material as the range of raw material pebbles available would be about the same at each site (personal observations).

The percentages of quartz flaked pieces per total quartz artefacts in the sites on the eastern side of the Warrumbungles (the Crazyman Shelter, the Kawambarai cave and Jack Halls Creek Camp site - which are within 6.5 km of each other) were in the range 6 to 16% whereas at the Ukerbarley Hayshed site and Camp Pincham (to the north and northwest of the other sites) the range was 29 - 31%. This divides the sites as far as quartz flaked pieces percentages are concerned into two geographic groups - east and west.

In Table 6.14, the fine grained portion (although there was an absence of fine grained flaked pieces at Jack Halls Creek Camp site) shows that the same geographic groups more or less apply for the fine grained as well as for the quartz, with the Crazyman Shelter and the Kawambarai cave in one group and Camp Pincham and the Ukerbarley Hayshed site in the other. The the Crazyman Shelter and the Kawambarai cave mean dimensions were not as close as the quartz means.

The percentages of flaked pieces per site seem to follow a pattern in both the quartz and fine grained, with the Crazyman Shelter having the smallest sample sizes in quartz and fine grained plus the smallest mean dimensions. This suggests that a different knapping procedure may have been employed at the Kawambarai cave and the Crazyman Shelter to that at Camp Pincham and the Ukerbarley Hayshed site. This difference I suspect, could be related to site function.

From the coarse grained flaked pieces tables, it can be seen that sample sizes in four sites (the Crazyman Shelter, the Kawambarai cave, the Ukerbarley Hayshed site, Jack Halls Creek Camp site) were so small or non existent that no meaningful deductions can be gained from them. In Camp Pincham which has a large percentage of coarse grained flaked pieces (32.35%) and a reasonable overall sample size (22), some deductions can be made. This percentage is the largest percentage of flaked pieces per raw material group in any of the five sites. This percentage (20.67%) per total coarse grained artefacts was also the largest percentage/assemblage in any of the five sites. This I would argue, could be associated with a suspected shortage of fine grained material near this site (this may be related to access and/or supply) and so the coarse grained was being substituted for the fine grained to some extent. Witter (1987 as cited by Geering 1988:1) has stated that this site was large in proportion to most other sites in the National Park, and so population pressures may have been responsible for the greater use of quartzite as a knapping medium.

6.6.15 Flaked pieces cortex

Further analysis of the flaked pieces was carried out to ascertain the position flaked pieces occupied in the knapping sequence. The results obtained were as follows :

QUARTZ FLAKED PIECES CORTEX PERCENTAGES

site	cortex	no cortex	sample size	total quartz
CMS	33.33 (3)	66.67 (6)	9	145
KACA	42.86(3)	57.14(4)	7	71
CP	16.22 (12)	83.78 (62)	74	235
UKBH	05.88(1)	94.12 (16)	17	55
JHCC	8.75 (15)	81.25 (65)	80	486

(actual numbers in brackets)

FINE GRAINED FLAKED PIECES CORTEX PERCENTAGES

site	cortex	no cortex	sample size	total FG
CMS	9.09(1)	90.91 (10)	11	98
KACA	25.00(2)	75.00(6)	08	34
CP	28.57(2)	71.43(5)	07	26
UKBH	0(0)	100(3)	03	11
JHCC	0(0)	0(0)	0	14

COARSE GRAINED FLAKED PIECES CORTEX PERCENTAGES

site	cortex	no cortex	sample size	total CG
CMS	0(0)	0(0)	0	10
KACA	100(1)	0(0)	01	05
CP	9.09(2)	90.91(20)	22	68
UKBH	0(0)	100(1)	01	09
JHCC	0(0)	0(0)	0	14

TABLE 6.15

These tables reveal that, in all cases, the numbers of flaked pieces with cortex present in quartz and fine grained were considerably less than the flaked pieces without cortex. This signifies that the flaked pieces were generally being made in all sites after the initial decortication has taken place and well into the reduction sequence. Numbers were small in all sites for coarse grained except at Camp Fincham where coarse grained follows the same pattern as in the other two groups (with many more artefacts without cortex than with cortex). It would seem then that if quartz had not been analysed in this instance, then the pattern found in fine grained would have been the same as for quartz (the majority of flaked pieces occurred after the cortex had been removed from the core). Analysing the fine grained portion of the total assemblage in this instance would have produced the same result as for the total assemblage.

6.5 COMBINATION OF ATTRIBUTES

The following Table (6.16) contains a summary of the most important attribute percentages in the three raw material groups. This table reveals trends in attribute percentages which

when combined, point to specific human behaviour. From Table 6.16, it was possible to set out where analysing only the fine grained material and ignoring quartz, would not have made any worthwhile difference to the results. There were, however, other attributes that if only the fine grained artefacts had been analysed, some aspects of human behaviour would have been overlooked (in 23 out of 44 cases). These were found mainly in the quartz portion of the assemblage rather than coarse grained, and were instrumental in defining the importance of quartz. A table outlining aspects of human behaviour (Table 6.17) and the attributes of artefacts that were associated with them follow that of the attribute percentages (Table 6.16). Table 6.17 reveals that if only the fine grained assemblage was analysed, then some behavioural inferences associated with particular attributes would have been missed. This finding, however, was not uniform across the five sites.

6.6 SITE SUMMARIES

Summaries for each site follows. These summaries document the inferences of human behaviour in each site according to the attributes outlined in Table 6.17.

6.6.1 The Crazyman Shelter summary

1) PREFERENCE FOR RAW MATERIAL

The Crazyman Shelter has the percentage of fine grained material at 38%, which is well above average, and is the highest percentage of fine grained in any site. The site then, according to Hiscock's criteria on raw material rationing, should be situated nearer to sources of the fine grained material than any other site. The low percentage of fine grained flakes and cores with cortex present, however, suggests that it was still some distance from the source (definitely further away than the quartz supply (1 km) which has larger percentages in both these attributes).

2) PREFERENCE FOR RAW MATERIAL

The Crazyman Shelter has the lowest percentage of quartz artefacts (57%) at any site. This suggests that this material was not favoured so much for knapping as at the Kawambarai cave. The nearest good supply of quartz and quartzite found around the Crazyman Shelter is about 1 km to the northeast. It is available, however, around the slopes at the Kawambarai cave, so availability may have been responsible for the differences in percentages.

