4.4.1 *'In doing so, the project will impact on the ability of future generations of Aboriginal people to interpret the landscape the way their ancestors might have'.*
Our Recommendation 1. That this statement is amended to read *'In doing so, the project will impact on the ability of present day and future generations of Aboriginal people to access and interpret the landscape the way their ancestors ~~might~~ have.'*

From here on, I will only make comments, in general, regarding a number of comments in the report regarding inflated assessments, disputed artefacts, registered and unregistered known sites and whether or not they are on any public register.

As mentioned previously, in my opinion, *'a cut into the hill'* proposed to us in June 2012 is an entirely different proposal to removing the entire crest of the hill of some 27 metres. Regardless, we expressed our concerns then and we continue to do so. A meeting with the developer in 2013 failed to convince him that, whilst there may be a belief that you can move artefacts from one place to another, for their protection, you cannot move significance, cultural expression or interpretation, in the same way.

I support the Aboriginal monitors views and those of Elder Des Williams, Chairperson Tweed Byron LALC. Recommendation 1 in the report and other comments seriously question our cultural integrity and our ability to determine the significance of our own heritage.
The comments made about *inflated assessments* are purely from a scientific perspective.

It is interesting to note that a number of sites from the Bundjalung Mapping Project (BMP) are not marked on the Figure 6 map on page 34, as would be expected, though they get a mention in Appendix C. Another layer on the same map, displaying their BMP number, would have displayed a more accurate record of the cultural landscape in that vicinity. In addition, a slight shift of the map limit to the south would have shown the close proximity of the Fraser Drive midden, Registered site 04-2-0088.

Approximately 500 metres to the south east of the project, another midden was recently uncovered by BMX riders and is yet to be recorded. This demonstrates that all of our data bases that keep a record of our cultural landscapes are works-in-progress, a living document, whether it be the AHIMs register, the BMP or the Tweed Shire Aboriginal Cultural Heritage Management Plan, (ACHMP) so it unreasonable to expect that everything should be, by now, on the public record and that, if it's not in the records, it could be assumed that *'It is more likely that such assertions relate to attempts to protect the intangible (non physical) values of the project'.*(page 84. 10.1.2)

The Tweed Shire ACHMP project began almost 2 years ago and although fairly comprehensive, it is recognised, that there are still places that need to entered into the system, as well as particular knowledge held by persons not willing to allow the information to be recorded.

Our Recommendation 2: Further consultation required.
Our Recommendation 3: Further investigation required for rock formations on slopes bench

Yours sincerely, (P.S.Error in Adam's surname. Should read Adam Mazzarella)

Jackie McDonald…Great great Granddaughter of Kitty Sandy of the Tweed Valley
Aunty Joyce Summers…Community Elder, member Aboriginal Advisory Committee

APPENDIX B: OEH ARCHAEOLOGICAL CODE OF PRACTICE CHECKLIST

REQUIREMENTS MET		Yes	No
Requirement 1: Review previous archaeological work			
	Requirement 1a - The Review of previous archaeological work:		
□	is appropriate to the scope of works	✓	
□	includes an AHIMS search	✓	
□	synthesises the known archaeology and ethnohistory of the region	✓	
□	evaluates the results of any previous reports for the subject area in light of current knowledge	✓	
□	describes the range and nature of Aboriginal sites & features present within & near the subject area	✓	
□	describes existing predictive models that are relevant to the project and subject area	✓	
□	is presented as a map showing the location of previously recorded sites / areas of previous surveys	✓	
	Requirement 1b - The AHIMS searches:		
□	are contemporaneous with the project	✓	
□	include an area larger than, and wholly containing, the subject area	✓	
□	include an area large enough to allow adequate landscape interpretation	✓	
□	include a search for any previous reports relevant to the subject area	✓	
□	have been assessed to determine the robustness of the search	✓	
□	the date of AHIMS search & AHIMS client service number is referenced in the Archaeological Report		
□	Other registers searched include NSW State Heritage Inventory & The Australian Heritage Database	✓	
Requirement 2: Review the landscape context			
	The landscape description:		
□	describes the landscape history at a an appropriate scale	✓	
□	describes the landforms present within the subject area using generally accepted classifications	✓	
□	identifies the primary modes of geomorphic activity in the subject area: aggraded, aggraded or eroded (stable), or eroded	✓	
□	determines if objects are likely to be concealed below the ground surface or revealed by erosional processes	✓	
□	identifies the forms of erosion within the archaeologically surveyed area, and subject area as a whole	✓	
□	describes the soils present and, where available, outlines their formation history	✓	
□	describes the land-use history of the subject area	✓	
□	describes, and/or maps the natural resources & features that will have influenced past use of the landscape	✓	
□	is explicitly referenced in the predictive model (see Requirement 4)	✓	
□	The landscape context is documented in the Archaeological Report as set out in Requirement 11.	✓	

Requirement 3: Summarise the local & regional character of Aboriginal land use and its material traces			
□	Requirements 1 & 2 are synthesises in the Archaeological Report	✓	
Requirement 4: Predict the nature and distribution of evidence			
	Requirement 4a - The Predictive model:		
□	integrates the distribution of known sites, landscape units interpreted in terms of their archaeological potential	✓	
□	characterises the patterning of material traces, evidenced in the ethnohistorical review	✓	
□	considers the distribution of natural resources, and the probable land-use strategies	✓	
□	considers the spatial and temporal relationships of sites	✓	
□	identifies what sorts of material traces are predicted to be present, and in what densities	✓	
□	makes inferences about past Aboriginal occupation of the landscape based on the evidence collected	✓	
	Requirement 4b – The Predictive model results:		
□	present statements of archaeological potential about areas that can be verified using archaeological methodologies	✓	
Requirement 5: Archaeological survey			
	Requirement 5a - The Survey sampling strategy:	✓	
□	includes all landforms that will potentially be impacted	✓	
□	places a proportional emphasis on those landforms deemed to have archaeological potential	✓	
□	describes how sampling relates to the footprint that is proposed to be impacted by the development	✓	
□	clearly states when a full coverage survey will be undertaken and justify when it is not	✓	
□	is documented in the Archaeological Report as set out in Requirement 11	✓	
	Requirement 5b – The archaeological survey has:	✓	
□	surveyed an area, on foot, for the purposes of discovering Aboriginal objects	✓	
□	been conducted in accordance with the sampling strategy above	✓	
□	been carried out using accurately defined and named survey units (see Requirement 5c)	✓	
□	included representative photographs of survey units and landforms where informative		
	Requirement 5b - The archaeological survey has:		
□	recorded landform and general soil information (see Requirement 2) for each survey unit	✓	
□	recorded the land surface and vegetation conditions encountered during the survey	✓	
□	recorded any Aboriginal objects (including those already on AHIMS) observed during the survey	✓	
□	recorded survey coverage – see Requirement 9	✓	

