

in uneven and patchy extinction of quartz grains. Feldspar grains commonly show the beginnings of core and mantle texture. "Cores" are large (strong) porphyroclastic feldspar grains, possibly microfractured, while the "mantle" (also termed "mortar") is composed of relatively finer grains of (typically) feldspar. The finer grained feldspar mortar is derived from the porphyroclastic feldspar grains and has separated largely through grain boundary migration recrystallisation in attempts to recover from dislocation tangles (these can be reduced through dislocation climb only at higher temperature;  $>400^{\circ}\text{C}$ ). Between approximately  $400\text{-}600^{\circ}\text{C}$ , diffusion assisted-dislocation processes in quartz are more prevalent and extensive quartz subgrain development and subgrain rotation recrystallisation operates. Passive flattening of quartz grains passes to wholesale recrystallisation at higher strains and leads to very continuous monomineralic ribbons of quartz. Feldspar grains develop extensive augen/mantled porphyroclasts with finer grained feldspar also forming ribbons. Above about  $600^{\circ}\text{C}$ , quartz and feldspar show somewhat similar textures; grain boundaries may be cusped/lobate, and diffusion creep processes (Nabarro-Herring, or "volume diffusion" and Coble, or "boundary diffusion") are thought to play a major role. Such finely-grained microtextures (e.g.,  $20\text{-}40\mu\text{m}$ ) were not observed, however, in any of the thin sections examined from NPHM.

### 5.9.3. Samples and thin sections from Nanga Parbat

#### *5.9.3.1 Samples from Nanga Parbat*

All samples that I collected in Nanga Parbat are detailed in three tables (5.2, 5.3, and 5.4) for 1995, 1996, and 1997, respectively. Nomenclature is straightforward: In 1995, NE95/27-V indicates 1995, 27th (of August), 5th sample collected since beginning of day. NE95/8-V indicates 1995, 8th (of September), 5th sample collected since beginning of day. In 1996 and 1997, a longer field season necessitated using a term for the month; E6/10/10-I indicates 1996, 10th (of October), 1st sample

collected since beginning of day. E7/9/14-IV indicates 1997, 14th of September, 4th sample collected since beginning of day. Where a thin section accompanies a sample, it is listed directly below the sample name, preceded by the batch number in bold. For example, NE95/26-V **T/S1** 5/26E indicates batch number 1. All thin section names are simple versions of the field name, truncated for chip labelling procedures.

Most samples remain housed in the Albany Geology Department archives. Some samples have been given away or consumed in other labs however. These are detailed with the recipient's initials and these are included in table 5.5 - Abbreviations used in other tables.

A description of simple lithology, location and an outcrop number (or distance to a nearby outcrop number) are given (outcrop numbers also appear on the map (plate 2) and in the text). Where appropriate, elementary remarks relating to structure are made for samples that have not been thin sectioned. GPS location numbers are provided for 1996, where they exist).

#### *5.9.3.2 Thin sections from Nanga Parbat*

Approximately 75 thin sections were prepared from chips cut by me. Where the sample bears marks to allow restoration of field orientation, the chip is accordingly marked to preserve record of the orientation. Preservation in the thin section of the original sample orientation from the field is essential for sense of shear analyses. Thin sections accordingly are prepared from samples oriented in the field and subsequently cut parallel with mineral lineation, perpendicular to main foliation (see section 5.9.1 sense of shear analysis and (e.g.) figs 5.9 and 10.1 in Passchier and Trouw, 1996). A cut is made in the upper (with respect to original field orientation) part of the sample and either the top left or the top right will point towards the plunging lineation. For example, from a 45°W dipping foliation, with 30°S plunging lineation, the top left cut in the thin section will point towards 30°S perpendicular to

the 45°W dipping plane. Alternatively, if the lineation was 30°N plunging on the same plane, the cut will be in the top right of the thin section and will point towards 30°N, again perpendicular to the 45°W dipping plane.

There are two situations where the scheme must be modified:

1. In cases where foliation is near or actually vertical, there is no "upper" part of the sample (with respect to original field orientation), and I have employed a scheme I term the "overhead rule"; whereby the top of the right hand edge (TR) of the chip must point with the lineation plunge direction when the sample is viewed overhead in original outcrop orientation. This scheme cannot be used in the unique situation where foliation is truly vertical and lineation is truly horizontal, but this was not encountered.
2. In cases where the lineation is horizontal, the top of the right hand edge (TR) of the chip is kept as upper surface with respect to original dip in field (because cut is always perpendicular to foliation). This scheme cannot be used in the unique situation where foliation and lineation are both truly horizontal, but this was not encountered. Three tables of thin sections are included. Each of the tables details a particular post-field season batch of thin sections, and in this way is suited to be used in conjunction with the box(es) containing a particular batch. Therefore, samples from 1995 appear in all three lists, samples from 1996 appear in two lists, and samples from 1997 appear in only one list. Batches are numbered **T/S1**, **T/S2**, and **T/S3**. Thin section names are a simple form of the parent sample name (with equivalents listed in the samples tables). For example NE95/12-XII is abbreviated to 5/12L. E6/10/10-I is abbreviated to 610/10A. E7/9/14-IV is abbreviated to 79/14D. Note that NE95/8-XV is abbreviated to 5/8P (the letter P, obviously, has the 16th position in the alphabet but "O" was omitted for clarity).