3) PREFERENCE FOR RAW MATERIAL

The Crazyman Shelter has the highest percentage of rotated cores without cortex in quartz and fine grained for any site. This adds weight to the argument that the source of the quartz was not on site as was the case for the other sites, so cores were reduced more at the Crazyman Shelter. The Crazyman Shelter had 51.6 % of quartz cores in the most reduced class

5 SITES SELECTED ATTRIBUTES PERCENTAGES

TABLE 6.16

QUARTZ

site	flakes %	flakes complete %	flakes trans %	flakes long. %	flakes with cort. %	flaked pieces %
CMS	31.72	21.74	47.83	30.43	28.26	6.21
KACA	23.94	17.65	41.18	17.65	29.41	11.27
CP	2.99	25	37.5	12.5	12.5	31.49
UKBH	40	22.73	68.18	4.55	40.91	29.09
JHCC	0.62	33.33	66.67	0	0	16.56
mean	19.85	24.98	51.81	23.59	22.22	18.92

	cores %	cores with cor. %	cores no c. & rot. %	cores cort. & not rot. %	MIcro-Debitage %	total assemblage
CMS	21.38	48.28	48.28	13.79	40.69	145
KACA	1.41	100	0	100	30.99	71
CP	42.13	47.96	42.86	29.59	21.7	235
UKBH	27.27	46.67	40	0	0	55
JHCC	80.75	85.24	11.96	57.25	0	486
mean	34.59	65.63	28.62	40.13	18.68	

****

FG

	flakes %	flakes complete %	flakes trans %	flakes long. %	flakes with cort. %	flaked pieces %
CMS	40.21	10.26	35.9	30.77	5.09	11.22
KACA	26.53	38.46	38.46	15.38	23.08	16.33
CP	20	60	0	20	0	33.33
UKBH	75	33.33	33.33	16.67	16.67	27.27
JHCC	21.43	33.33	66.67	0	0	0
mean	36.63	28.41	46.82	28.51	8.97	17.63

	cores %	cores with cor. %	cores no c. & rot. %	cores cort. & not rot. %	MIcro-Debitage %	total assemblage
CMS	17.53	5.88	94.12	5.88	30.93	98
KACA	4.08	50	0	50	44.9	34
CP	42.86	43.75	50	25	0	26
UKBH	25	100	0	0	0	11
JHCC	71.43	40	60	10	7.14	9
mean	32.18	47.93	40.82	18.18	16.59	

****

CG

site	flakes %	flakes complete %	flakes trans %	flakes long. %	flakes with cort. %	flaked pieces %
CMS	20	0	50	50	50	0
KACA	20	100	0	0	50	20
CP	13.24	77.78	0	0	22.22	32.35
UKBH	75	0	80	20	0	22.22
JHCC	5	100	0	0	33.33	0
mean	26.65	35.56	26	14	31.11	14.91

	cores %	cores with cor. %	cores no c. & rot. %	cores cort. & not rot. %	MIcro-Debitage %	total assemblage
CMS	70	71.43	28.57	14.29	10	10
KACA	60	66.67	33.33	66.67	0	5
CP	54.41	64.86	29.73	21.62	0	68
UKBH	25	50	0	50	0	9
JHCC	90	88.89	11.11	22.22	0	20
mean	59.88	68.37	20.55	34.96	2	

5 SITES BEHAVIOURAL INFERENCES ATTRIBUTES RESULTS
TABLE 6.17

BEHAVIOURAL INFERENCE	*ATTRIBUTE*	*SITE*	*PRESENT IN QUARTZ*	*PRESENT IN FG*	*missed if only FG analysed*
PREFERENCE FOR	**HIGH % OF QUARTZ**	JHCC	94.36%	N/A	YES
RAW MATERIAL (quartz)	**LOW % OF QUARTZ**	CMS, KACA	57.31 %, 64.55 %	N/A	YES
PREFERENCE FOR	**BELOW AVERAGE % OF CG**	JHCC, KACA, CMS	N/A	N/A	YES
RAW MATERIAL (CG)	**IN TOTAL ASSEMBLAGE**				
	ABOVE AVERAGE % OF CG	CP, UKBH	N/A	N/A	YES
	IN TOTAL ASSEMBLAGE				
REDUCTION OF RAW MATERIAL	**% MICRODEBITAGE**	UKBH	0%	0%	NO
		CP	21.70%	0%	YES
		KACA, CMS	40.99 %, 30.99 %	30.99 %, 44.90 %	NO
REDUCTION OF RAW MATERIAL	**HIGH % OF FLAKES**	CP	2.99%	20%	YES
		JHCC	0.62%	21.33%	YES
		KACA, CMS,	31.72 %, 23.94 %,	40.21 %, 26.53 %	NO
		UKBH	40%	75%	YES
RATIONING OF RAW MATERIAL	**HIGH % NON ROTATED**	JHCC	57.25%	10%	YES
	CORES WITH CORTEX	CMS	13.79%	5.88%	NO
		CP	29.59%	25%	NO
RATIONING OF RAW MATERIAL	**% OF CORES**	CMS	48.28%	5.88%	YES
	WITH CORTEX	JHCC	85.24%	40%	YES
		CP	47.96%	43.75%	NO
		KACA, UKBH	TOO SMALL A SAMPLE IN FG FOR COMPARISON		

5 SITES BEHAVIOURAL INFERENCES ATTRIBUTES RESULTS
TABLE 6.17

BEHAVIOURAL INFERENCE	*ATTRIBUTE*	*SITE*	*PRESENT IN QUARTZ*	*PRESENT IN FG*	*missed if only FG analysed*
RATIONING OF RAW MATERIAL	**% OF FLAKES**	CMS	28.26%	5.09%	YES
		CP	12.15%	0.00%	YES
		UKBH	40.41%	16.67%	YES
		KACA, JHCC	29.41%,0%	23.08%, 0%	NO
DEGREE OF TRAMPLING	**% OF TRANSVERSE**	CMS	47.83%	35.90%	NO
	BREAKS IN FLAKES	KACA	41.18%	38.46%	NO
		CP	37.50%	0%	YES
		UKBH	68.18%	33%	YES
		JHCC	66.67%	66.67%	NO
KNAPPING SKILLS	**% OF LONGITUDINAL**	CMS, KACA	30.43%, 17.65%	30.77%, 15.28%	NO
	BREAKS IN FLAKES	CP	12.50%	20%	NO
		UKBH	4.55%	16.67%	YES
		JHCC	0%	0%	NO
LACK OF EXPERIENCE IN	**% OF BIPOLAR CORES**	KACA, CMS, UKBH	0%	0%	NO
KNAPPING DIFFICULT MATERIAL		CP	17.34%	25%	NO
		JHCC	66.75%	0%	YES
STRESS IN POPULATION	**% OF BIPOLAR CORES**	KACA, CMS, UKBH	0%	0%	NO
(JESKE'S CONTENTION)		CP	17.34%	25%	NO
		JHCC	66.75%	0%	YES
SMALL SIZE OF RAW MATERIAL	**% OF BIPOLAR CORES**	KACA, CMS, UKBH	NIL %	NIL %	NO
		CP	17.34%	25%	NO
		JHCC	66.75%	0%	YES

"rotated without cortex" while at Jack Halls Creek Camp site it was only 11.96%.

4) REDUCTION OF RAW MATERIAL

The range of the sizes of quartz cores was generally lower at the Crazyman Shelter than at the other sites, which also indicates more reduction of cores was occurring at this site than at any other site. Wall (1993:99) found that rationing of quartz can be determined by a number of attributes including core rotation, flake size and raw material percentages when the source reaches a distance of 2 km (the Crazyman Shelter is 1 km from the nearest raw material source). This would suggest that Wall's findings could be refined further or that the knappers were sourcing the quartz from further away.

5) REDUCTION OF RAW MATERIAL

Core and flake percentages per total assemblages in the quartz and fine grained were much higher at the Crazyman Shelter than at the Kawambarai cave. This suggests that the raw material may have been used for different purposes at these two sites. The mean dimensions of quartz flakes at the Crazyman Shelter and the Kawambarai cave were fairly similar. This was not the case for the mean dimensions of fine grained flakes and fine grained flaked pieces at the Crazyman Shelter and the Kawambarai cave. This strengthens the argument that a different reduction technique was being used at the Kawambarai cave for the fine grained material than at the Crazyman Shelter.