□	been used to calculate survey effectiveness – see Requirement 10, and	✓	
□	been accurately mapped and presented visually at an appropriate scale	✓	
□	been documented and summarised in the Archaeological Report as set out in Requirement 11	✓	
	Requirement 5c – The archaeological survey units recorded include:	✓	
□	the beginning and end points of transects or boundaries of survey units as otherwise defined	✓	
□	the beginning, length, and end points of transects using a handheld GPS receiver	✓	
□	the spacing between survey personnel	✓	
□	the beginning and end of transects, or survey unit boundaries	✓	
Requirement 6: Site definition has been described using the following criteria:			
□	the spatial extent of the visible objects, or direct evidence of their location		✓
□	obvious physical boundaries where present, e.g. mound sites and middens, a ceremonial ground		✓
□	identification by the Aboriginal community on the basis of cultural information		✓
Requirement 7: Site recording			
	Requirement 7a - Information to be recorded		
□	Site recording provides the information required to complete the current AHIMS Site Recording Form		✓
□	when applicable used the appropriate AHIMS Feature Recording Form		✓
□	identifies the site boundaries and indicate how they have been determined		✓
□	provides an accurate site plan, using professional judgment to determine appropriate scale and precision		✓
	Requirement 7b - Scales for photography		
□	All photographs include an appropriate graded metric scale		✓
Requirement 8: Location information and geographic reporting			
	Requirement 8a - Geospatial information recorded using a GPS receiver includes:		
□	the location of objects and sites		✓
□	the location of survey units (both location and area of survey units)	✓	
□	the location of landscape units (Requirement 2)	✓	
□	the location of test excavation units (Section 3.1)		✓
□	the location of other relevant features.	✓	
	Requirement 8b - Datum and grid coordinates are:		
□	reported as grid coordinates using the Map Grid of Australia 1994 (MGA94) cartesian coordinate system	✓	

☐	checked and confirmed using a 1:25,000-scale topographic map (or the next best available scale)	✓	
Requirement 9: Record survey coverage data			
	When recording survey coverage data:		
☐	visibility and exposure are independently described for each survey unit	✓	
☐	visibility has been determined and recorded to the nearest 10%	✓	
☐	exposure has been described in terms of the natural erosion processes and / or contributing processes	✓	
☐	exposure has been estimated to the nearest 10% of the surface area of the survey	✓	
☐	obtrusiveness of above-surface archaeological features and vegetation is described	✓	
☐	coverage appropriately quantified by describing any sampling procedures	✓	
Requirement 10: Analyse survey coverage			
☐	The survey results are presented in table format (see examples) or include justification for other format	✓	
☐	The survey results include a summary of effectiveness of the survey for each landform unit & whole of subject area	✓	
Requirement 11 - Archaeological Report content and format			
	General formatting compliance:		
☐	All pages must be numbered	✓	
☐	All sections and sub-sections must be sequentially numbered	✓	
☐	All tables, charts, plates, figures and appendices must be sequentially numbered	✓	
☐	Headers or footers with a short project name should be included	✓	
☐	Cover and title page complies with requirements	✓	
☐	Report contents complies with requirements	✓	

APPENDIX C: AHIMS SEARCH RESULTS

Site ID	Site Name	Latitude	Longitude	Context/Type	Features
04-2-0065	Site 1	-28.229840	153.563784	artefact	open site camp
04-1-0024	Banora Point	-28.222732	153.553401	midden	earth mound, shell artefact
04-2-0006	Terranora 19, BMP-05-0161	-28.237341	153.539258	midden	open site burial midden
04-2-0007	Terranora 3, BMP-05-0162	-28.237053	153.543640	midden	open site midden
04-2-0017	Barney's Point, BMP-05-0165	-28.222297	153.549322	midden	earth mound, shell, artefact
04-2-0064	Minjunbul Memorial	-28.237305	153.548432	midden	open site midden
04-2-0067	Site 2	-28.225499	153.565901	midden	earth mound, shell, artefact
04-2-0071	Sexton Hill midden	-28.209944	153.550941	midden	open site midden
04-2-0166	Kinnear Aboriginal Midden Site	-28.219795	153.551847	midden	
04-2-0018	Terranora 6, BMP-05-0166	-28.237303	153.548941	Open / camp	open camp site
04-2-0021	Chinderah, BMP-05-0156	-28.249764	153.564753	midden	earth mound, shell artefact
04-2-0036	Cudgen ck 1	-28.298081	153.558889	Open / camp	artefact
04-2-0093	Cudgen	-28.289492	153.562414	Open / camp	artefact
04-2-0100	Cudgen burial Ground	-28.248911	153.552517	Not a site	Burial/s; Not an Aboriginal site
04-2-0091	Duranbah 3	-28.301342	153.533919	Open / camp	artefact
04-2-0111	Seaside City 1	-28.288114	153.568014	Open site	shell
04-2-0113	Seaside City 2	-28.288558	153.569750	Open site	Shell, arefact
04-2-0090	Duranbah 2	-28.301333	153.535958	Open / camp	artefact
04-5-0138	Kings Beach 1	-28.291903	153.568544	Open / camp	artefact
04-5-0139	Kings Beach 2	-28.300750	153.568386	Open / camp	artefact
04-5-0140	Kings Beach 3	-28.303749	153.568456	Open / camp	artefact
04-2-0027	Camp site 1 (NTH)	-28.314706	153.560049	Open site	PAD
04-2-0032	Campsite 1 (Nth)	-28.314706	153.560049	Open site	Ochre quarry, ceremonial ring, Ab. ceremony, scarred tree