All thin sections remain housed in the Albany Geology Department archives. None have been given away.

In the thin sections tables, information from the samples tables is duplicated, and additional general microstructural notes are made for thin sections that are of interest to the specific investigations in this thesis.

Table 5.2

Sample Name	Lithology	location /outcrop no	Foln / Lin	comments
<b>Table 5.2 Samples collected in Nanga Parbat, Pakistan during 1995.</b>				
August Astor to Lower Rupal (1995) samples (T/S = Thin section prev. cut, 1=1st batch, 2=2nd batch, 3=3rd batch)				
26/8/95 (Astor Gorge)				
NE95/26-I	brown weath bt-sch w/ conc. felsic lenses	#A74	040/50W (underside marked)	
T/S2 5/26A			030/40W	
NE95/26-II	brown weath grey bt-sch (f'spar poor)	near #A74	E on vert face marked	
NE95/26-III	<1mm bt in migmatitic gn altered cord. appearance	near #A75	040/55W	
NE95/26-IV	"bt-f'spar gn" migmatitic musc, bt gn (good l'some)	do	N/O	
NE95/26-V	cren bt sch w/ minor Qtz? augen	50m above #A75 on climb to Doian	175/75W	
T/S1 5/26E	poss. filled holes			
27/8/95 (Astor Gorge)				
NE95/27-I	fine bt gn (some L fabric)	#A3	N/O	
NE-95/27-II	bt-sch. =sphene(!) in th. sec.	~50m E of #A3	020/40W 30@340	
T/S1 5/27B				
NE-95/27-III	fine banded amph sch, with occ. augen. =gnt (<mm)	#8, few km B4 Astor village (Ladakh)	140/60E	
T/S1 5/27C				
NE95/27-IV	"dotted" amph. f'spar gn	3 km S of #8	N/O	
NE-95/27-V	ladakh, amph. gn.	before Astor village	N/O	
T/S1 5/27E				
28/8/95 (Lwr Rupal)				
NE95/28-I	"bt-f'sp gn" (asymm. aug. gn, of R.C.S.Z.)	#9 Tarshing hillside (W of Churit F.)	005/80W	
T/S2 5/28A				
NE-95/28-II	"more banded"	#9 Tarshing hillside	005/85W 20@170	!th/sec check hand spec sugg. dext!
T/S1 5/28B	asymm f'par augen in grey gn.		use O/H TR rule	
NE95/28-III	"v. gnt rich Bt-gn. !!! gnt-pelitic sch. (=amph.)greenish, weak	#9A	010/89W	

Table 5.2 Samples collected in Nanga Parbat, Pakistan during 1995

Table 5.2 (cont.)

NE95/28-IV	thick brown-weath Qtzof bands in S>>L bt-gn	100m on (E).	010/80E W is marked
NE95/28-V	clear, c'bite crylline layers in sch.	#10 (beyond gully)	020/85W
NE95/28-VI	cse. crylline, white, marble	do	020/60W
NE95/28-VII	lge ~7 mm gnt metaP	5m on (E)	010/60W & sub horiz lin
NE95/28-VIII	black gnt amph. gn	10m E, nr. travertine	010/85W
NE95/28-IX	metaP (few gnts)	#11 Churit School	170/85W 18@170
NE95/28-X	metaP (cse gnts)	#11 Churit School	170/85W 18@170
T/S3' 5/28J	do	50m from #10 (not 11!)	use O/H TR rule ~N-S/~50-70W lin gentle to N
NE95/28-XI	do		
T/S3' 5/28K	do		
29/8/95 (Lwr Rupal)	flattened (L3isW-E) v. felsic, prev. migmatitic bt.gn	300m from #10	020/80E 29@022
NE95/29-I	streaked felsic "L" tectonite	#12	005/89E 10@005
T/S2 5/29A	"junior" stretched f'par gn	E of #12	020/40W 20(N)
NE95/29-II	do	do	180/70W 10@359
T/S2 5/29B	do		
NE95/29-III	metaP (cse gnts)	lowest outcrop in centre if Churit re-ent.	010/85E 32@010 use O/H TR rule
NE95/29-IV	amph-sch w/ protolith banding (probably) nr gnt metaP section	#13 cliff overhang below Churit school	010/80W 20@005 E is underside
T/S2 5/29C	amph	#13	N/O
NE95/29-V	do	#14	010/85W
NE95/29-VI	postkinematic amph needles in amph. gn (Assifs mylonite)	do	020/85W
T/S1 5/29F	felsic-granitic orthogneiss	nearby #14	015/60W 41@355
NE95/29-VII	do		
NE95/29-VIII	do		
NE95/29-VIIIa	do		
NE95/29-IX	do		
T/S2 5/29j	do		
30/8/95 (Ghurikot)	do		
NE95/30-I	postkin. amph in amph sch	nr #16	040/85W