6) DEGREE OF TRAMPLING

The high percentage of transverse breaks at the Crazyman Shelter suggests that much trampling could have occurred the site in the recent past. Transverse breaks can occur from the backing of artefacts, excessive heating, or in some cases during manufacture (intentional or unintentional). The backing alternative seems remote as the manufacture of these artefacts seems to have ceased by this time.

7) KNAPPING SKILLS

The Crazyman Shelter has the highest percentage of longitudinal breaks in the quartz and fine grained flakes of any site and this could indicate less control in knapping these two raw materials than at Camp Pincham and the Ukerbarley Hayshed site. As Jack Halls Creek Camp site had only one complete flake in each of quartz, fine grained and coarse grained, then Jack Halls Creek Camp site could not a used as a comparison of any value with the Crazyman Shelter.

8) STRESS, INEXPERIENCE IN KNAPPING, SMALL SIZE OF RAW MATERIAL

Only one quartz core at the Crazyman Shelter showed signs of bipolar knapping, which is in

contrast to Jack Halls Creek Camp site which has 263 out of a total of 394 quartz cores showing signs of bipolar knapping If the large percentage of bipolar knapping at Jack Halls Creek Camp site is indicative of stress as argued by Jeske (1992:481-482), then no such stress was evident at the Crazyman Shelter or for that matter at the Kawambarai cave which has only one bipolar core (made on coarse grained material). If bipolar knapping was a sign of inexperience in knapping the raw material, then the knappers were much more experienced at the Crazyman Shelter and the Kawambarai cave than at Jack Halls Creek Camp site. Alternatively, some other explanation may be proposed (for example bipolar flakes may have a special function at Jack Halls Creek Camp site.

6.6.2 The Kawambarai cave summary

1) REDUCTION OF RAW MATERIAL/PREFERENCE OF RAW MATERIAL

The most noticeable feature of this site was the very low numbers of cores present in quartz, fine grained and coarse grained (1, 2 and 3 respectively) and the large number of fine grained artefacts in the assemblage (34 out of 110). This percentage of fine grained was well above the averages found in the open sites (Camp Pincham was the nearest site with 14%). The Crazyman Shelter, however, has a higher percentage of fine grained (38%).

2) PREFERENCE FOR RAW MATERIAL

The high percentage of fine grained debitage (60.23%) in the Kawambarai cave, combined with the low core percentage (4.08%), suggests that the fine grained material may have been used as a type of personal gear in this site (according to Binford 1979 and see Chapter three), the presence of personal gear in a site is indicated by a large percentage of debitage and few cores.

3) PREFERENCE FOR RAW MATERIAL

The large percentage of fine grained material in the site suggests that the source of some or all of the fine grained raw material may be closer to the Kawambarai cave than to Camp Pincham, the Ukerbarley Hayshed site and Jack Halls Creek Camp site or that some other restriction of access was operating at the other sites.

4) REDUCTION OF RAW MATERIAL

The mean length of fine grained flakes was greater at the Kawambarai cave than those at the Crazyman Shelter and the Ukerbarley Hayshed site, indicating that this site was closer to the raw material source than other sites or there was a preference for longer flakes at this site.

5) REDUCTION OF RAW MATERIAL

All these attributes combined suggest that the fine grained artefacts at the Kawambarai cave were being reduced in a different way to the other sites. I would argue that either a different

group were using the Kawambarai cave than the other sites or that the Aboriginal knappers were producing artefacts to exploit a resource that was not generally available at the other sites.

6) REDUCTION OF RAW MATERIAL

The amount of debris that has accumulated from the maintenance of the personal gear in residential sites bears a strong relationship to intensity of site use (Binford 1979, Camilli 1989). This means that the debris from the retouching or flaking of the personal gear will be found in a site, but not many of the flakes or the cores, which are carried on to the next site. The larger the amount of personal gear debris per assemblage should relate to a higher degree of site use. The small number of fine grained cores in the Kawambarai cave (five out of an assemblage of 110) would fit the "personal gear" category as described by Binford (1979) and Camilli (1989) where the artefacts were carried from site to site. The Kawambarai cave has a high percentage of debris (flaked pieces plus microdebitage) from the curated fine grained material (60.23%). This is the highest percentage in any site. The percentage of quartz debitage at the Kawambarai cave was only 42.26%, which is well below that of the fine grained. Quartz does produce plenty of debitage when knapped and one would expect (because of the high percentage of quartz in the assemblage) that quartz would have had the highest percentage of debitage but this was not the case. This is another example found where if only the fine grained material was analysed, the results would have been different to that found for the overall analysis, as quartz does not appear to have been used as personal gear.

7) KNAPPING SKILLS

There were fewer fine grained flakes with longitudinal breaks per total flakes present in the Kawambarai cave than at any other site except Jack Halls Creek Camp site (which has only 3 flakes). The percentages were - the Kawambarai cave 15%, the Crazyman Shelter 53%, Camp Pincham 40%, the Ukerbarley Hayshed site 33%. This suggests that much more care was being taken at the Kawambarai cave when knapping the raw material than at the other sites because the percentage of longitudinal breaks is an indicator of knapping skill.

6.6.3 Camp Pincham summary

1) REDUCTION OF RAW MATERIAL

Because of the high percentage of cores in all three raw material groups at Camp Pincham and the fairly large percentages of cores in the most reduced class "rotated without cortex" in the quartz and fine grained groups, it would appear that these artefacts represent a large amount of situational gear. Situational gear was described by Binford (1979) and expanded upon by Camilli (1989: 23). Camilli stated that there was a strong link between the length of

stay at a site and the amount of situationa gear found at the site as this type of gear was not carried on to the next site. If this is the case at Camp Pincham, then this site would fit the seasonal residential type camp as described by Bamforth (1991:227). This contention is in line with comments on the NPWS site report that states that the whole site was large by Warrumbungle National Park standards before it was altered by reconstruction of the car park, also suggesting it could have been a residential type site.

Camilli (1989:23) stated that there is a strong relationship between the amount of debitage at a residential site and discarded curated tools. The fine grained artefacts, however, although curated at this site do not show that relationship, as there is a large percentage of fine grained cores and little debitage.

2) REDUCTION OF RAW MATERIAL

The large amount of coarse grained artefacts present suggest that this material was being utilised here to a greater extent than at other sites.

3) REDUCTION OF RAW MATERIAL

There is a large number of coarse grained flaked pieces present without cortex (20 out of a total of 22). These artefacts have come from further down the reduction sequence than the primary knapping. This is the highest percentage of coarse grained flaked pieces without cortex in any site and suggests a much higher reduction of this material at Camp Pincham than at other sites.

4) REDUCTION/PREFERENCE FOR RAW MATERIAL

The small number of coarse grained cores present (only 2 out of an assemblage of 68) suggests that this material was being reduced further here than at the other sites. This also suggests that the coarse grained material was being used instead of the fine grained material to some extent. This replacement of fine grained with coarse grained also suggests that the effort to obtain the fine grained raw material was too great at this site. This would also strengthen my contention that this site was largely residential and journeys to obtain the fine grained raw material were costly in terms of time and effort. If this high percentage of coarse grained is connected with the rationing of the fine grained material, than Camp Pincham may be further away from reliable fine grained sources than the other four sites.