Site ID	Site Name	Latitude	Longitude	Context / Type	Features
04-2-0139	Coolangatta Airport-2	-28.170950	153.503578	Open site	artefact
04-2-0140	Coolangatta Airport-3	-28.1749782	153.5074164	Open site	artefact
04-2-0141	Coolangatta Airport-4 Tugun Bypass zone 7	-28.1687763	153.5001548	Open site	artefact
04-2-0076	Coolangatta Airport 5	-28.1668187	153.4979565	Open site	artefact
04-2-0130	Fingal Point Quarry	-28.2038397	153.5665301	Open site	Habitation structure
02-2-0143	Ukerebach Island	-28.1882609	153.5484455	open site	Aboriginal resource/ gathering, habitation structure, PAD
02-2-0144	Fingal Point Community	-28.1943768	153.5606522	open site	Burial, habitation structure
04-2-0171	Anconia Avenue	-28.1911469	153.5045381	open site	shell
04-2-0170	Anconia Avenue	-28.1911469	153.5045381	open site	shell
04-1-0152	Leda 1	-28.1801219	153.4828898	open site	artefact
04-2-0182	KR1 Scarred Tree	-28.1958406	153.5382658	open site	Scarred tree
04-2-0183	KR3 ScarredTree	-28.1957455	153.5371952	open site	Scarred tree
04-2-0103	Kings Forest 1	-28.2923565	153.5231678	Open / camp	artefact
04-2-0102	Kings Forest 2	-28.2959564	153.5262424	Isolated find	artefact
04-2-0146	Kings Forest 7	-28.3017199	153.5524836		artefact
04-2-0098	Cudgen; Old Bogangar Rd	-28.2894925	153.5624144	Open / camp	artefact
04-2-0112	Seaside City a	-28.2881147	153.5680149	Open site	Shell
04-2-0142	KF-CE 1	-28.1713043	153.3250329	Open site	artefact
04-2-0106	Kings forest 3	-28.2915693	153.5619147	Midden	earth mound, shell, artefact
04-2-0104	Kings Forest 6	-28.3167392	153.5485333	Midden/ open camp site	artefact, earth mound shell
04-2-0105	Kings Forest 5	-28.3063308	153.5554154	Open / camp	artefact
04-2-0005	Terranora Broadwater , BMP-05-0160	-28.2110787	153.5329607	Burial/ midden	Earth mound, shell, artefact
04-2-0009	South Tweed Heads Bora Ring, BMP-05-0164	-28.1989370	153.5495606	Bora/ ceremonial/ midden	Earth mound, shell, artefact, ceremonial ring
04-2-0089	Duranbah 1	-28.3008032	153.5382526	Isolated find	artefact
04-2-0092	Duranbah 4	-28.3050537	153.5362341	Open / camp	artefact

Site ID	Site Name	Latitude	Longitude	Context / Type	Features
04-2-0010	Fingal Point	-28.2046334	153.5645164	Burial/s	burial
04-2-0011	Fingal Point; Fingal	-28.2029337	153.5655781	Midden	Earth mound, shell, artefact
04-2-0014	Ukerebagh Island Midden	-28.1974824	153.5471571	Midden	Earth mound, shell, artefact
04-2-0035	Greenbank Island; Tweed Heads	-28.1815248	153.542186	Midden	Earth mound, shell, artefact
04-2-0034	Terranora Inlet Midden, BMP-05-0182	-28.1922035	153.535312	Midden	Earth mound , shell, artefact
04-2-0039	Coolangatta Airport Gate 12; BMP-05-0140	-28.1750943	153.500388	midden	Earth mound, shell, artefact
04-2-0053	N.O.S. 14	-28.3070618	153.516477	Isolated find	artefact
04-2-0076	Fingal Head	-28.1992195	153.563978	Open / camp	artefact
04-2-0077	Fingal Head	-28.2020157	153.564503	midden	Earth mound, shell, artefact
04-2-0013	Fingal Head Aboriginal Cemetery	-28.1965178	153.562436	Burial/s	burial
04-2-0016	Ukerebagh Island, BMP-05-0154	-28.1893544	153.548135	Natural mythological	Aboriginal ceremony/ Dreaming
04-2-0087	Cobaki Broadwater 2	-28.1876321	153.508444	Midden	Earth mound, shell, artefact
04-2-0109	Crescent St 1	-28.2628616	153.545708	open site	artefact
04-2-0084	Restriction applied			open site	
04-2-0019	Restriction applied			open site	
04-2-0020	Restriction applied			open site	
04-2-0021	Restriction applied			open site	
04-2-0028	Restriction applied			open site	
04-2-0029	Restriction applied			open site	
04-2-0031	Restriction applied			open site	
04-2-0035	Restriction applied			open site	

Site ID	Site Name	Latitude	Longitude	Context / Type	Features
04-2-0157	Restriction applied			open site	
04-1-0143	Restriction applied			open site	
02-2-0088	Restriction applied			open site	
04-2-0027	Restriction applied			open site	
04-2-0033	Restriction applied			open site	
04-2-0086	Restriction applied			open site	
04-2-0024	Restriction applied			open site	
04-2-0026	Restriction applied			open site	
04-2-0030	Restriction applied			open site	
04-2-0023	Restriction applied			open site	
04-2-0148	Restriction applied			open site	
04-2-0022	Restriction applied			open site	
04-2-0008	Restriction applied			open site	
04-2-0078	Restriction applied			open site	
04-2-0079	Restriction applied			open site	
04-2-0080	Restriction applied			open site	
04-2-0081	Restriction applied			open site	
04-2-0082	Restriction applied			open site	
04-2-0083	Restriction applied			open site	
04-2-0085	Restriction applied			open site	
04-2-0156	Restriction applied			open site	
04-2-0150	Restriction applied			open site	
04-2-0151	Restriction applied			open site	
04-2-0152	Restriction applied			open site	
04-2-0153	Restriction applied			open site	
04-2-0154	Restriction applied			open site	
04-2-0155	Restriction applied			open site	
04-2-0031	Restriction applied			open site	
02-2-0149	Restriction applied			open site	
04-2-0147	Restriction applied			open site	

Site ID	Site Name	Latitude	Longitude	Context / Type	Features
04-2-0148	Restriction applied			open site	
04-2-0149	Restriction applied			open site	
04-2-0150	Restriction applied			open site	
04-2-0158	Restriction applied			open site	
04-2-0159	Restriction applied			open site	
04-2-0160	Restriction applied			open site	
04-2-0161	Restriction applied			open site	
04-2-0162	Restriction applied			open site	
04-2-0163	Restriction applied			open site	
04-2-0164	Restriction applied			open site	
04-2-0165	Restriction applied			open site	
04-1-0141	Restriction applied			open site	
04-1-0142	Restriction applied			open site	
04-1-0144	Restriction applied			open site	
04-1-0145	Restriction applied			open site	
04-1-0146	Restriction applied			open site	
04-1-0136	Restriction applied			open site	
04-2-0025	Restriction applied			open site	
04-1-0022	Restriction applied			open site	

