank of the Hispar glacier; a group of folded limestone and marble beds, part of the KMC*, and lying south or within the central batholith.

Hundur conglomerate, Karakoram, (Le Fort & Gaetani, 1998); after the name of a village on the left-bank of the Darkot-Yasin valley; a polygenic sedimentary conglomerate located south of the southern branch of the central Karakoram batholith, resembling the Reshun one, and containing fossiliferous pebbles of Early Permian age.

Hunza granodiorite, or **Hunza plutonic unit**, Karakoram, (Le Fort, 1983; Debon et al., 1987); middle Hunza valley, large (>300×12 km) pluton dominantly made up of deformed medium-grained granodiorite containing Bi-Hb ± Cpx, calc-alkaline, dated by U-Pb on Zr at 95 +4/-6 Ma (Fig. 11).

Indus confluence acid dykes, Kohistan, (Petterson & Windley, 1985); from the confluence of the Gilgit and Indus rivers; a dense network of acid dykes, aplitic to pegmatitic, intrusive into the Dainyor diorite and Gilgit gneiss, dated at 34±14 Ma by Rb-Sr errorchron (Fig. 29).

Indus-Tsangpo suture, Ladakh-Himalaya, (Gansser, 1966, 1977); tectonized mélange zone at the northern boundary of the Indo-Pakistani continental mass.

Iskere orthogneiss, Himalaya, (Madin et al., 1989); after the name of a village of the valley to the NE of Haramosh; granitic orthogneiss with early Proterozoic (1850 Ma) U-Pb age on zircon (Zeitler et al., 1989) (Fig. 36D).

ITS: see **Indus-Tsangpo**

Joring quartz diorite, Kohistan, (this work); after the name of a summer pasture on the left bank of the Jaglot valley; a small pluton of quartz diorite only known from the boulders collected on both sides of the crest; a similar body of granitoid rock lies on the right bank slope of the Hunza, opposite to the Joring one.

Jutal dykes, Kohistan, (Petterson & Windley, 1991); after the name of a village on the left (east) bank of the lower Hunza valley; basaltic dykes intruding Nomal* leucotrondjhemite and Dainyor* diorite, and dated at 75 Ma.

Jutial granite: see **Phuparash granite**

Karakoram batholith, Karakoram, (Ivanac et al., 1956, who also call it Karakoram granodiorite); also named Karakoram axial batholith or Karakoram **central batholith** (this study); designates the long belt of granitoid rocks lying between the northern sedimentary belt and the Karakoram metamorphic complex*, and extending from Mastuj to northern Kashmir.

Karakoram metamorphic complex (KMC), Karakoram, (Desio et al., 1964); groups all the metamorphic formations from Karakoram lying south of the central batholith. For Desio et al. (1964), it included mainly the Ganchen* paragneiss, the Dumordo* metasedimentary formation, and a number of orthogneiss bodies; for us, the distinction between Dumordo* and Ganchen* is arbitrary; we only differentiate limestone formations within the KMC (Chutrun*, Bolocho*, etc), the numerous domes and massifs of orthogneiss being separate entities (Fig. 13).

Karakoram thrust: see **SKT**

Katchura gneiss and **Katzarah gneiss**: see Gilgit-Katchura gneiss.

Khaltaro emerald deposit, at the contact of Himalaya with Kohistan, (Kazmi et al., 1989); after the name of a village and valley north of the Indus; in pegmatites issued from the Phuparash granite, the only gem emeralds of Pakistan confined to pegmatitic dykes.

Khusomik schists, Karakoram, (this work), sequence of schists with intercalations of limestone and arenite outcropping to the south-east of the map, in the higher valleys of Skoro and Bauma Harel.

Kunyang porphyritic granite, Karakoram, (Pêcher); after the name of a major glacier, right bank tributary to the Hispar glacier; a rounded shape pluton of little deformed porphyritic granite, intrusive into the Hunza granodiorite, similar to several other small plutons (see Baltar*, Toltar*, and Bubli Motin* porphyritic granites).

Lady Finger, see **Bubli Motin**

Liachar thrust, see **Raikot fault**

Main Karakoram Thrust, contact of Karakoram with Ladakh-Kohistan; in Ladakh, often used a synonym of the **Shyok suture zone** or the northern suture zone; already partly recognised by Casnedi (1976) as the neo-tectonic Shigar Line (Fig. 25).