Table 5.2 (cont.) Samples collected in Nanga Parbat, Pakistan during 1995

Table 5.2 (cont.)

Sample Name	September Upper Rupal to Mazeno & Airl Gah (1995) samples Lithology	location /outcrop no	(T/S = Thin section prev. cut) Foln / Lin	comments
NE95/30-II	gnt metaP	#17	N/O	
NE95/30-III	stretched f'spar gn.	#17	020/85W 40@360 W face marked	
NE95/4-I	thinly laminated bt gn / granitic	#18 1st in valley after	020 / 80W 40@200	
T/S1 5/4A	orthogn w/ strch'd late qtz	Chongra Gl.	("E" is underside)	
NE95/4-II	2 pcs (1 is float) RCSZ orthogn.	near #18	N/O	
NE95/6-I	Rupal Glacier Day (6.9.95.) musc, l'granitic gn poorly (fol'd)	#19	170/80W	
NE95/6-II	folded bt schist (i.e. grey gn.)	#19	010/40W 40@220	5/4B is 2"x3" slide
T/S1 5/4B	w/ ~15cm boudin of l'granite			
NE95/7-I	Mazeno base camp to high camp (7.9.95.) variable foliation thickness	#20	010/85W 42N, sinistr	
T/S2 5/7A	granitic orthogn.	20m over fir #20	E underside, is marked	
NE95/7-II	incr. felsic granitic orthogn		N/O	
NE95/7-III	w/ X cutting qtz pegmatite vein	#21	N/O	
T/S2 5/7C	fine granitic orthogn (grey)		<from imm, float>	
NE-95/7-IV	cse asymm. augen granitic	#21 Climb to Mazeno	020/90W 50@020	
T/S1 5/7D	orthogn. (lge slide)	(side hill w/o pack)	dext, E side up	
NE95/7-V	qtz pegmatitic =tourm. vein	#21	N/O (plane 100/70S)	
[7.9.95.]	(fine grained, grey l'gr)	nearby #21 (Float )	N/O (Float )	
NE95/8-I	After Mazeno high camp (8.9.95.) cse, asymm augen granitic	#22 Just above	005/70E 30@005	sinistral; W-side up
T/S1 5/8A	orthogn, cut by fine grained l'gr	Maz High Camp	dyke: 060/30SE	
NE95/8-II	Sample outcrop: Each of above <b>and</b> X-cutting peg bt-qtz vein	do	vein 100/85S	
NE95/8-III	Coarser tourmaline Horiz in l'gr	300m on (fir. #22)	N/O	
T/S3 5/8C	<b>MISSING!</b> ("bt-gn")	200m on, still	080/60N	
NE95/8-IV				

Table 5.2 (cont.) Samples collected in Nanga Parbat, Pakistan during 1995

Table 5.2 (cont.)