APPENDIX D: HISTORICAL AERIAL PHOTOGRAPHY & PARISH MAPS

Figure 21: 1962 Aerial photograph of the Project Area

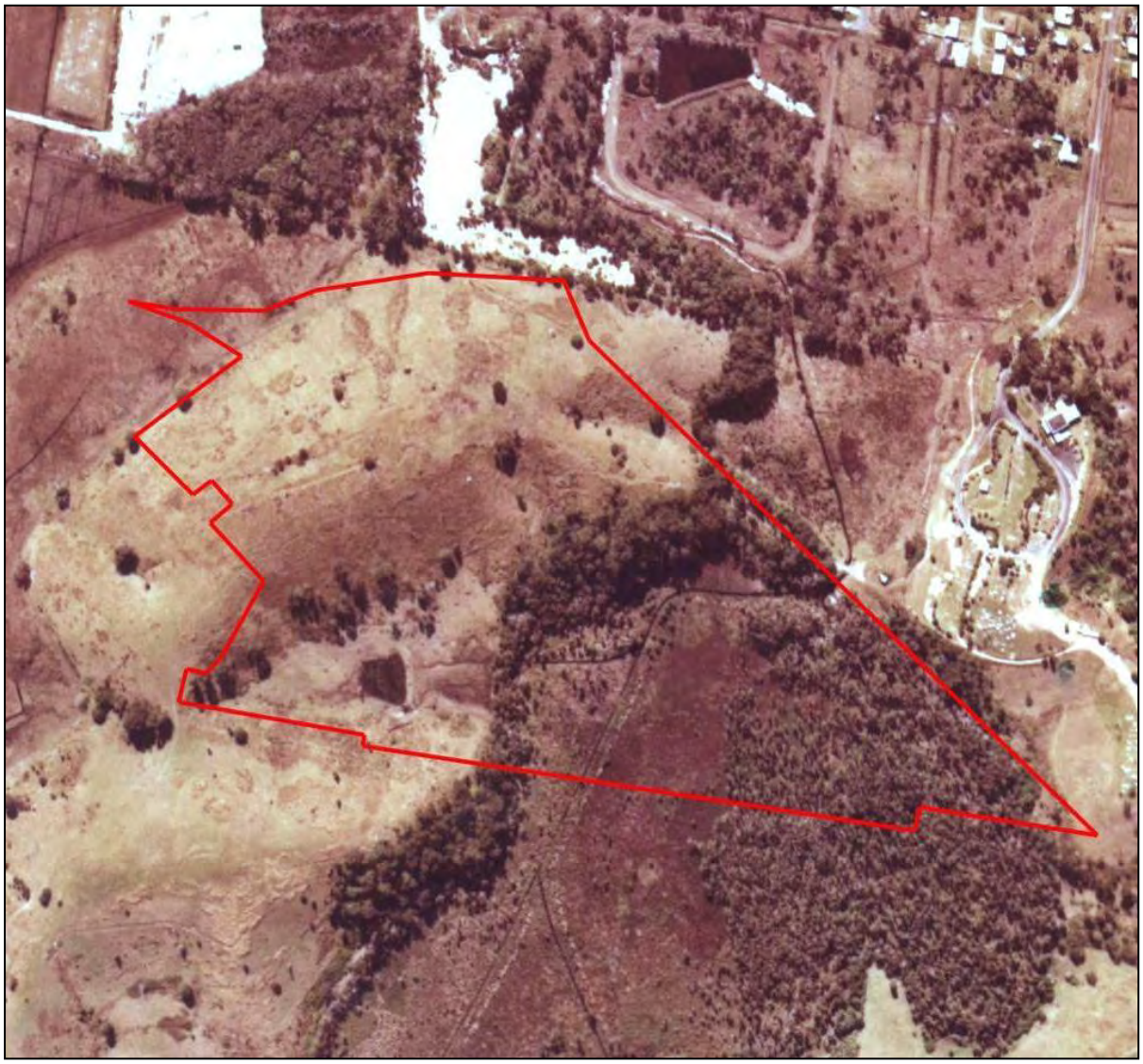

Figure 22: 1976 Aerial photograph of the Project Area

Figure 23: 1987 Aerial photograph of the Project Area

Figure 24: 1995 Aerial photograph of the Project Area

Figure 25: Historic Parish Map 1894

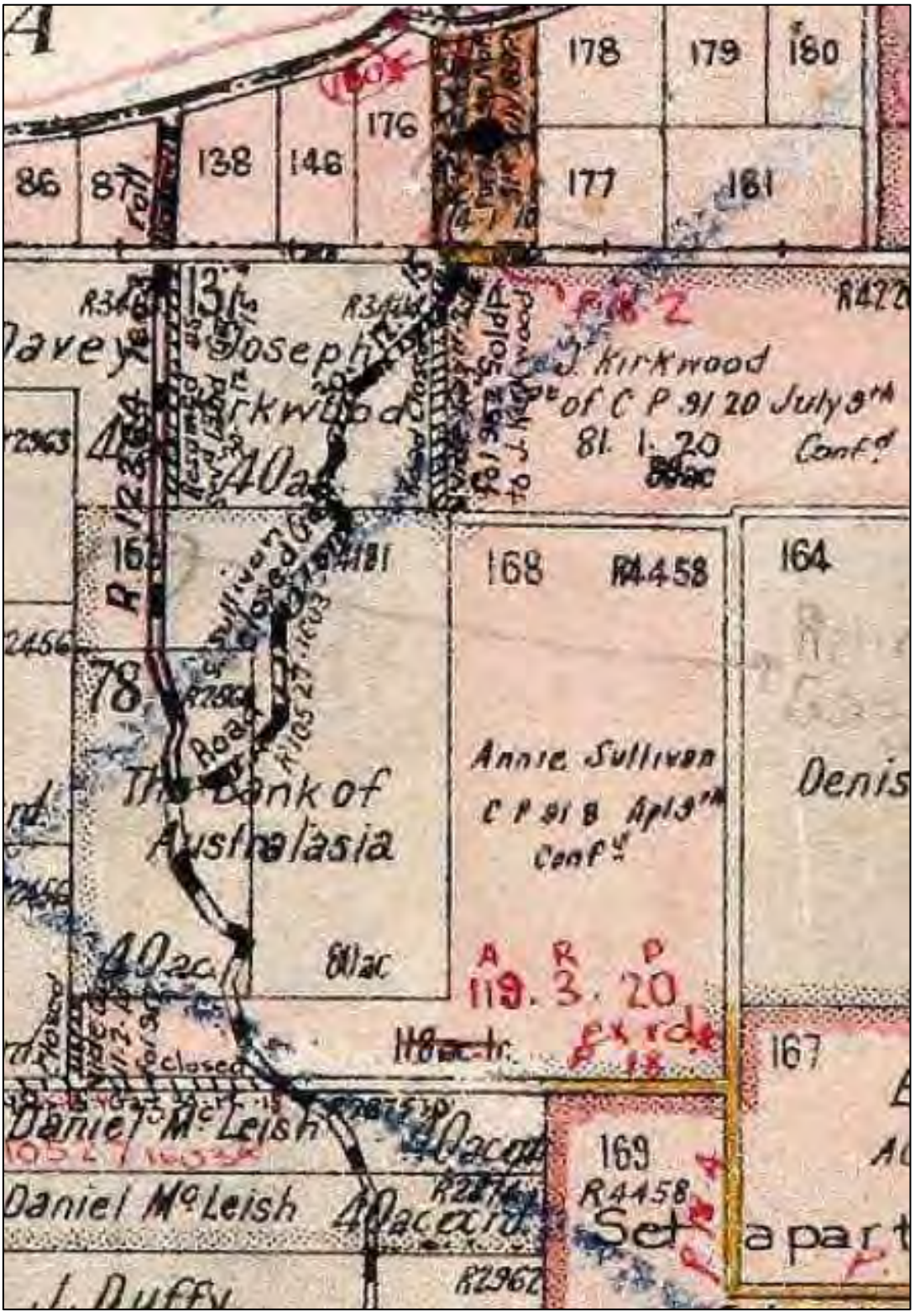

Figure 26: Historic Parish Map 1913

Figure 27: Historic Parish Map 1918

APPENDIX E: ADDITIONAL STAKEHOLDER CORRESPONDENCE

TWEED BYRON LOCAL ABORIGINAL LAND COUNCIL

P.O. Box 6967
Tweed Heads South NSW 2486
21/25 Ourimbah Road,
Tweed Heads NSW 2485
Telephone: (07) 55361 763
Fax: (07) 55369 832
admin@tblalc.com.au

Monday, 11 July 2011

Tim Robins
Everick Heritage Consultants
PO Box 146
RED HILL QLD 4059

Dear Tim,

Re: RIVER HEIGHTS TOURIST ACCOMODATION
PROPOSED EXOTIC UNDERSTORY VEGETATION REMOVAL

We write to you in support of the proposed clearing of exotic understory vegetation on the ridgeline at the River Heights tourist accommodation site (Lot 33 on DP1073293).

I participated in a cultural heritage survey of the River Heights site on 17 May 2011. During the survey, we were unable to inspect the top of the ridgeline at River Heights, due to the dense cover of vegetation. I believe this area has the potential to contain significant cultural heritage. It is important that this area is cleared of most vegetation, so that we can inspect the ground surface.

I ask that ground disturbance during any removal of the understory vegetation be kept to a minimum. Vegetation should be slashed (or similar). Given the history of the site as farmland, it may be suitable to use tractors or tracked, heavy machinery to access the site, as they would be unlikely to cause additional disturbance to any artefacts located there.

Thank you

Cyril Scott
Cultural Sites Officer
Tweed Byron Local Aboriginal Land Council

Mrs Jacqueline McDonald
63 Tringa St
TWEED HEADS WEST NSW 2485

11 July 2011

Mr Tim Robins
Project Manager
Everick Heritage Consultants
PO Box 146
RED HILL QLD 4059

Dear Tim,

I write to you in support of the proposed removal of exotic understory vegetation on the ridgeline at the proposed River Heights tourist accommodation site (Lot 33 on DP1073293).

I participated in a cultural heritage survey of the River Heights site on 17 May 2011. During the survey, we were unable to inspect the top of the ridgeline at River Heights, due to the dense cover of vegetation. I believe this area has the potential to contain the physical evidence of my ancestors occupation of this site. It is important that this area is cleared of most vegetation, so that we can inspect the ground surface.