As very little debitage was recorded for the fine grained, it is doubtful that the fine grained was used for personal gear. One criterion, according to Binford (1979:262) of the use of personal gear in a site, is the presence of a large amount of debitage from the maintenance of

this gear.

5) STRESS, INEXPERIENCE IN KNAPPING, SMALL SIZE OF RAW MATERIAL

The presence of the second largest percentage of bipolar cores in quartz and the presence of the only fine grained and coarse grained cores knapped by the bipolar method suggests that some pressures were being exerted on the Aboriginal inhabitants of this site. If bipolar knapping was alternatively a sign of inexperience in knapping the raw material, then the knappers were much more experienced at the Crazyman Shelter and the Kawambarai cave than at Camp Pincham. The range of core lengths at Camp Pincham (8 to 68 mm) would suggest that small raw material size was not the reason for bipolar knapping. This is in contrast to Wall's findings that bipolar knapping techniques were used to reduce only small raw materials. There is a low percentage of quartz flakes with cortex present, 12.5%, which is at least 17% lower than all other sites except Jack Halls Creek Camp site which has only three quartz flakes). This implies that quartz was an important knapping material at this site.

5.6.4 The Ukerbarley Hayshed site summary

1) REDUCTION OF RAW MATERIAL

This site has a higher percentage of fine grained artefacts than the other two open sites and so it would first appear that the source of the fine grained material may be closer to the Ukerbarley Hayshed site. Rationing, as put forward by Hiscock (1988:280),

> *with increasing distance to the raw material source, the proportion of a raw material type in an assemblage decreases, the size of artefacts made on the raw material decrease and the morphology of artefacts is increasingly more reduced*

may explain this difference.

2) REDUCTION OF RAW MATERIAL

Fine grained was not heavily reduced or maintained in this site, but may have been brought in as a type of personal gear. Lurie (1989:47) has argued that the high carrying cost of obtaining raw material from a distance, has a restricts the time left for manufacturing artefacts. As a consequence of this time restriction, curated artefacts will be smaller in size and less waste will be left from their manufacture. This fits in well with fine grained artefacts at the Ukerbarley Hayshed site as there were smaller amounts of debitage (flaked pieces plus microdebitage) per number of flakes at this site.

3) REDUCTION OF RAW MATERIAL

Low core and high flake numbers per total raw material support the contention that cores were taken from the site probably as personal gear, while flakes were not. Cores were most likely to be made from local pebbles (principally quartz) and taken as personal gear.

4) REDUCTION OF RAW MATERIAL

The present landholders have recently found a good supply of red and white ochre at this site and I would suggest that this area with its resources would make it an attractive area for ceremonial purposes. If this site was used for a meeting/ceremonial place then low debitage percentages would be expected as stays would probably be of short duration and more controlled knapping would occur. This I would argue, would be in keeping with a site used for special purposes where knapping was not the prime purpose at hand such as appears to have been occurring at Jack Halls Creek Camp site. When knapping occurred at the Ukerbarley Hayshed site , it was done carefully, leaving the smaller flaked pieces.

5) REDUCTION OF RAW MATERIAL

The small number of fine grained and coarse grained cores (2 each) were too small a sample on which to base any trends, except that cores were little used or alternatively were carried away from the site. As there was little debitage found, this would fit the criterion that this was a short term camp site as described by Bamforth (1991:227). The present owners of the property, Milton and Jane Judd, state that oral history handed down to them through previous owners of the property relates to how this spot was used as a meeting place for large gatherings of Aborigines. A combinatior of oral European history, the availability of red and white ochre on site and the attributes of artefacts analysed suggest that this site could have been connected with ceremonial activities. This is supported by attributes of the fine grained material which was not heavily reduced and the very small amounts of microdebitage present. This suggests that the fine grained was probably personal gear and was carried in by Aborigines from the region and beyond.

6) DEGREE OF TRAMPLING

The high percentage of flakes with transverse snaps in all three raw material groups suggests that this site although an open site, was heavily trampled in the past. The meeting place would have been subject to trampling but probably not a lot of knapping, although a good supply of quartz and coarse grained (quartzite) raw material was available within 200 metres of the site (personal observations).

6.6.5 Jack Halls Creek Camp site summary

1) PREFERENCE FOR RAW MATERIAL

Jack Halls Creek Camp site, although it is situated very close to the two shelters (5.5 and 6.5 km from the Kawambarai cave and the Crazyman Shelter respectively) displays the greatest differences in attribute percentages to all other sites. Jack Halls Creek Camp site did, however, seem typical of many of the sites recorded in the Warrumbungle National Park in 1986, inasmuch as it had a very high proportion of quartz artefacts per assemblage (see Table 2.1).

2) PREFERENCE FOR RAW MATERIAL

Very little fine grained material was found in this site, and very little debitage was present, suggesting that repairing of personal artefacts (if the fine grained was used for that purpose) was not occurring to any extent at this site. I would argue that the fine grained material was not easily accessible near this area.

3) PREFERENCE FOR RAW MATERIAL

The amount of coarse grained material, 20 out of a total of 520 artefacts and one was a hammerstone) suggests that the coarse grained material was seldom knapped and its primary function would seem to have been as hammerstones or backup knapping material.

4) PREFERENCE FOR RAW MATERIAL/REDUCTION

The small number of fine grained artefacts present at this site (only 14 - of which 10 were cores) suggests that the source of this superior knapping material was not close by. The preference for bipolar knapping the quartz on site could be suggestive of a certain amount of stress on the population (Jeske 1992:180-181), or that the skills necessary to reduce pebbles by the freehand method were not present. If time was of essence then this raw material and the knapping method could be used quickly.

5) REDUCTION OF RAW MATERIAL

The recovered raw material assemblages had low flake percentages suggesting that obtaining flakes to be used elsewhere was the prime objective of this site. Kuhn (1994:432-437) has pointed out that :

> *The best overall strategy to maximise utility per unit mass is to carry many smaller flake tools, as long as they are within a certain size range.*

Kuhn suggests that flakes 1.5 to 3 times the minimum usable size provide the most economical option. Because of the lack of flakes and the abundance of cores at Jack Halls

Creek Camp site, it would appear that if Kuhn's model was valid, then the flakes were being carried away from the site as the most economical option, with the majority of cores left on site.

6) RATIONING OF RAW MATERIAL

Because of the high percentage of quartz cores in this site that were still in the primary stage of reduction (cortex and not rotated class), it suggests that this raw material was plentiful in the area and that minimum rationing was occurring. At this site the mean dimensions of quartz cores were the highest for all five sites.

7) REDUCTION OF RAW MATERIAL

It is doubtful that the fine grained was used as personal gear in this site as large percentages of debitage and very few cores are the normal trademarks of personal gear in a site and this site had very little debitage (no flaked pieces and only one piece of microdebitage) but a large percentage of fine grained cores/fine grained assemblage.

8) DEGREE OF TRAMPLING

Total flake numbers in Jack Halls Creek Camp site were so small that the percentage of transverse snaps in the flake sample cannot be used as a measure of human behaviour.