NE95/8-V	odd mix, cse-fine pegmatite to l'gr (1-3cm patches)	#23		
NE95/8-VI	uneven fol'd gran. orthogn	do	030/50W 55(N)	
T/S2 5/8F				
NE-95/8-VII	weath. bt-sch	At Mazeno Pass	050/80NW 20@050	
T/S1 5/8G			sinist. W side up	
NE95/8-VIII	mix: uneven fol'd gr. orthogn & intermix l'gr (not migmatite)	do	050/55Nn 18@020	
T/S2 5/8H				
NE95/8-IX	Mazeno Pass <b>Leucogranite</b>	do	N/O	
NE95/8-X	sl. coarser Mazeno l'gr	100m down from Pass	N/O	
NE95/8-XI	v greenish <b>leucocratic</b> intrusive w/ chlorite slickenfibres	200m down from Pass	N/O	
NE95/8-XII	sl. coarser greenish l'gr w/ slicks	300m down from Pass	N/O	
NE95/8-XIII	crumpley (bt) granitic orthogn.	#24 At foot of "cliff"	060/89W 55(N)	
T/S2 5/8M				
NE95/8-XIV	v.black crumpley bt gn (orthogn)	#25 L.B (SW side) of Glacier @4600m		
NE95/8-XV	crumpley bt gn (fine asymm. augen) ( <i>NB P=XI, here</i> )	#25 L.B. (SW) side of Lobah Glacier	095/60N 60@005	sinist, top to S
T/S1 5/8P			S marked, arrow to W	
NE95/8-XVI	bt, musc, cse qtz vein	do	N/O	
NE95/8-XVII	crumpley bt-gn w/ qtz aug tension gashes sugg top to NW!	do	090/60W 60@360	
T/S3 5/8Q				
To Airl Gah camp (11.9.95.)				
NE95/11-I	(3pcs) amph, fine-gr. gn. & uneven bandwith gn.	Gashit camp site; 200m W of #AR1	030/vert	
NE95/11-II	fine-gr bt-gneiss	Near Gashit Fold; 200m E of #AR1	179/50E 30@035	
T/S2 5/11B				
NE95/11-III	gn. w/ uneven fpar sizes	do	170/50E	
NE-95/11-IV	v. granitic gn w/flattened bt planes giving sinistral? SoS	few 100m into granite - E of #AR	160/vert (25@160 - calc'd post field)	
NE95/11-V	V; granitic. rel high strain,	further up Airl Gah; 500m E of #AR5	170/85W 35@350	dext, E side up
T/S1 5/11E			use overhead view	

Table 5.2 (cont.) Samples collected in Nanga Parbat, Pakistan during 1995

Table 5.2 (cont.)

NE95/11-VI T/S2 5/11F	blotchy bt-granite (aka Jalhari)	100m further east	N/O	
NE95/11-VII T/S2 5/11G	porph granitic gn w/ good C/S	150m further east	170/vert (50@350 - calc'd post field)	dext, E side up
NE95/11-VIII	porph granitic gn w/ scrappy S/C	Upper Airl Gah; 300m W of #AR6	??? Prob 170/vert (55@170 - calc'd after)	
To Airl Gali (12.9.95.)				
NE95/12-I	well fol'd gr. orthogn. w/ C/S	200m W of #AR6	175/75E 40@005	
NE95/12-II	bt-sch w/ irreg. f spar augen (bt-rich "laths")	200m E of #AR6	010/65E 20@035	
NE95/12-III	v. granitic, non-fol'd ("Jalhari")	400m E of #AR6	010/65E 20@035	
NE95/12-IV	fine-gr bt sch/gn.	20m before Airl Gali (#AR8)	nearest lin: 32@078	
T/S2 5/12D	well fol'd, mm-porh. gr. orthogn.	200m W of #AR8	030/40E	
NE95/12-V	later buckled		hinge: 50@060	
NE95/12-VI	greeny calc silicate	50E of #AR7	170/30E 40@068?	
T/S1 5/12F	nr local hinge zone	(not common)		
NE95/12-VII	gr. orthogn. w/ good S/C	Jalhari in Airl Gah;	jointing: 170/60E	
T/S2 5/12G		400m W of #AR7		
NE95/12-VIII	"pelitic/felsic sch.	200m E of AR6	070/35E 30@040	Occurs as lenses or bodies! in Jalhari
T/S2 5/12H				
NE95/12-IX	amphibolite. note v. green min in contact w/ sch (part of above)	same outcrop as above	N/O	
T/S2 5/12H	noteably higher strain orthogn	*note scheme irregularity	thin sec misnamed 5/27H	
NE95/12-X	but w/greenish hue!	Just W of #AR6	not outcrop	
NE95/12-XI	much odd bt in Jalhari	Few 100m W of #AR6	170/30E	
NE95/12-XII	less odd bt in gr. foln is defined by mm bt "pancakes"	IJalhari granite zone, ~500m W of #AR6	170/vert	
T/S2 5/12L	v dense bt "pancakes" in granitic gn	do		
NE95/12-XIII				

Table 5.2 (cont.) Samples collected in Nanga Parbat, Pakistan during 1995

Table 5.3

Table 5.3 Samples collected in Nanga Parbat, Pakistan during 1995.