I ask that ground disturbance during any removal of understory vegetation be kept to a minimum. Vegetation should be slashed (or similar). Given the history of the site as farmland, it may be suitable to use tractors or tracked, heavy machinery to access the site, as they would be unlikely to cause additional disturbance to any artefacts located there.

Please feel free to contact me should you have any questions.

Regards,

Jackie McDonald
Great Great Granddaughter of Kitty Sandy of the Tweed Valley and Great great great Granddaughter of Bilin Bilin and Nellie Logan of the Gold Coast and hinterland.

TWEED BYRON LOCAL
ABORIGINAL LAND COUNCIL

P.O. Box 6160,
Tweed Heads South, NSW 2486
Telephone: (02) 6674 3600
Fax: (02) 6674 3603

Chairperson:

Secretary:

Mr Adrian Piper
Consultant Archaeologist
54 The Quarterdeck
Tweed Heads NSW 2485

Dear Mr Piper

RE: KIRKWOOD ROAD PROJECT

Tweed Byron LALC representative Cyril Scott and consultant archaeologist Mr Adrian Piper inspected the above area.

The area that was inspected ran 250 metres along the crest of the hill, from north east of the Tweed Bypass to north west to Fraser Drive. The visibility of the whole site was 0 to 5% as most of the area was overgrown.

There were no signs of Aboriginal sites/artefacts. Tweed Byron LALC do recommend that if there is any development in this area Tweed Byron LALC must be on site to monitor works.

Yours sincerely

for) CLARENCE PHILLIPS
Co-ordinator

APPENDIX F: KAMMINGA ASSESSMENT OF AHIMS 04-02-0184

Report on examination and assessment of a contemporary cache of basalt rocks at River Heights Tourist Park Project Area, Tweed Heads, NSW

Report to Everick Heritage Consultants

National Heritage Consultants

Canberra

July 2013

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

EXECUTIVE SUMMARY

This inspection report has been commissioned by MCM Group Holdings Pty Ltd. The observations and conclusions reported here are based on:

1. fracture mechanics literature and original research by the consultant;
2. inspection of basalt rocks cached in a small cluster at the base of a storm damaged Tuckeroo tree within the River Heights Project Area;
3. inspection of the immediate area surrounding the cache;
4. review of relevant documents on the archaeology of the region and the geology and modern land-use of the River Heights Project Area, and
5. interviews with management and staff of Everick Heritage Consultants who have been engaged in archaeological survey and assessment of the River Heights Project Area.