Main Mantle Thrust, MMT, contact of Himalaya with Kohistan (and Ladakh), (Tahirkheli et al., 1976 and 1979); the tectonic contact of Kohistan over the northern margin of the Indian shield; "a term which emphasises both its characteristics, and its similarity to the other two major overthrusts of the Himalayan belt further east - MCT and MBT"; in Ladakh, often used as equivalent to the Indus-Tsangpo* suture zone (ITS) (Fig. 44).

Mango Gusar granite, Karakoram, (Rex et al., 1988); after the name of a summit (6288 m) of the Shigar-Braldu crest just east of our map; a poorly known granite that, according to Searle (1991), would be made up of medium-grained Bi-Mu undeformed granite-leucogranite; Parrish has obtained a U-Pb Zr age of 37.0 ± .8 Ma.

Mangol Bluk orthogneiss, see **Basha** (Figs.15A and E).

Marshakala plutonic complex, Ladakh, (Hanson, 1986; this work); after the summit (5153 m) above the Shigar-Indus confluence; a large (25×5 km) plutonic complex making most of the right bank of the Shigar valley, made up of diorite to quartz-monzodiorite, often foliated, and intrusive into the Katchura* gneiss; includes the Chundupon gabbrodiorite of Desio (1963a).

Masherbrum greenstone complex, Karakoram, (Picard et al., 1998, Rolland et al., 2001c), east of the map. A dismembered ophiolitic series formed by slices of metagabbros and metabasalts separated by ultramafic lenses. It is a kilometre thick sequence, best preserved on the SW side of the Masherbrum glacier at elevations from 3900 to 6000 metres. In the northwest prolongation, the Askole amphibolites could be an highly metamorphozed equivalent.

Matum Das: see **Nomal**

Matuntore limestone, Karakoram, (Desio, 1963a), see **Chutrun**

Miar conglomerate, MKT zone (northern suture), (this work); after the tributary glacier to the Barpu glacier of the Hunza watershed; polygenic metasedimentary conglomerate rich in limestone pebbles, metamorphosed in the greenschist facies (Figs.23A and B).

MMT, see **Main Mantle Thrust**

Nagar leucogranite, Karakoram, (Searle, 1991); after the name of a major village on the left bank of the Hispar valley; a small slab of two-micas leuco-adamellite, cut by the Hispar river, with Gr-T-Be, and intrusive into the Karakoram metamorphic complex.

Niamur quartz-diorite, Ladakh, (this work); after the name of a valley and glacier, right bank tributary to the Chogo Lungma glacier; plutonic body of unknown extension, squeezed along the Haramosh gneisses, and made up of foliated Hb-Bi quartz-diorite.

Nomal leucotrondjhemite, Kohistan, (Debon et al., 1987); after the village on the right (west) bank of the lower Hunza valley; deformed pluton made up of leuco-trondjhemite and leuco-tonalite, dated by WR Rb-Sr at 102 ± 12 Ma with an initial Sr ratio of 0.7039 by Petterson & Windley (1982, who call it Matum Das, after the former name of a village located upstream of the pluton, on the left bank of the Hunza river), and at 109 ± 4 Ma with an initial Sr ratio of 0.7044 by Debon et al. (1987) (Fig. 27F).

Pakora limestone, Ladakh, (Le Fort et al., 1995); from the name of a summer settlement and valley, left bank tributary to the Turmik river; a remarkably continuous limestone formation, up to 1 km thick, with black marly horizons, in which shell remains of rudists suggest a (Lower?) Cretaceous age (Le Fort et al., 1995), equivalent to the Munbluk saccharoidal and marly limestone of Desio (1963a) (Fig. 34).

Pakora conglomerate, Ladakh, (this work); from the name of a valley, located on the Tisar side of the Ganto La (not to be mistaken with the Pakora summer pasture, Turmik side of the Ganto La, where the Pakora limestone has been defined).A large (2 by 6 km) conglomeratic lense, forming with the Pakora limestone the Tisar peak.

Parri acid dykes, Kohistan, (Petterson & Windley, 1985); after the name of a village along the Karakoram highway on the right bank of the Gilgit river; a dense network of acid dykes, aplitic to pegmatitic, intrusive into the Dainyor diorite, dated at 29±8 Ma, and (George et al., 1993) 26.2±1.2 Ma, by Rb-Sr errorchron with an initial Sr ratio of 0.7054

Phuparash granite, Himalaya, (this work); also called Jutial granite (Butler et al., 1992), from the name of a right bank tributary of the Indus; an 8×3 km elongated heterogeneous pluton made up of biotite granite and/or two-micas ± tourmaline coarser-grained leucogranite (adamellite), dated at 10 Ma by U-Pb on Zr and 5.3 Ma by Th-Pb on monazite (Schneider et al., 1997).