Sample Name	Lithology	location /outcrop no	Foln / Lin	lat/long +/-or outcrop no.
E6/6/18-I	asymm. augen bt-orthogn.	1st Rupal sidevalley after Chongra Gl.	060 / 89E 40@@240 ("N" is ENE)	#18
E6/6/18-II	do	do	020 / 65W 55@@250	do
E6/6/18-III	"qtzite"! boudin in bt-orthogn.	do	040 / 50W 30@@248	do
E6/6/18-IV	bt-augen gn.	do	040 / 80W 50@@238	do
<b>T/S3</b> 66/18D				
E6/6/21-I	mm streaky f'pathic grey gn	Rama RB, B4 glacier	120/56 30@@160	1 km E of #RL71
<b>T/S3</b> 66/21A				
E6/6/25-I	Cse & fine gnt sch. (cf Churrit)	Indus, W of Stack F.	040 / 50S	
E6/6/27-I	minor gnt in amphibolite (marked: 160 / 30 E)	MMT, E Astor Gge	010 / 65W 12(N)	1.5 km N of #8
<b>T/S2</b> 66/27A				
E6/6/27-II	20m on, (marked: 010 / 58 E)	do	do	do
<b>T/S2</b> 66/27B				
E6/6/27-III	20m on, (marked: 010/ 80 E)	do	do	do
E6/6/27-IV	bt w/ cse gnt, foln plane marked	do	170 / 89E 15(N)	do
<b>T/S2</b> 66/27D				
E6/6/27-V	fine grained "lath unit"	W. of E. margin of Astor Gorge	060/38S 14N	300m W of #71
<b>T/S2</b> 66/27E				
E6/6/30-I	(bt - rich portion) bt-orthogn.	Tarshing local hill	020 / 80W 40S	700m W of #9
E6/6/30-II	asymm. augen bt-orthogn.	100m E along hillside	020 / 90W	600m W of #9
E6/6/30-III	asymm. augen bt-orthogn.	Still E (after 1st gnt)	020 / 85W 55S	500m W of #9
E6/7/1-I	asymm. augen (rich)-orthogn.	1st Rupal sidevalley after Chongra Gl.	038 / 50N 40@@240	#18
(II not taken)				
E6/7/1-III	granitic: cm isoclinal felsic layer	do	N/O	do
E6/7/2-I	do	Chichi Nala (before 1st day lunch stop)	030 / 50N 40@@250	#C1
E6/7/3-I	fine grained bt-orthogn?	sinistral, W-down loc. in Chichi Nala	marked foln: 080 / 50S 130 / 38S 38@@215	#C3
<b>T/S2</b> 67/3A			marked line: 060 / 38	

Table 5.3 Samples collected in Nanga Parbat, Pakistan during 1996

Table 5.3 (cont.)

E6/7/3-II	sandy-"granitic" metaseds	top of Chichi near lunch & shaving stop	160 / 30 W 28@217	#CC5
E6/7/5-I	actin. sch. w/ post-kin. amphib.	"by Assif's mylonite	marked foln: 020 / 40E	#14
E6/7/5-II	cse gnt amph. <i>in</i> metaP.	cascading folds	N-S buckled.	#13
E6/7/5-III	gnt psammite	do	do	do
E6/7/5-IV	gnt, fine-gr, grey gn. w/ rare str, fspar	across Churit F.	018 / 68W 18N	#12
E6/7/5-V	v. str fspar gn. w/ mig. layers	50m along (W)	004 / 82E 16N	50m W of # 12
"Astor East"	"lath unit"	Eastern Astor		0-500m W of #71
<b>T/S2 AS/E</b>				
Sept. / October samples				
Sample Name	Lithology	Location /outcrop no	Foln / Lin	lat/long or GPS
E6/9/20-I	white "gnt" in Ladkh gnt-amph-bt-sch.	Ghurikhot (left trib.)	170 / 78W 33@347	35o16.4'N 74o48.8'E (G40)
E6/9/20-II	gnt-amph. in meta P.	do	030 / 37W 22@003	35o16.61 74o48.49
E6/9/21-I	bt-amph-schists of cascade folds	Cascade folds of S side (r.b.) Lwr Rupal	178 / 89W 32N	35o12.97 74o47.5 outcrop #51
E6/9/21-II	gnt-amph. meta P. Not oriented	"churit F" on S side	N/O (015 / 81W)	500m W of #50
E6/9/24-I	chloritic schist (Ladkh)	Near Rattu checkpoint	004 / 87W 40N	#52 (GPS # 43)
E6/9/24-II	v. def'd, retrogr? gneiss	betw Churit & Tarsh.	012 / 87W	1 km E of #9
E6/9/25-I	pes of poss cord melt segr	Rupal Vill. deep valley	N/O	#18A
E6/9/25-II	very green poss. cord. melt segr	do	N/O	do
E6/9/26-I	C/S poor, granitic orthogn	Polish Base Camp, l.b. of Bezhin GI	083 / 73S 44W	#48 (also GPS #48)
<b>T/S3 69/26A</b>				
E6/9/27-I	thin bt fspar gn.	Tapp meadow local	172 / 46W 22@320	35o11.8 74o36.4
E6/9/27-II	incr. fspar gn	r.b. of U.Rupal before Shigiri Village	float	
E6/9/27-III	incr. bt gn	do	143 / 81W 30N	GPS #49 (49a)
<b>T/S2 69/27C</b>				
E6/9/27-IV	lwr grade bt-gneiss	Shigiri Village	039 / 62W 36N	
<b>T/S2 69/27D</b>				
E6/9/27-V	Amphibolite dyke	do	horiz, S-dipping	

Table 5.3 (cont.) Samples collected in Nanga Parbat, Pakistan during 1996

Table 5.3 (cont.)