9) STRESS, INEXPERIENCE IN KNAPPING, SMALL SIZE OF RAW MATERIAL

The high percentage of bipolar knapped quartz cores in this site, may imply that social pressures were being exerted on the population. When time is valuable, a bipolar assemblage, although not very aesthetic, is nevertheless functional and serves most purposes. These pressures could have been associated with lack of raw material(but this is unlikely due to many quartz cores not being reduced to their fullest extent. The pressures would be more likely connected to other factors such as time consuming activities such as warfare and ceremonies) or for making other tools (for example from wood, bone or string), or acquiring food (for example hunting, scavenging, gathering), or environmental activities (for example drought or flood). These activities would leave less time for stone knapping.

If bipolar knapping (instead of reducing the quartz by the freehand method) was a sign of inexperience in knapping, then the knappers were much more experienced at the Crazyman Shelter and the Kawambarai cave in reducing quartz by the freehand method, than at Jack Halls Creek Camp site. This, however, seems unlikely given that the Crazyman Shelter is probably a residential site. The range of core lengths at Jack Halls Creek Camp site (7 to 80 mm) suggests that small raw material size was not the reason for bipolar knapping.

6.7 OVERALL CONCLUSIONS RELATING TO THE FIVE SITES

6.7.1 Overall site characteristics

After the detailed analysis of each site's assemblage, it is necessary to examine overall site cahracteristics. Archaeological indicators of camp site functions were described earlier in section 3.7 (Bamforth 1991). The Crazyman Shelter, Camp Pincham and Jack Halls Creek Camp site show some indications of residential type camp sites. These assemblage indicators were :

1. Large proportions of cores.
2. More highly reduced cores (especially fine grained).
3. A large range of core sizes including large cores.

This may indicate that a range of activities were taking place in these sites, with site furniture (for example very large cores) present, and artefacts being made and used on site (situational gear) as well as possibly being made for specialised activities off-site(personal gear).

Kawambarai cave and Ukerbarley Hayshed sites in contrast, showed indicator of limited use sites. These indicators were :

1. Very few cores per assemblage.
2. Cores that were small and less reduced than at the residential type sites.

At Kawambarai cave there is a large proportion of microdebitage, which may indicate the maintenance of specialised artefacts (personal gear), which have been carried away from the site.

These conclusions must remain somewhat tentative, however, as more specific evidence for site function is lacking.

The analysis of the five Coonabarabran sites also showed that there were major differences between the shelters and open sites. Although the the two groups of assemblages generally looked similar, there were subtle differences when the assemblages were broken up into their respective artefact categories and classes. Fine grained flakes were present in the shelters in higher percentages and more highly reduced in the shelters, than in the open sites. Fine grained flakes in the shelters had, however, lower percentages of cortex present suggesting they were reduced more in the shelters than in the open sites.

Analysing only the fine grained material would have failed to uncover some traits of human behaviour but this was not consistent across all sites. In some cases there was little difference in attributes between the two main raw materials - quartz and fine grained.

Overall conclusions as to the importance of quartz across time and space are discussed in the next chapter.

CHAPTER SEVEN
DISCUSSIONS AND CONCLUSIONS

7.1 INTRODUCTION

The general aim of this thesis was to make quartz technology better known and to assess the problems and potential of quartz containing assemblages. The large percentages of quartz in many assemblages in Southeastern Australia (Witter 1992:43) and indeed around the world (for example, Breuil and Lantier 1965:117, Deacon 1976:57, Van Noten 1977:35, Flenniken 1981:41, Noone 1940:1-24, Saville 1993 :59), highlights the significance of any work defining the importance of quartz to prehistoric knappers. Quartz may be unpopular with many researchers who analyse stone artefacts, but its presence in stone assemblages cannot be ignored if all inferences of human behaviour contained in a stone assemblage are to be explored. The results from this research then, could have implications for any assemblage containing quartz. Following a review on the problems and potential of quartz analysis, a discussion of how the results from this research fit in with the generally accepted view of Aboriginal stone technology . The final sections in this chapter re-examine the model for quartz use in the study proposed in Chapter 2, and suggest future research.

7.2 QUARTZ IN AUSTRALIAN ASSEMBLAGES

The problem of the recognition of knapped quartz is, however, dependent on identifying that context in which artefacts are found, as well as their physical features (see Chapter Three for definitions). Potentially quartz could be analysed more frequently carried out by researchers than is currently practised.

Quartz has obviously played a role in the life of people from the Coonabarabran/ Warrumbungle region for the last 20,000 years. Quartz occurs in all the sites studied and quartz artefacts make up at least 40% or more of all the assemblages. The role of quartz may have changed over time. In the late Pleistocene/early Holocene phase, quartz was used preferentially to produce flakes. This continued throughout the Holocene, although more specialised artefacts such as backed blades were also produced from about 5000 to 1000 years ago, and a preference for quartz was replaced by fine grained material. In the last 1000 years, quartz again becomes dominant, no backed blades were made, and bipolar flaking of quartz occurs in some sites. These observations suggest that quartz has always been an important raw material, but that there have been differences in its role in knapping technology.

Very similar patterns of quartz use can be seen at other excavated rockshelters in

Southeastern Australia where quartz is accessible. Quartz is found in most Southeastern Australian assemblages which date from the Pleistocene to the late Holocene period. Pleistocene to mid Holocene Aboriginal shelter sites that contain varying percentages of quartz include Birrigai, south of Canberra (Flood et al. 1987), Kings Table Shelter, in the Blue Mountains, west of Sydney (Stockton and Holland 1974), Bone Cave, about 200 km northwest of Hobart, Tasmania (Niven et al.1993), Shaws Creek 2 in the Blue Mountains, west of Sydney (Kohen, Stockton and Williams 1984), Cave Bay Cave on Hunters Island, Tasmania (Bowdler 1979). Mid Holocene sites that also include quartz artefacts in their assemblage include Horseshoe Falls in the Blue Mountains, west of Sydney (Stockton and Holland 1974), Bendemeer 2, north of Tamworth (McBryde 1974), Bobadeen near Cassilis (Moore 1970). Late Holocene sites with quartz include Maidenwell rockshelter, about 130 km northwest of Brisbane (Morwood 1986), Bendemeer 1 north of Tamworth (McBryde 1974), Sandy Hollow 1 (Moore 1970), Sassafras 1 and Sassafras 2, about 190 km southwest of Sydney (Flood 1980), Caddigat Shelter (Flood 1980), Bobs Cave near the Sassafras site (Boot 1993). Recent assemblages are often dominated by quartz. Recent sites that have quartz in their assemblages include Yankee Hat 1 and Yankee Hat 2, south of Canberra (Flood 1980), Mumbulla Creek near Bega (Hiscock 1982), Gatton shelter, about 130 km southwest of Brisbane (Morwood 1986), Lyre Bird Dell Shelter 2 in the Blue Mountains, west of Sydney (Stockton and Holland 1974), Gymea Bay near Sydney (Megaw and Wright 1966), Bogong Moth 2, south of Canberra (Flood 1980), Durras North, near Sydney (Lampert 1966) Burrill Lake, about 180 km southwest of Sydney (Lampert 1971), Cave Bay Cave on Hunters Island, Tasmania (Bowdler 1979). Quartz is a widely occurring for making artefacts, and so was important throughout Southeastern Australia and not just in the Coonabarabran /Warrumbungle region. However, there are practical problems in analysing quartz artefact assemblages.