Polan La serpentine, northern suture, (this work); after the high pass (5840 m) between Chogo Lungma and Barpu glaciers; a tectonic lineament underlined by pods of serpentine and altered ultramafics between the Miar* meta-sedimentary conglomerate and the Tagafari* meta-volcanic conglomerate and breccia of the northern suture (MKT zone).

Raikot fault, Himalaya-Kohistan contact, (Lawrence & Ghauri, 1983); after the name of a small village on the left bank of the Indus valley; an active fault at least 50 km long, running along the western margin of the NPHM; differential movement reaches 7 mm/a (Zeitler, 1985; Zeitler et al., 1989); partly corresponding to the West Haramosh Fault of Casnedi (1976); named **Liachar thrust** (Butler and Prior,1988) by some authors.

Range Blok orthogneiss, Himalaya, (this work); after the name of a pasture on the promontory at the confluence between the upper Stak (also called Lecho Nala) and Goropha valleys; a relatively small homogeneous mass of augen gneiss intrusive into the Stak La* paragneiss, and resembling the Himalayan Cambro-Ordovician granites (Fig. 36C).

Rash Phari (orthogneiss), Karakoram, (this work), after the name of the lake and summit (5044 m) on the right bank of the Barpu glcier; small lenticular mass of orthogneiss whith a composition akin to that of the Hunza* granodiorite (Fig. 15G).

Remendok granodiorite, Ladakh, (this work); after the name of a valley and glacier, right bank tributary to the Chogo Lungma glacier; a small granodiorite body outcropping on the left bank of the Remendok glacier, and resembling very much to the Karakoram Hunza* granodiorite.

Remendok leuco-trondjhemite, Himalaya-Ladakh, (Le Fort et al., 1995); after the name of a valley and glacier, right bank tributary to the Chogo Lungma glacier; a small elongated (4×1 km) body of leuco-trondjhemite, intruding the rocks of the Ladakh island arc as well as the Himalayan gneisses on the right bank of the Remendok glacier; two muscovites give ^{40}Ar-^{39}Ar ages of 8.2 and > 9 Ma (Villa et al., 1996a) (Fig. 28).

Salkhala, Kohistan-Ladakh, (Wadia, 1932); see **Gilgit-Katchura**

Satpara tonalite and granite, Ladakh, after the name of a lake 7 km south of Skardu (outside the map); a plutonic body of unknown extension out of the map, made up of undeformed tonalite to granodiorite, and granite, and intrusive into the Katchura* gneiss to the north, and into volcano-sedimentary formations to the south.

Shengus gneiss, see **Stak-La** gneiss

Shengus pegmatites, Himalaya, (Kazmi et al., 1985); after the name of the big village in the Indus gorge (written Shingus by Kazmi et al., 1985); a large network of pegmatites particularly rich in gemstones that include aquamarine, topaz, tourmaline, and garnet.

Shigar plutonic complex, Ladakh, (Shigar group, Desio, 1963a); after the name of a major tributary to the Indus, opposite Skardu; a 35×5 km plutonic complex poorly documented, associating gabbro-dioritic to monzodioritic bodies of the Marshakala* and Strongdokmo La* type, with tonalitic ones of the Tisar* type.

Shiskhat linéament, Karakoram, (this work); after the name of a locality of the Hunza valley (KKH bridge); steep band underlined by intensely deformed marbles that separate the two facies of the Hunza* granodiorite in the entire western portion of the map (Fig. 11A); has probably reworked during the ductile deformation of the granodiorite with a large strike-slip component.

Shispar granite, Karakoram, (this work); after the name of a peak (7,611 m) and glacier flowing into the Hasanabad valley; a Bi-Amf granite apparently forming most of the Shispar SW face, but only known and sampled from morainic boulders.

Shittinbar, Karakoram, (this work); after the name of a glacier and valley tributary to the Bola Das at Budelas; a rather monotonous terrigeneous formation of dominant sandy and pelitic alternances (Fig. 19A).