E6/9/28-I T/S2 69/28A	granitic orthogneiss	Shaggin Gl mouth l.b.	031/70E 50S	# CR 52 (GPS #52)
E6/9/29-I	old favourite bt orthogn.	Campsite above Shigiri on Rupal Gl. l.b.	023 / 54NW 54S	#Sh 1
A1 to A4 (all 29.9.96.)	A1, A2: amphibolite	"steep hill" above pond	N/O	#Sh 2
(all sent to CPC)	A3: bt schist	& Zeitler camp of 1995	N/O	
E6/9/29-II	A4 gnt, bt sch			
	banded gn. late, inj asymm folds	sandy corner on trail to Mazeno base camp	037 / 49N 14@348	#Sh 3
E6/9/29-III	hb needles & gnt - amph.gn.	Freiburg's back valley	050 / 24N 22@332	300 m N of #Sh 3
E6/9/30-I	L-tectonite of boudins / pods	Uppermost Rupal Gl	048 / 89E 24S	#56 & #57
T/S2 69/30A	Leucogranite (E610/1A)	At Mazeno Pass	marked is 035 / vert.	GPS same
Mazeno Top	~8 kg; 2 pcs		n/a	nearest is Mazeno high camp #61
5358m	l'gr dyke ±tourmln intr amph gn	W. margin on Astor R.	N/O (to DAS)	
E6/10/6-I	Stretched f'spar gn w/ gnt!	Rama l.b. near Rest Ho.	159 / 33W 7@332	#62 GPS same
E6/10/7-I	"lath unit" (pematitic gn?)	do	018 / 27E 11@160	do
T/S3 610/7A	mig-bt-gn.	Upper Gurikhot, W. of "Churit F."	158 / 58W 10@336	#69, GPS same
E6/10/7-II	green spotted / banded felsic amph gn	Ladakh at foot of Bulan Gah	Underside (marked) E	
E6/10/8-I	green amph gn	(at contact w/ meta P)	160 / 55E 32N marked	#70 GPS same
E6/10/9-I	stretched f'spar gn. "angel hair"	Dichil Glen LB, S side-	010 / 52W no lin.	500 m W of #70
T/S3 610/9A	def'd leucogranite (intruded parallel to foln)	across "Dichil Pass"	076 / 53W 32N	1.5 km E of #73
E6/10/9-II	mm-feldspar banded bt-sch.	nearer Dichil Pass	underside marked	
E6/10/10-I	gnt-mig-amph dyke	at pass	N/O	500m E of #73
E6/10/10-II	do	Dichil Bridge	160 / 80E 42N	#73
E6/10/10-III	bt-amph gn	Dashkin synform	N/O	
T/S2 610/10C		do	N/O	1 km SE of A711
E6/10/10-IV				
T/S2 610/10D				
E6/10/10-V				
E6/10/10-VI				
T/S2 610/10F				

Table 5.3 (cont.) Samples collected in Nanga Parbat, Pakistan during 1996

Table 5.4

Sample Name	Lithology	location /outcrop no	Foln / Lin	Notes
<b>Table 5.4 Samples collected in Nanga Parbat, Pakistan during 1995.</b>				
<b>1997 (4.7.97. to 19.7.98.)</b>				
July samples (field days with Bill Kidd and Asif Khan)				
E7/7/4-I	(3 pcs) marble & amph tuff (sampled 6.7.97.)	W'most Indus ("cover")	N/O	
"Rama Tuff"		Upper Rama l.b. #R3	143/18NW	7@006
E7/7/6-I	v granitic banded gneiss	Rama l.b. furthest point #R5	(prob.) 152/38W	
E7/7/7-I	deformed angel hair U.	#71 l.b. E. Astor, opp footbridge w/ casc. folds on r.b.	310/50N	
E7/7/7-II	non-porph (incr. strain?) of above w/mm banding	do (50m W of #71 l.b.)	005/38W	
E7/7/7-III	further incr. strain of above	do (80m W of #71 l.b.)	001/49W	3@001
E7/7/7-IV	mm-layered pale gneiss	imm. B4 bridge @ river bed (from Astor vill.) #H1	042/43NW	
E7/7/7-V	myl? stretched pelite gn w/gnt	imm. B4 Luskum cafe #H2	077/60W	4IN marked 320/60N
E7/7/7-VI	mm-grainy porph gn	do	??	
E7/7/10-I	S-C in qtz/fpthic unit-2 in Kamila	Niat Gah MMT h.w. #N71	012/49W	49@244
"Niat cover"	<4mm gnt metaP	Niat after bridge (200m W of #N72)		
Nt-3	fol'd peg body (to DAS)	Niat, B4 Chukawai moraine #N74	N/O	
Nt-4	bt-sch (to DAS)	near bridge? 100m W of #N72	N/O	
E7/7/12-I	gnt metaP (to NBWH)	lower Airl Gah 100m W of #AR1	178/68W	
E7/7/12-II	do (to NBWH)	#AR1	142/71E	
E7/7/12-III	qtz peg. in grey gn.	100m E of #AR1		
E7/7/12-IV	gnt metaP (=chloritic) NBWH	do		