The stone objects had previously been identified and registered on AHIMS as “Aboriginal axes’’ and a small piece of “white ochre”. However, the expert inspection and assessment of these objects does not corroborate an identification of any of these objects being Aboriginal stone objects or representing an Aboriginal archaeological site. The available evidence supports the interpretation of the basalt objects as a collection of rocks comprising natural weathered saprolitic basalt clasts, at least one fragment of basalt clast that may have been fractured during land clearance, ploughing or more recent subsurface disturbance by heavy earthmoving equipment during construction activities within or in the vicinity of the Project Area. The purported “white ochre”: is a small piece of decomposing whitish metamorphic stone of irregular shape; there is no known mineral that can be described as “white ochre” and it is concluded that this item is also a natural piece of decomposing rock.

1.0 THE BRIEF

Dr Johan Kamminga, Principal, National Heritage Consultants, was commissioned by MCM Group Holdings Pty Ltd to inspect a contemporary cache of nine stone objects (collectively registered on AHIMS database as Site No. 04-02-0184) to determine whether any of the objects can be identified as or reasonably inferred to be Aboriginal stone objects, and whether any of these objects suggest the possible existence of an Aboriginal archaeological site on the ridge crest, such as a quarry or former encampment area. The cache of stone objects is located at the base of a storm damaged Tuckeroo tree (*Cupaniopsis anacardioides*) within the River Heights Project Area (Figure 1; Figure 2). This location was recorded by non-differential GPS during the field inspection as 28°11'51.340"S/153°31'41.940"E.

The record relating to AHIMS Site No. 04-02-0184 was not available to Dr Kamminga prior to or during the drafting of this report. However, Dr Richard Robins provided the following information about the history of the cache of stone objects:

Indigenous stakeholders notified Everick Heritage Consultants that seven “stone axes” had been discovered by Aboriginal monitors during their independent monitoring of construction works on the road easement immediately north of the Project Area. These purported “stone axes” were cached within the Project Area, and registered as Site 04-2-0184 on the AHIMS database. There was an initial suggestion that the Project Area may therefore contain a ‘men’s place.’ The original find spots were not indicated at the time of the notification to Everick Heritage Consultants. However, it was suggested that the original locations of the stone objects may have been within the Project Area. During a programme of archaeological test excavations in 2013, Everick Heritage Consultants archaeologists Adrian Piper and Dr Richard Robins carried out detailed examinations and recording of the stone objects comprising the Site #04-02-0184 cache at that time. The cache was monitored during subsequent visits to the Project Area by Everick Heritage Consultants archaeologists.

2.0 FIELD INSPECTION

The observations and conclusions in this report are based on a field inspection of the ridge crest and the cache of stone objects within the proposed River Heights Tourist Park Project Area (Figures 1-18). The field inspection was undertaken by Dr Johan Kamminga on 3 July 2013. Dr Kamminga was guided to the location and assisted in his inspection by Dr Richard Robins, Mr Adrian Richard and Ms Jordan Towers (Everick Heritage Consultants). A low magnification hand lens was used in examining and identifying the stone objects comprising the cache.

As far as can be ascertained, there is no record of precise locations of these stone objects. During on-site interviews with Dr Richard Robins and Adrian Richard and later Tim Robins, who had previously inspected the cache on at least two occasions, eight of the stone objects (Rocks 1-8) had been collected and cached within the Project Area before 8 May 2013. A ninth stone object (Rock 9) had been added to the cache after 8 May 2013 and before 12 pm on 25 June 2013.

2.1 Description of the locality of the cache

The cache is located on a hill or ridge of Lamington Volcanics bedrock (EHA 2008; Morand 1996); there are numerous small basalt exposures and scattered basalt clasts on ground surface (Figure 2). The vegetation of the ridge has been severely modified by initial land clearance and subsequent agricultural use, as a banana plantation, which would have required repeated ploughing. Construction of buildings also occurred in the 1960s and in recent years the land has been cleared of vegetation by heavy earthmoving equipment. Some of the basalt rocks currently visible on the land surface have been deposited from relatively recent earthworks activities in the adjacent residential subdivision. A summary of successive land-use activities and subsurface disturbance activities is provided in a consultancy report by HMC (2011).

The tilling equipment used would have comprised a tractor and possibly a heavy duty chisel plough. The chisel plough is a common tool for deep tillage with limited soil disruption. The chisel plough is typically set to rip to a depth of 20 to 30 cm. However some models may rip much deeper. Such a plough can encounter significant soil drag, and therefore a tractor of sufficient power and good traction is required that will deliver at least 10 to 15 horsepower (7 to 11 kW) per shank (Niemuth Implement Co 2010). The stoniness of the ground surface and topsoil increases as a result of breaking up of the bedrock. The plough is capable of ripping bedrock to a depth of 20-40 cm and sometimes is intentionally operated to do so (see van Wesemaela *et al*. 2006). Both large and small rock fragments are created during chisel ploughing (Oostwoud-Wijdenes *et al*. 1997; Poesen *et al*. 1997).

3.0 CRITERIA FOR DIFFERENTIATING ABORIGINAL STONE OBJECTS (MANUPORTS AND ARTEFACTS) FROM NON-ABORIGINAL STONE OBJECTS

The criteria used for discriminating Aboriginal stone objects from non-Aboriginal modified and/or culturally transported objects or natural stone objects include the following:

1. Intrinsic attributes

a) mechanical and material attributes (e.g., stone types);
b) object shape and size;
c) presence, number and configuration of fracture surface(s); and
d) fracture surface features (including positive and negative flake scars and areas of abrasion/grinding); (see Cotterell and Kamminga 1979, 1987, 1992).

2. Extrinsic attributes

a) geographical and spatial context;
b) associations with other Aboriginal objects/sites and features; and
c) colonial-era and more recent land-use history.