Shuta (gabbro): see **Dainyor**

Shyok suture: the suture between Kohistan-Ladak and Karakoram, recently reactivated along the **Main Karakoram Thrust**.

Sinakkar volcano-sedimentary formation, Kohistan, (this work); after the name of a right-bank village of the Bagrot valley; thin band fringing to the south the Dobani* ultramafics, the Chalt formation, and the N Barti and Nomal

plutons, made up of very varied lithologies (arenite, quartzite, microconglomerate, schists, marbles, amphibolite and sulfide masses); resembles the Turmik* formation.

Skardu sequence, Ladakh, (Cronin et al, 1989), after the name of the capital of Baltistan; a glacio-lacustrine sequence of rocks deposited east of the Skardu Rock.

Skoyo tonalite, Ladakh, (Skoyo gneiss, Desio, 1963a); after the name of a village on the right (north) bank of the Indus river; a large pluton made up of foliated tonalite intrusive into the Askor* amphibolite and Thowar* diorite.

SKT or SKF, South Karakoram Thrust or South Karakoram Fault, Karakoram-Kohistan-Ladakh, (Le Fort and Pêcher, 1995) also called Drosh fault by Desio (1979); the recent tectonic line following the Karakoram - LKIA ill defined boundary; often too schematically considered to be the actual southern boundary of Karakoram.

Stak La paragneiss, Himalaya, (this study) (equivalent to the Shengus* gneiss of Madin, but Shengus locality is entirely located in the orthogneiss of Iskere*; also partly equivalent to the Stak migmatite of Desio, 1963a); after the name of the Stak La (pass) leading from Stak to the Turmik valley ; composed of dominant two-mica peraluminous gneiss with subordinate layers of amphibolite, quartzite, calc-silicate gneiss, and marble, and presenting abundant intercalations of orthogneiss, usually clear-coloured; contact with Iskere* orthogneiss is probably complex and folded; kyanite-grade metamorphism has overprinted a former high-pressure granulite facies metamorphism still present as relictual assemblage in mafic crosscutting dykes (Fig. 37).

Stak Nala pegmatites, Himalaya, (Kazmi & O'Donoghue, 1990); after the name of the right bank tributary of the Indus; a set of pegmatites mined for their gems, particularly colour-zoned tourmalines and aquamarine.

Strongdokmo La plutonic complex, Ladakh, (Hanson, 1986); after the name of a small pass opening the way to the Shigar valley on its left (east) bank; a small heterogeneous plutonic complex made up of rocks ranging from gabbrodiorite through tonalite, to granodiorite-adamellite, magnesian, with a sub-alkaline affinity.

Sumayar granite, Karakoram, (Crawford & Searle, 1992); after the name of a valley, left bank tributary to the Hunza opposite of Karimabad; a small elliptical pluton (some 10 km^2) of two-micas leuco-adamellite with Gr-T-Be, intrusive into the Karakoram metamorphic complex with a metamorphic contact aureole; dated at 9.2 ± 0.2 Ma by U-Pb on Zr and uraninite, and 8.55 ± 0.15 Ma by U-Pb on xenotime (Fraser et al., 1998).

Tagafari limestone, MKT zone, (this work); after the summer upper settlement on the left (west) bank of the Minapin glacier; a hundred metres thick metamorphic limestone in the vicinity of the southern boundary of the MKT zone, intercalated within greenstone rocks, that can be followed eastward for some 35 km.

Thhwar heterogeneous diorite, Ladakh, (Desio, 1963a); after the name of a village and a small tributary of the Indus on its right bank (also written Thowar on the 1:50,000 topo sheet, and Twar by Desio and Zanettin); a large complex pluton made up of diorite to tonalite, equivalent to the Dainyor* heterogeneous diorite of Kohistan.

Tisar tonalite, Ladakh, (Desio, 1963a); after the name of a village on the right (west) bank of the lower Basha valley; the name, sanctioned by use, is a poor choice for the plutonic body as Tisar village is not in the pluton, nor in Ladakh, but north of the MKT, in a thick marble horizon of the KMC* (the Chutrun* limestone).

Toltar porphyritic granite, Karakoram, (this work); after the name of a summer settlement at the confluence of the Kukuar and Baltar glacial valleys; small circular pluton of little deformed porphyritic granite intrusive into the Karakoram metasedimentary formations as well as in the Bola Das* migmatitic gneiss (cf Baltar*, Bubli Motin*, Kunyang* porphyritic granites).