Table 5.4 Samples collected in Nanga Parbat, Pakistan during 1997

Table 5.4 (cont.)

E7/7/13-I	gnt pelitic "mylonite"	start of Nashkin Gah #BA1	005/41W
E7/7/13-II	stretched porph. gn.	central spine hill betw. Nashkin & Airl #BA2	017/71W 01S (dext?)
E7/7/15-I	porphyritic unit (part of Jalhari gr?)	Above Rollo camp #P6	171/51W 33N
E7/7/16-I	Jalhari Granite (to DAS)	Above Phailobat #PL1	161/56W 42@181
E7/7/16-II	do (finer grained for monazite)	50m N of #PL1	N/O
E7/7/16-III	do	100m N of #PL1	N/O
E7/7/16-IV	felsic "blasts" in pred. bt pelite	#P5 (br. below Phailobat)	179/29W 21@217
<b>T/S3</b> 77/16D			
E7/7/17-I	metaP	tricky crossing nr. confluence below Garrol; #P45	152/60W 26@308
no name	bi peices for Schneider	100m N of #P45	
E7/7/19-I	"retrogr." metaP outboard Jalhari	#D11 (nr. Zangot)	170/80E
E7/7/19-II	Jalhari (between metaP layers)	100m W of #D11	175/80E
E7/7/19-III	W'ern flattened 'Jalhari'	Diamir, #D9	180/vert
E7/7/19-IV	"typ. Jalhari" (1kg sample)	Diamir, #D5	N/O
E7/7/19-V	def'd, more porphyritic Jalhari	do (nr. bt. hydroth s.z.)	180/80E 80@270
<b>T/S3</b> 77/19E			
E7/7/19-VI	flattened, odd bt w/cse felsic bit	Diamir, #D3	160/70W 50N
<b>T/S3</b> 77/19F			

Table 5.4 (cont.) Samples collected in Nanga Parbat, Pakistan during 1997

Table 5.4 (cont.)

Sample Name	Lithology	location /outcrop no	FoIn / Lin	lat/long or GPS or notes
<b>(5.9.97. to 27.7.97.)</b>				
September samples (field days with Schneider, Grenobleise & Nano)				
Deosai	7 Schneider Deosai samples	2nd&3rd Sept.		
E7/9/5-I	dioritic body	nr Satporo granite @ checkpoint N of Deosai	N/O	
E7/9/6-I	leucogranite	Deosai "campsite"	N/O	
E7/9/6-II	granodiorite	W of Deosai, nr. first outcrop w/Schneider	N/O	
E7/9/7-I	v felsic gneiss (sandy)	furthest up Dichil tributary l.b.#74D (w/Pecher)	N/O	
E7/9/7-IIa & b	several pieces of amph. and large piece of marble	do	N/O	
E7/9/8-I	musc in peg. X-cut amphibolite gn (to DAS)	furthest point up Dichil #74G	N/O	
E7/9/8-II	Dichil Lath unit (5kg?) (to DAS)	below Dichil campsite #74B		
E7/9/13-I	bt from peg. X-cut L-orthogn. (to DAS)	Shaggin Gl. l.b. #CR52		photo 27
E7/9/13-II	S.o.S. fabric in gran. orthogn. (5 kg sample)	further up Shaggin Gl. l.b. 1 km S of #CR52	179/74W 35S	
E7/9/13-III T/S3 79/13C	altered?? L/Sorthogneiss	SW Rupal corner #CR52B	surface 040/70W main:062/68S 60S	Below debris-throwing edge of Rupal r.b. #2 Gl.
E7/9/14-I T/S3 79/14A	1-2mm gnt grey orthogn.	W'most Rupal (Toshain) #56	032/62NW 35S	
E7/9/14-II	Dm L-tectonised X-cutting pod (to DAS)	do	plane marked 130/70	
E7/9/14-III	aligned t'maline 1m peg.	opposite (N) side of gl. #T2	N/O	
E7/9/14-IV T/S3 79/14D	poss. cord 3cm peg	do	N/O	

Table 5.4 (cont.) Samples collected in Nanga Parbat, Pakistan during 1997

Table 5.4 (cont.)