3.1 Standard classification methodology

Defined Aboriginal stone object categories are polythetic groupings for which no single attribute is essential or sufficient for membership; a group of objects as a whole represents a constellation of attributes (see Sokal and Sneath 1963:13; Clarke 1978:36; Hayden 1980:3; Kamminga 1985:10; Kamminga *et al*. 2008:168). Such categories are not rigidly bounded. An artefact attributed to a classificatory type or category needs to have only some of the defining attributes of that type or category, such as a particular shape, presence of retouched on a certain part, or particular attributes of use-wear, and some of these attributes may be shared with other artefacts categories. Fragments of artefacts are often allocated to a general category because they do not have sufficient attributes to be allocated with confidence to a more specifically defined category. An example of this is a microblade fragment that is identified only to the level of flake portion.

The term 'lithic item' denotes pieces of stone exhibiting fracture surfaces not identified as natural pieces of stone. Some lithic item categories are specific in nature (e.g., microblade portion or bondi point). Other categories represent more general groupings of artefact types (e.g., flake or step-terminated flake). In practical terms, lithic items are classified in a general hierarchy, in terms of the degree to which an item can be specifically identified. At the lowest level in this hierarchy is lithic fragment, which denotes 'nondescript' lithic items that do not have sufficient intrinsic morphological attributes to identify them with certainty as complete or portions of artefacts. Manuport fragment or artefact status for these items may be inferred from contextual evidence with varying levels of confidence.

When pieces of natural 'background' siliceous stone, manuports and artefacts are fractured by natural weathering processes or by modern land-use activities (such as vehicles or farm machinery, or stock treadage) a proportion of the fragments may be indistinguishable from prehistoric artefacts. Bushfires may also play a role in natural fragmentation of siliceous stone, creating 'potlid' flakes and other artefact-like fragments of stone. The presence of naturally fractured stone, especially siliceous stone, often creates major difficulties in reliably identifying Aboriginal archaeological sites and artefacts.

3.2 Description of stone objects comprising the cache

Nine stone objects are identified as basalt (See Table 1). Some of the basalt objects are narrower at one end, which superficially gives these objects an 'axe-like' shape. However, it is concluded that these generalised shapes are fortuitous and are most likely the result of saprolitic weathering within a groundwater-saturated soil horizon (see Eggleton *et al.* 1987). Basalts weather relatively quickly because the typically iron-rich minerals within the rock oxidises rapidly in water and air, usually staining the rock a brown to red colour due to iron oxide (rust); other colouration derived from the sedimentary context, such as grey, also can occur.

In essence, there is no evidence of human workmanship for eight of the basalt objects (Rocks 1-8; Figures 4-17): the surfaces of these stones are naturally weathered (and actively weathering), there is no evidence of intentionally patterned fractures (flake scarring) that can be interpreted as human knapping, and there is no evidence at all of edge-grinding or other related stone tool-preparation such as pecking. Additionally, some of the stone objects in question do not have an axe or hatchet-like appearance but are simply amorphous in shape. The presence of large crystals are within the Project Area groundmass were also noted during inspection, indicating that this type of basalt is not suitable for stone-tool making.

The ninth stone object (Rock 9; Figures 19-20), which according to the information provided appeared late in the cache, is different to the other eight stone objects. It is identified as a fragment of unweathered basalt of very 'fresh' appearance indicating a relatively recent origin for the fracture. Under magnification some small patches of unidentified organic substance, coloured pale red and dull grey, were observed adhering to the primary fracture surface. The fracture initiation on the primary fracture surface is hard-indenter and the fracture type is sub-conchoidal (see Cotterell and Kamminga 1987). Hard-indenter impact during stone-working typically creates a range of fractures such as compression, sub-conchoidal and conchoidal accompanied by various degrees of initiation-surface crushing and cracking, cascading multiple fractures or partial or complete Hertzian cones at the point of fracture origin. Whilst hard-indenter fracture is normal in prehistoric stone knapping, it commonly also occurs in nature and as a consequence of modern agricultural practices. Rock 9 is identified as a fragment of basalt broken from a parent rock in recent years most likely

by modern earthmoving equipment, and therefore not identified as an Aboriginal object. The reasons for this determination are:

1. there is only a single major fracture surface;
2. there is no evidence of patterned fracturing or intentional modification of any other kind (such as grinding or pecking);
3. there is no Aboriginal cultural context, such as associated with any identifiable Aboriginal activity area within the Project Area; and finally,
4. as an individual stone item its overall dimensions are inconsistent with the range of stone items in lithic scatters recorded in the local area.

The recent prehistoric Aboriginal flaked stone technology in the general region is predominantly microlithic (see Mulvaney and Kamminga 1999). The remainder of the stone tool kit generally includes utilised flakes, an assortment of flake scrapers, hammerstones, pestles and mortars, hatchet heads and worimi cleavers. silcrete, chert, quartz, quartzite and a range of metamorphic stone types were used. Common elements of assemblages are microblade flaking and bipolar flaking débitage elements such as microblade cores, discard microblades, compression flakes and a range of mostly small stone fragments. Rock 9 is at best a lithic fragment (see above). Lithic fragments do not have sufficient diagnostic attributes for identification of the item as an Aboriginal object. Given the 'fresh' appearance of Rock 9 and its dissimilarity to the other eight stone objects (identified by Dr Kamminga as rocks) it is possible that the ridge crest within the Project Area is not its natural place. However, it should be noted that Rock 9 appeared in the cache after vegetation was cleared from the Project Area by heavy earthmoving equipment.

One purported piece of "white ochre": is identified as a whitish decomposing metamorphic stone of irregular shape; there is no known mineral that can be described as "white ochre" and it is concluded that this item is simply a natural piece of decomposing rock.

Notably, the archaeological test-pitting programme undertaken by Everick Heritage Consultants revealed no evidence at all of former prehistoric or historic Aboriginal activity such as camping or quarrying within the Project Area. Erroneous identifications of Aboriginal stone artefacts, by insufficiently trained monitors and even by trained archaeologists is not uncommon (see Kuskie and Kamminga 2000).

There are even notable instances of misidentifications by trained archaeologists of natural concentrations of siliceous stone fragments as Aboriginal stone quarry sites (see Kamminga 1993, 2010 for re-evaluation of two identified quarry sites).