SE Trivor porphyritic adamellite, Karakoram, (Debon, 1995); see **Kunyang**.

Turmik formation, Ladakh, (Desio, 1963a); after the name of a major right bank tributary to the Indus; a thick formation of basaltic and andesitic submarine lavas, with abundant volcano-sedimentary conglomerates and detrital rocks, arenaceous shales, and some marble horizons, of probable Cretaceous age; an equivalent of the Dras volcanics further east in Ladakh, and of the Chalt* volcanics of Kohistan.

Ultar granodioritic band, Karakoram, (this work); after the name of a right-bank glacial tributary to the Hunza river; a kilometre-thick slab of granodioritic material extending for some 20 km from Hunza valley to the uppermost Muchiohul (Muchuhar) glacier where it probably joins directly with the Hunza granodiorite, probably representing a limb of a south-vergent isoclinally folded part of the Hunza granodiorite; see also Hindi* granodioritic band.

Yasin group, Kohistan and Ladakh, northern suture zone, (Ivanac et al., 1956); after the name of the big village on the right bank of the Yasin valley, on the northern edge of the Kohistan island arc; assemblage of Lower Cretaceous sedimentary formations and volcano-clastic rocks, overlying the Greenstone* complex with a marked unconformity.

Zil gneiss, Karakoram, (this work); after the name of the big village on the left bank of the Basha valley; dominant orthogneiss with decimetric to hectometric intercalations of high-grade, sometimes migmatitic, biotite and amphibole-rich paragneiss, partially equivalent to the Ganchen* Complex of Desio (1964) and Desio et al.(1985), but with a much smaller extension (Fig. 16B).

ANNEXURE 6 - LIST OF THE PLACES REFERED TO IN THE MAP EXPLANATORY NOTES

Annexe 6 - Liste des noms cités dans la notice explicative de la carte

All names on the map are listed in the 3 tables and appear in the attached sketch map. Their locations can be found using the alphanumeric grid (e.g. Arelter is in the rectangle E4). G: glacier, L: lake, P : pass, R: river or stream, S: summit, V: summary settlement, village or town.

Tous les noms de la carte géologique sont donnés dans les 3 tableaux et apparaissent dans la carte jointe. On peut retrouver leur position en utilisant la grille alphanumérique (par exemple, Arelter doit être cherché dans le rectangle E4). G: glacier, L: lac, P: col, R: rivière ou torrent, S: sommet, V; alpage, village ou ville.

Annex 6 - Names of the map (table 1)

		G	L	P	R	S	V	
Alchori	F5						V	
Arelter	E4				R			
Arendu	E4						V	
Arincho	D4				R			Aren Cho
Askobar	D5				R			
Askor	D5				R			
B21 peak	E5						S	*(pt. 5828m)*
Bagrot Gah	B3-A4				R			
Baintha	G4						V	
Baltar	A2	G					V	
Baltit	B2						V	
Baltoro		G						*East of the map*
Bar	A2						V	
Baroluma	C4-C5				R			
Barpu	C3						V	
Barpu Giram	C3						V	
Bartar	A3				R			
Barti	A3						V	
Basha	E4-E5				R			
Batura	B1					S		
Bauma Harel	G6						V	
Bauma Harel	G6-F6				R			
Bayicha	E5						V	
Berelter	E4				R			
Bialo	F3-G5	G						
Bilchar	B4				R		V	
Bilchar Dobani	B4					S		
Bisil	E4						V	
Bola Das	A2				R			
Bolocho	D3-D4	G						
Boram	E5				R			
Bragzago	E5				R			
Braldu	G5-E5				R			
Bualtar	B3-C3	G						
Bubli Motin	B2					S		Lady Finger
Budelas	A2						V	
Bukpun	E4					S		
Bulche	B3						V	
Burimis	D4				R			
Burtswa	E4						V	Omba Tsok
Chalt	A2						V	
Chaunpisha	G4					S		
Chogo Lungma	C3-E4	G						
Chukutens	B3						V	
Chutrun	E5						V	
Dambudas	D5						V	
Darchan	B4						V	
Dassu	F5						V	
Dasu	E5						V	
Datocha	B4						V	
Daynior	A4					S	V	Daniyor
Distaghil						S		*(North of E3)*
Dobani	B4					S		Bilchar Dobani
Doko	E4						V	
Dongbar	G4					S		
Ganchen	E4					S		
Ganto La	E5			P				
Garesh	A3						V	
Gasherbrum						S		*(East of the map)*
Ghammesar	C2						V	