E7/9/15-I	l'cratic x-cutter	up on Shagiri Gl. r.b.	!float in glacier	
E7/9/16-I	marble & h/b rich layer	Hanging Lake Gl. r.b.	152/58E no lin visible	
<b>T/S3</b> 79/16A	<b>Alert!</b> (T/S-labelled 19/16A)			
E7/9/20-I	gnt-bt-sch w/sinistral pressure shadows	inside Chichi #1 Gl l.b. 750m E of #CC5A	020/80N (underside)	
E7/9/20-II	RCSZ gr. orthogn.	highrest Chichi #1 Gl l.b. #CC5A	110/50N 29@270	W-side up, dext (note overturned)
E7/9/21-I	v. granitic layer in gneisses (to DAS)	Chichi #2 Gl. r.b. #CC5B	018/44E	
E7/9/21-IIa	marb & amph pair in cover	upper Chichi	N/O	
E7/9/21-IIb		#CC5C	hinge 18@216	
E7/9/21-III	lge gnt-bearing leucogranite (to DAS)	uppermost Chichi 500m SW of #CC5C	N/O	
E7/9/21-IV	bt-sch (for DAS)	do	N/O	
E7/9/22-I	RCSZ orthogn	Chichi r.b. opp. Abadidas	120/70N (marked) 018/53W 29@195	dextral
E7/9/26-I	crumpled granitic orthogn	200m above Zangot #Z1 in Diamir	025/77E	
E7/9/26-II	fine grained gr. orthgn.	#Z2 further up Diamir	019/69E	
E7/9/26-III	chunky f'spar bt-gn.	few 100m into Diamir Gl r.b. valley	044/87W (local buckle)	
E7/9/26-IV	gr orthogn	@Gajal (nr. base camp) #Z3	318/35E 28N	
<b>T/S3</b> 79/26D				
E7/9/27-I	v. weath. fine grained gn.	#Z4 above base camp	N/O	
E7/9/27-II	Fe-stained gr. orthogn. (a la base of Mazeno Pass cliff	Terminal moraine B4 base camp	023/83E 55N	
<b>T/S3</b> 79/27B				

Table 5.4 (cont.) Samples collected in Nanga Parbat, Pakistan during 1997

**Table 5.5 Abbreviations used in other tables**

amph	amphibolite/-itic	vert	vertical
asymm.	asymmetric/-al	vill.	village
B4	before	W <sup>ern</sup>	western (also N,S & E)
br./Br.	bridge	W <sup>most</sup>	westernmost (also N, S & E)
bt	biotite	w/	with
casc	cascading		
cse	coarse		
cord.	cordierite/-itic		
defd	deformed		
do	ditto (as above)		
F.	fault		
f <sup>spar</sup>	feldspar		
f <sup>pathic</sup>	feldspathic		
fol'd	foliated		
foln	foliation		
Gge/G.	Gorge		
Gl./gl.	glacier		
gn	gneiss		
gnt	garnet		
gr	granite		
hb	hornblende		
imm	immediately		
intr.	intrusive/-ding		
kin.	kinematic		
ky	kyanite		
lgr	leucogranite		
l <sup>cratic</sup>	leucocratic		
l.b.	left bank		
loc	location		
Maz.	Mazeno		
metaP	metapelite		
mu	muscovite		
myl	mylonite/-itic		
N/O	not oriented		
nr.	near		
pcs	pieces		
peg	pegmatite		
porph	porphyroclastic		
poss.	possible		
prob.	probably		
qtzite	quartzite		
r.b.	right bank		
s.z.	shear zone		
sch	schist		
segr.	segregated		
slicks	slickenfibres/-sides		
staur	staurolite		
v.	very		

**Persons receiving samples**

CPC	C. Page Chamberlain
DAS	D.A. Schneider (geochronologist)
NBWH	Nigel B.W. Harris

**Acronyms used throughout thesis**

DCF	Dzong Chu Fault
DEM	Digital Elevation Model
HHC	High Himalayan Crystalline
KLS	Kohistan Ladakh Series
MBT	Main Boundary Thrust
MCT	Main Central Thrust
MMT	Main Mantle Thrust
NPHM	Nanga Parbat Haramosh Massif
RCSZ	Rupal Chichi Shear Zone
STDS	Southern Tibet Detachment System
TM	Thematic Mapper
YGRS	Yadong Gulu Rift System