7.3 THE ANALYSIS

This study has demonstrated that quartz artefacts can be successfully analysed using a technological approach. In general the findings illustrate that selected attributes of quartz artefacts can be widely used for comparisons with other raw materials despite the lack of formal knapping characteristics. The results from Chapter Five and Six have pinpointed which aspects of human behaviour would have been missed or deemed as unimportant, if only the fine grained portion or the fine grained and coarse grained portions of the assemblages had been analysed in the Coonabarabran Region (these are compared on the following page).

From these results, it has become clear that in some instances including the quartz artefacts in the analysis would have revealed more inferences of past behavioural patterns of the

Aborigines of the Coonabarabran region, than if only the fine grained material had been analysed. This points to the importance of quartz to the local Aboriginal population in prehistoric times and by inference to other assemblages in Southeastern Australia and the world.

The results from this research and that from my Honours research (Gaynor 1987) show that the percentages of the fine grained material varied greatly through time at the two shelters, the Crazyman Shelter and Kawambarai cave. This was also apparent across the region where access to this raw material seemed to be more restricted at sites such as at Camp Pincham (the most westerly site), and at Jack Hall Creek Camp site (the most easterly site). It appears from the results of the analysis, that fine grained material may have been more accessible at the Ukerbarley Hayshed site because it had a higher percentage of fine grained artefacts present than the other two open sites.

Percentages of the fine grained artefacts in the surface phases in the two shelters were over twice as high as those in the open sites, but this could have been related to certain biases. Rolland and Dibble (1990:488) have found in Europe that :

> *rockshelters and cave sites contain, on balance, greater variability in assemblage composition and many more instances of intensively reduced assemblages than do open air sites.*

This may also be true for the Coonabarabran/Warrumbungle region, but what is more evident here, however, is that leaving out the quartz and coarse grained portions of all assemblages in the Coonabarabran/Warrumbungle Region, only addresses less than half of the assemblage, except in the period between C.5000 and C.1000 BP in the shelters. The results of the analysis of the assemblages from the Crazyman Shelter and other sites in the Coonabarabran/ Warrumbungle Region, point to the fact that quartz and the strategies used to reduce this raw material, played a very large part in the everyday life of Aborigines in the past. Even when the emphasis was on backed blade production, quartz with all its inherent knapping difficulties, was still being used to make backed blades (of the 26 backed blades recovered at the Crazyman Shelter, 11 were made from quartz).

Archaeologists familiar with quartz artefacts, would know that when you compare certain technological attributes (such as overhang removal) between fine grained and quartz flakes, you are bound to end up with many more instances of this attribute being recorded for the fine grained material than on the quartz flakes. According to Hiscock (1986) the presence of

overhang removal is important in assessing knapping skills. In view of this and other attributes generally not visible on quartz, the attributes I chose for the analysis were those that I thought would be suitable for both quartz, the fine grained and the coarse grained material from the Warrumbungles. These attributes may have seemed simplistic to some researchers dealing with fine grained material such as chert, jasper, chalcedony or mudstone, but in order to get a fair comparison, I felt this was the necessary path to take. Quartz has not figured greatly in any typological analysis (one exception was by Moore 1970), because of inherent knapping qualities, so a technological analysis, because it is not confined by typological aspects, was more suited to an analysis of an assemblage containing quartz.

Tables 7.1 and 7.2 (see following pages) list the differences between the quartz and fine grained attributes through time and space, highlighting those that point towards certain inferences of human behaviour that would have been missed if the quartz portion of the assemblage had not been analysed at the Crazyman Shelter or the other four sites.

These tables show just as many differences between the quartz and the fine grained material at the Crazyman Shelter through time, as there were for the surface sections of the five sites. Most differences occurred in attributes that imply human behaviour regarding the reduction and rationing of raw material. This would strongly suggest that the ability to handle quartz in relation to the fine grained material differed markedly in the reduction process, as the original tables in Chapters Five and Six, from which these tables were derived, show these results were not consistent across all sites or between the four phases at the Crazyman Shelter.

The tables also show that there were more cases of differences of interpretation between the fine grained analysis and the whole assemblage in two open sites (Camp Pincham and Jack Halls Creek Camp site) than in the other sites. Many of these differences were about the reduction and/or the rationing of the raw material. The results from Camp Pincham stand alone in having large differences in debitage percentages between the quartz and fine grained material, suggesting that very little reduction (either in the initial reduction sequence or by artefacts being retouched) of fine grained material was occurring on this site. There were large differences in the percentage of cores with cortex between the quartz and fine grained at Jack Hall Creek Camp site and also in the surface phase (1) of the Crazyman Shelter. This suggests that quartz was more plentiful around each site (but some rationing of quartz seemed to be occurring at the Crazyman Shelter) Access, however, to the fine grained material, seemed to be much more restricted at these sites.

CMS BEHAVIOURAL INFERENCES ATTRIBUTES DIFFERENCES
TABLE 7.1

BEHAVIOURAL INFERENCE	*ATTRIBUTE*	*PHASE*	*PRESENT IN QUARTZ*	*PRESENT IN FG*	*missed if only FG analysed*
PREFERENCE FOR	**HIGH %**		phases 1,3,&4	phase 2	**YES**
RAW MATERIAL	**LOW %**		phase 2	phase 1, 3, and 4	**YES**
REDUCTION OF RAW MATERIAL	**HIGH % CORES**	3 & 4	43.15%, 55.75%	18.52%, 27.06%	**YES**
	LOW % CORES	1 & 2	21.38%, 28.85%	13.49%, 14.35%	**YES**
RATIONING OF RAW MATERIAL	**HIGH % NON ROTATED**	2, 3 & 4	31.72%, 44.03%,67.01%	10.75%,12.21%, 21.74%	**YES**
	CORES WITH CORTEX	1	12.90%	5.88%	**NO**
RATIONING OF RAW MATERIAL	**% OF CORES WITH CORTEX**	3 & 4	77.89%, 84.85 %	37.29%, 47.83%	**YES**
		1 & 2	48.48, 65.97%)	5.88%, 34.05%	**YES**
RATIONING OF RAW MATERIAL	**% OF FLAKES**	1 & 3 & 4	28.26%, 24.95%, 40%	5.09%, 4.27& 0%	**YES**
	WITH CORTEX	2	17.81%	16.2%)	**NO**
REDUCTION STRATEGY	**PERCENT OF**	1 & 2	6.21%, 49.76%	11.22%, 55.99%	**NO**
	FLAKED PIECES	3 & 4	11.69%, 20.69%	22.63%, 31.76%	**TO SOME EXTENT**
REDUCTION STRATEGY	**PERCENT OF**	1 & 3	21.74%, 26.27%	10.26%, 12.39%	**YES**
	COMPLETE FLAKES	2	34.92%	47.07%	**NO**
		4	25.71%	25%	**NO**
DEGREE OF TRAMPLING	**% OF TRANSVERSE**	1	30.94%	58.97%	**YES**
	FLAKE BREAGAGE	2	50.27%	45.86%	**NO**
		3	37.88%	57.27%	**YES**
		4	42.86%	10%	**YES**
KNAPPING SKILLS	**LOW/HIGH**	1	47.85%	58.97%	**NO**
	% OF LONGITUDINAL	2	38.62%	45.86%	**NO**
	FLAKE BREAKAGE	3	50.31%	57.27%	**NO**
	(LOW = HIGH SKILLS)	4	37.14%	70%	**YES**