Annex 6 - Names of the map (table 2)

		G	L	P	R	S	V	
Gharesa	C2	G						
Gilgit	A4						V	
Gilgit	A4-B4				R			
Gontsar	D5				R			Matumbar Nala
Goropha	D4	G						
Goyungo	F5						V	
Gulmit	C2	G						
Gutumi	B4-B3	G						
Hachindar	B2						V	
Hapakund	B3						V	
Haramosh	C4					S		
Hasanabad	C2				R			
Hemasil	E5						V	
Hindi	B2						V	
Hispar	C3						V	
Hispar	F3-D3	G						
Hispar sar	E3					S		
Hoh Luba	F4-F5				R			
Hunza	C2-A4				R			
Indus	G6-C5				R			
Iskere	C4						V	
Jaglot							V	*(Indus valley, South of B5)*
Jaglot	A3						V	Jaglot Gur
Joring	A3						V	
Jutal	A3						V	
Jutial	C4						V	
Jutmaru	E2	G						Yutmaru
Kanibasar	E2	G						Khani Basa
Karpochi	F6						V	Karfachu, Karpochu
Katch Bore La	E5			P				
Kero Lungma	D3-E4	G						
Kero Lungma	E4				R			
Khaltaro	B4						V	
Khanegao	B3				R			
Khomara	E5				R			
Khusomik	East to G5						V	
Kilwuri Gans	D4	G						
Kothia	C4-D4	G						
Kunyang	D2-D3	G						
Kunyang Kish	D2					S		Kunyang Chhish
Kurumal	D4						V	
Lady Finger	B2					S		Bubli Motin
Mala Kha	D5				R			
Malubiting	C4					S		
Mangol Bluk	E4					S		
Manu Gah	A3-A4				R			Dyor
Markoi	A3						V	
Marpoh	D4	G						
Marshakala	F6					S		
Maruk Gah	B4				R			
Matumbar	D5				R			Gontsar
Mayon	A2				R			
Minapin	B3	G					V	
Moraine	D3	G						
Muchiohul	B2	G						Muchuhar
N Barti	A3						V	
Nagir	C2						V	Nagar
Namla	G5						V	
Niamur	D4	G						
Niamur	E4						V	

Annex 6 - Names of the map (table 3)

		G	L	P	R	S	V	
Niesolo	E4						V	
Nomal	A3						V	
Pakora	E5						V	
Parri	B4						V	
Pekher	B3					S		
Phuparash	C3	G						
Phuparash	C4				R			
Pisan	B3	G						
Polan La	C3			P				
Pumari Kish	E3					S		Pumari Chhish
Rahimabad	A3						V	
Rakaposhi	A3					S		
Rakhan gali	B4			P				
Range Blok	D4						V	
Rash Lake	C3		L					
Remendok	D4	G					V	
Rondu	D5						V	
Sai Nala					R			*(West of B4)*
Sangemar	B2					S		
Sassi	B4						V	
Satpara			L					*(South of Skardu)*
Serac	C3-D3	G						
Sharain Gali	B4			P				
Shigar	F6						V	
Shigar	F5-F6				R			
Shishkat	C2						V	
Shiskin	C3						V	
Shittinbar	A2				R		-	
Shumar Bakar	B3						V	
Sim Gang	F3-F4	G						
Sinakkar	B4						V	
Skardu	F6						V	Skardou
Skoro	G5-F6				R			
Skoro La	G5			P				
Skoyo	E5						V	
Slikiang	B3	G						Silkiang
Snow Lake	F3-F4	G						
Solu	E4	G						
Stak	D4-D5				R			
Stak La	D5			P				
Strongdokmo La	F6			P				
Sumayar	B3-B2				R			
Sumayar	C3	G						
Sumayar	D3					S		
Tagafari	B3						V	
Tashot	B2						V	
Thalle					R			*(East of the map)*
Thhwar	D5						V	Thhwar, Twar, Thowar
Tipur	E4	G						
Tisar	E5						V	
Toltar	A1	G						
Toltar	A2						V	
Trivor	D2					S		
Tungas	E5						V	
Turmik	D4-E5				R			
Ultar	B2						V	
Yuna	B3	G						
Yuna	B3	G						
Zil	E4						V	

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