5 SITES BEHAVIOURAL INFERENCES ATTRIBUTES DIFFERENCES
TABLE 7.2

BEHAVIOURAL INFERENCE	*ATTRIBUTE*	*SITE*	*PRESENT IN QUARTZ*	*PRESENT IN FG*	*missed if only FG analysed*
PREFERENCE FOR	**HIGH % OF QUARTZ**	JHCC	94.36%	N/A	YES
RAW MATERIAL (quartz)	**LOW % OF QUARTZ**	CMS, KACA	57.31 %, 64.55 %	N/A	YES
PREFERENCE FOR	**BELOW AVERAGE % OF CG**	JHCC, KACA, CMS	N/A	N/A	YES
RAW MATERIAL (CG)	**IN TOTAL ASSEMBLAGE**				
	ABOVE AVERAGE % OF CG	CP, UKBH	N/A	N/A	YES
	IN TOTAL ASSEMBLAGE				
REDUCTION OF RAW MATERIAL	**% MICRODEBITAGE**	UKBH	0%	0%	NO
		CP	21.70%	0%	YES
		KACA, CMS	40.99 %, 30.99 %	30.99 %, 44.90 %	NO
REDUCTION OF RAW MATERIAL	**HIGH % OF FLAKES**	CP	2.99%	20%	YES
		JHCC	0.62%	21.33%	YES
		KACA, CMS,	31.72 %, 23.94 %,	40.21 %, 26.53 %	NO
		UKBH	40%	75%	YES
RATIONING OF RAW MATERIAL	**HIGH % NON ROTATED**	JHCC	57.25%	10%	YES
	CORES WITH CORTEX	CMS	13.79%	5.88%	NO
		CP	29.59%	25%	NO
RATIONING OF RAW MATERIAL	**% OF CORES**	CMS	48.28%	5.88%	YES
	WITH CORTEX	JHCC	85.24%	40%	YES
		CP	47.96%	43.75%	NO
		KACA, UKBH	TOO SMALL A SAMPLE IN FG FOR COMPARISON		

5 SITES BEHAVIOURAL INFERENCES ATTRIBUTES DIFFERENCES
TABLE 7.2

BEHAVIOURAL INFERENCE	*ATTRIBUTE*	*SITE*	*PRESENT IN QUARTZ*	*PRESENT IN FG*	*missed if only FG analysed*
RATIONING OF RAW MATERIAL	**% OF FLAKES**	CMS	28.26%	5.09%	YES
		CP	12.15%	0.00%	YES
		UKBH	40.41%	16.67%	YES
		KACA, JHCC	29.41%,0%	23.08%, 0%	NO
DEGREE OF TRAMPLING	**% OF TRANSVERSE**	CMS	47.83%	35.90%	NO
	BREAKS IN FLAKES	KACA	41.18%	38.46%	NO
		CP	37.50%	0%	YES
		UKBH	68.18%	33%	YES
		JHCC	66.67%	66.67%	NO
KNAPPING SKILLS	**% OF LONGITUDINAL**	CMS, KACA	30.43%, 17.65%	30.77%, 15.28%	NO
	BREAKS IN FLAKES	CP	12.50%	20%	NO
		UKBH	4.55%	16.67%	YES
		JHCC	0%	0%	NO
LACK OF EXPERIENCE IN	**% OF BIPOLAR CORES**	KACA, CMS, UKBH	0%	0%	NO
KNAPPING DIFFICULT MATERIAL		CP	17.34%	25%	NO
		JHCC	66.75%	0%	YES
STRESS IN POPULATION	**% OF BIPOLAR CORES**	KACA, CMS, UKBH	0%	0%	NO
(JESKE'S CONTENTION)		CP	17.34%	25%	NO
		JHCC	66.75%	0%	YES
SMALL SIZE OF RAW MATERIAL	**% OF BIPOLAR CORES**	KACA, CMS, UKBH	NIL %	NIL %	NO
		CP	17.34%	25%	NO
		JHCC	66.75%	0%	YES

Camp Pincham was the only site that had large differences between the percentages of transverse breaks in the quartz and fine grained material. What is more interesting, however, is that Camp Pincham and the Ukerbarley Hayshed site had twice the percentages of fine grained flakes with longitudinal breaks present, than those from the quartz portion of these assemblages. Conversely Kawambarai cave had less than half the longitudinal flake breaks in fine grained than there were in the quartz. This suggests to me that the knappers at Kawambarai cave had much more control over the fine grained material than they had over the quartz. Conversely the knappers at Camp Pincham and the Ukerbarley Hayshed site had more control over the quartz than the knappers at Kawambarai cave. This may have been related to experience in knapping the fine grained material as this percentage of raw material was much higher at Kawambarai cave than at the two open sites. Jack Hall Creek Camp site stands alone with a very high percentage of bipolar knapping present in the assemblage and according to Jeske (1992:180-181), this could indicate a certain amount of stress on these knappers. It could also indicate that the knappers did not possess a high degree of expertise in reducing the quartz by the freehand method, and choose to use an easier method of reduction.

Although this type of analysis did not go into the depth of analysis of flakes and/or cores that has been attempted by some archaeologists (e.g. Hiscock 1984, 1986), it did provide a platform from which to evaluate the importance of quartz in relation to the fine grained portion of the assemblages of the Coonabarabran/Warrumbungle Region. As such, the analysis could be used in other areas of Southeastern Australia and the world, that have large percentages of quartz in assemblages.

The previous tables have highlighted which aspects of human behaviour would have been missed if only the fine grained section of the assemblage had been analysed. It has also shown the importance that quartz had in the lives of the Aboriginal knappers (even though it is unpopular with archaeologists). Although quartz has been regarded as hard and intractable and difficult to interpret (Hiscock 1982:33), my research has been instrumental in showing that by using particular artefact attributes, inferences of human behaviour can be gleaned from the whole assemblage, and comparisons can be made between the quartz, fine grained and coarse grained raw materials. Some of these inferences may be related to particular activities of the prehistoric knappers, while some may be related to changes in stone technology. All changes carry with them a certain amount of risk to prehistoric knappers.

7.4 THE RISK CONCEPT

Hiscock (1994:267) suggested that the exploitation of previously unoccupied landscapes by Aborigines posed significant risks to their survival in the past. Prehistoric highly mobile

Aborigines moving into a new landscape would need to employ risk reduction strategies, whereas more sedentary groups would know the location and abundance of necessary resources (e.g. stone material suitable for knapping).

Other risks involved, were related to stressful environmental change, and the high mobility of the inhabitants. The environmental changes in the mid Holocene were, according to Hiscock (1994:287), correlated with increasing population, the development of long distant trading networks and the regionalization of art styles. In unfamiliar landscapes, dependable supplies of flakable stone were not always guaranteed, so it was an advantage for mobile groups to carry a portable toolkit that could be retouched and used for a variety of activities. Sedentary groups relied on well known local stone sources, and made tools on-site.

If Hiscock's theory is correct then the results from the five recent sites Coonabarabran/ Warrumbungle region suggest that the inhabitants were becoming increasingly sedentary in the period c.1000 to 200 BP. The high percentage of quartz in all surface assemblages recorded in the Coonabarabran/Warrumbungle region is one indicator of this. The Post Microblade phase suggested by Witter (see Chapter two) proposes that Aborigines were living mostly on the flat plains country to the west of the Warrumbungles during this period. If we use Hiscock's theory, then it would appear that the main Coonabarabran/Warrumbungle region was home to many Aborigines year round, and the plains were less frequently inhabited than Witter suggests. This is supported by environmental data which suggests that water was limited on the plains except in very wet seasons.

7.5 CLARIFICATION OF MODEL

7.5.1 Changes from 20,000 BP to 8000 BP (20 310 BP- 7410 BP at CMS)

The results from Phase 4 at the Crazyman Shelter (20310 - 7410 BP) revealed that although there were many quartz artefacts present (61.7% of the assemblage), none were reduced by the bipolar method. The range of lengths in unbroken flakes made on quartz, fine grained and coarse grained material in this phase were the smallest in any phase (see table 5.13). These assemblages are therefore more homogeneous than those of the later Holocene period. Flood (1995:146) has stated that Australian Pleistocene assemblages were much more homogeneous than those attributed to the Holocene period. Length, width and thicknesses was also the smallest in quartz and fine grained cores for any phase (see table 5.9). Given that even with a portion of the assemblage belonging to the early Holocene, the artefacts of phase 4 would support this proposition.

7.5.2 Changes between 8000 and 5000 BP (7410 BP -5090 BP at CMS)

This phase which predates the appearance of the backed blade technology at the Crazyman Shelter and has the highest buildup of sediment in any phase. It showed that this was the period where the Crazyman Shelter was used to a much greater extent than at any time previously. There was a greater demand on raw materials for knapping and quartz had the highest percentage of the raw materials in any phase (70%) in the shelter. This percentage, however,was still not as high as some percentages in the more recent open sites (see table 2.1 and Figure 6.1). The environmental data (see Dodson et al 1992) suggests that the Holocene became warmer and wetter in the period 8000 - 6000 BP. This corresponds with the emergence of the Crazyman Shelter as a site well used by Aborigines, so climatic conditions may have had influenced the inhabitants to use this Shelter. This period is also the time when the Swamp sites at Lime springs and Trinkey dried up (Wright 1986), which then may have influenced movement of people around the landscape as these sites are only 80 km to the east of the Crazyman Shelter.

7.5.3 Changes between 5000 and 1000 BP (5090 BP - 1380 at CMS)

The appearance of backed blades at the Crazyman Shelter (c.4750 BP) occurred within the boundaries of dates obtained from other Southeastern Australian sites, that is between 6000 and 4000 BP (White and O'Connell 1982:117-120). The manufacture of these types of artefacts continued until c.1000 BP at Kawambarai cave (Gaynor 1987:168). These particular artefacts disappeared from the assemblage between 1650 and 1380 (Cal) BP at the Crazyman Shelter.

This phase had the highest percentage of fine grained and the lowest percentage of quartz and the most reduced assemblages in all phases. It also had the highest percentage of debitage (that is flaked pieces plus microdebitage). Hiscock's (1994) model of risk reduction toolkit to accompany a mobile population may fit this period at the Crazyman Shelter. This would explain the high percentage of fine grained material in the shelters which could have been collected during travels.

7.5.4 The last 1000 years (1380 to Surface at CMS)

There is a general increase in artefact density during this phase at the Crazyman Shelter, but the same phase at Kawambarai cave shows decreasing artefact density. This may be related to differing site use (see Chapter Six). Hiscock (1981:33) has also suggested that a technological change in the recent Holocene to a more efficient tool kit or more reliance on wood, bone and shell, or a change in the availability of raw material would affect artefact numbers. The decrease in artefact density at Kawambarai cave since C.1000 (Gaynor

1987:181), may not necessarily be connected with population decrease, but simply a change in technology.

Hiscock (1994:285) has also questioned the view that the diminishing numbers of backed artefacts signalled a reduction in stone knapping skills as implied by Hale and Tindale (1930:204). Instead, he suggests it was a response to new economic stresses. He suggests that it pointed only to a population that was becoming larger and more sedentary. Hiscock also suggested that there was a correlation between becoming more sedentary and the presence of highly reduced assemblages made on local stone. These assemblages would have few retouched flakes present. The results from the five sites show that there were no retouched artefacts present in these assemblages and quartz (the local stone resource at all sites) was dominant. Many of the open sites analysed by Gaynor (1987:171) contained 90 to 100% quartz. These results then are in keeping with Hiscock's model. The assemblage at the Crazyman Shelter in this period had the lowest percentage of cores in quartz and fine grained, the highest percentage of highly reduced cores in quartz and fine grained, the highest percentage of flakes in all three raw material groups, and the highest percentage of microdebitage. Collectively the percentages of these attributes imply increased pressures on local stone resources and much reduced assemblages.

It does also appear that if backed artefacts were being made up to European contact in some areas in Southeastern Australia as claimed by Hiscock (1994:284-285), they were not evident in any non-eroded surface sites in the Coonabarabran/ Warrumbungle region or in the surface phases of the excavated shelter sites used in this research. Morwood (1986:98) also noted the disappearance of backed blades from the Maidenhead Shelter assemblage in Southern Queensland at c.1000.

7.6 FUTURE RESEARCH

Future research needs to be directed to other assemblages in order to compare the quartz technological sequence in the Coonabarabran/Warrumbungle region with other sites. Appropriate researches could be:

1. To extend the analysis of quartz to nearby sandstone regions to a site with a large percentage of quartz . Such a site could be Bobadeen This site is about 120 km east of Coonabarabran and has a base date of of approximately 8000 BP. As this site, as far as I know, has not been the subject of a technological analysis, it could hold valuable clues to various ways of knapping quartz as well as other inferences of human behaviour. On the level of knapping skill at Bobadeen, Moore (1970:45-46) has commented :

The extraordinary quality of the quartz-working at this site surprised all those excavating. Quartz Bondis ranged from perfect specimens to rough stubby ones, but some of the quartz crystal geometric microliths, many less than a centimetre in length, could scarcely be believed to be man-made, until they were placed under a medium powered microscope,when it could be seen that there was unquestionable secondary working along the backs

It would be very useful to compare the technological sequence at Bobadeen with phases 1 to 3 at the Crazyman Shelter.

2. A technological analysis of a total assemblage from a spring/swamp such as Trinkey or Lime Springs (Wright 1986). These site are about 80 km to the east of Coonabarabran. This would seem to be another step to cover a full range of site types in the northwestern region of NSW.

3. To carry out a technological analysis of a total assemblage where only one raw material from the assemblage had previously been technologically analysed (e.g. such as the Sandy Hollow assemblage analysed by Hiscock (1986)), which is about 200 km east of the study area. This site has also been the subject of a typological analysis (Moore 1970).

In conclusion, this thesis has provided a way of addressing the problem of identifying, measuring and quantifying quartz in artefact assemblages. This has been a problem that has endured for many years. The method of analysis used in this thesis provides links between behaviour and attributes, which lend themselves to further testing. One of the strengths of this method of analysis is that it can be widely applied to a range of assemblages in Australia and elsewhere. The limitations may be that the method is better suited to assemblages based on pebbles rather than on reef quartz.

This thesis, however, should encourage archaeologists to explore other ways of analysing quartz so that it is comparable with all raw materials found in assemblages. From the results of this analysis of Aboriginal stone assemblages, it is clear, that further inferences about human behaviour will be forthcoming if all the raw materials in an assemblage are technologically analysed. This will add to the knowledge that is available to local Aboriginal communities in their quest to preserve their culture, as well as providing a more comprehensive database for archaeologists.