Table 1: Rock items at base of tree (Figures for metrical dimensions are maximums)

#	Item ID	Stone type	Length (cm)	Width (cm)	Thickness (cm)	Photo #
1	Weathered rock	Basalt	14	11	7	449, 450
2	Weathered rock	Basalt	13	10	3.5	451
3	Weathered Rock	Basalt	13	10	5	452, 453, 454
4	Weathered rock	Basalt	11	8.5	4	455
5	Weathered rock	Basalt	10	9.5	2	456, 457
6	Weathered rock	Basalt	10.5	9	5	458
7	Weathered rock	Basalt	9	9	6	459, 560
8	Weathered rock	Basalt	16	9	5	461, 262
9	Rock fragment (Hard-indenter initiated fracture)	Basalt	6	10	2	463-466

4.0 Conclusion

No evidence of prehistoric Aboriginal stone detachment from basalt bedrock within the Project Area has been identified during archaeological test pitting or subsequently during the filed inspection and assessment by Dr Kamminga. In particular, there is no evidence for Aboriginal campsites or quarrying activity. While the occurrence of a hard-indenter sub-conchoidal primary fracture surface was noted on a single basalt object (Rock 9) this attribute alone is not sufficient to infer that it is a product of Aboriginal knapping or even that it might be a fragment of prehistoric Aboriginal manuport. This hard-indenter fracture surface appears to be relatively 'fresh' and therefore it may be very recent in origin. The nature of this stone item is consistent with damage by farm machinery, or by heavy earthmoving equipment involved in construction activity within the Project Area or perhaps in an adjoining area of land subject to development activity. In the expert opinion of the NHC consultant, Dr Johan Kamminga, none of the relocated rocks in the cache designated AHIMS Site No. 04-02-0184 can be identified as Aboriginal objects.

GLOSSARY

Axe (stone)

See ‘Hatchet head’.

Cache

A collection of objects concealed in concealed in a hiding place.

Clast

A fragment of rock resulting from the breakdown of a larger rock or rock unit. Examples are waterworn stones or basalt rocks [From Greek ‘klastos’, broken].

Conchoidal flake **(Pronunced kŏn-koid'l).**

A flake that has a smooth, (bivalve) shell-like convexity on its upper part of its inner (ventral) surface; this inner surface is called the primary fracture surface. The convexity emanates from a partial Hertzian cone crack (called Hertzian initiation). Conchoidal fracture is one form of hard indenter impact fracture of brittle, siliceous stone. It is a common fracture type in Aboriginal knapping of brittle, fine grained siliceous stone, such as silcrete, chert, and to a lesser degree quartz and quartzite.

Core

A core is a chunky piece of stone, often a piece of a pebble or cobble, but also quarried stone, from which flakes have been struck to make stone tools. Flakes removed from a core are called 'primary flakes' and may be further shaped by finer flaking, called 'retouch'. Cores are especially evident on eroded land surfaces because of their relatively large size. Cores in subsurface sediments comprise only a small percentage of the lithic assemblage, usually less than 10% of the total number of artefacts of any size (cf, Kuskie and Kamminga 2000:Fig. 112). Categories of core types include polyhedral or amorphous (with flakes struck opportunistically from different surfaces), microblade, bipolar, pebble core (retaining cortex over most of the original surface, and single platform cores (sometimes forming a classic horse-hoof shape). Bipolar cores were supported on a stone anvil and struck repeatedly with a hammerstone from above. Diagnostic attributes of bipolar fracture damage on this type or core are point or sinuous-ridge type initiation platforms, crushing, cracks, and concentrated overlapping step fractures emanating from areas of hammer impact (Cotterell and Kamminga 1979, 1987, 1992).

Flake

A flake is a piece of stone detached from a stone nucleus such as a core, or from a stone implement being made. The most common type of flake is called 'conchoidal flake' and is initiated by Hertzian cone crack formation (Cotterell and Kamminga 1987). The inside (or ventral) fracture surface of a well-formed conchoidal flake is more or less similar to that of a bivalve shell, hence the term 'conchoidal'. This fracture surface generally exhibits features such as a partial Hertzian cone, bulb of force, érraillure scar, undulations and lances (Cotterell and Kamminga 1979, 1987, 1992) which indicate the point of origin of the fracture and the direction in which it grew. Bipolar flakes are created when a stone core is placed on an anvil and struck from above with a hammerstone. Different flake types are created in bipolar flaking, some of which have diagnostic fracture damage features. One of these types is the 'compression flake' which is formed when a substantial dynamic compressive force from as hammer blow caused the bipolar core to break into two or three pieces of roughly equal size.

Flakes are the predominant artefacts in débitage from flaking of all kinds – freehand, bipolar and microblade flaking. There are a number of identifiable subtypes of flake débitage from making microliths, and often they are so small that magnification is required for reliable identification. In certain circumstances conchoidal and other types of flakes may occur naturally. For instance, bushfire can cause ‘potlid’ flakes to spall from siliceous stone such as chert and silcrete – potlid flakes are generally dome-shaped and have a distinct fracture initiation within the fracture rather than on its margin.

Hatchet head

With some exceptions, stone implements described as ‘axes’ in Australian ethnographic accounts and in most archaeological reports are hatchet heads (normally the handle held with one hand only). During the nineteenth century stone hatchets were used throughout much of Australia, the notable exceptions being the southwest (where the unique kodj hammer-hatchet served as its functional equivalent), the Nullarbor Plain and Tasmania. The hatchet was the ideal multi-purpose tool, especially in forests and woodlands. Both men and women used stone hatchets for everyday tasks such as extracting honey, insects and small game from trees and fallen logs, and cutting sheets of bark and branches to make canoes, huts and shelters. The butt of the hatchet head commonly served as a hammer and pounder and, when laid on its side, the tool also served as a convenient general-purpose anvil. Not all hatchet head finds indicate former habitation sites since many must have been lost in the forest during hunting and foraging activities.

In making a hatchet head, a preform (rough-out) was first shaped by flaking a piece of stone. Sometimes there was also finer shaping by pecking the surface of the preform with a stone pounder or hammer. The cutting edge, and to some extent the surfaces of the preform, were then shaped by grinding on a portable whetstone, or on sandstone or quartzite bedrock, usually at a watercourse, a task that could take less than an hour. Fully ground hatchet heads are not common in Australia, and grinding was most often restricted to the area of the hatchet's cutting edge. A wrap-around handle about 30 centimetres long, made from a split sapling or branch, was bent tightly around the head and the joint secured with plant resin or *Trigona* beeswax and tightly lashed.

The average weight of an Aboriginal stone hatchet head is about 500 grams. The hatchet head had to be made from very tough stone because it had to resist high impact stress on the cutting edge during use. Ideal stone types are hornfels and medium to fine-grained basalt that has recrystallised by the intense heat of magma intruding into basalt bedrock.

There is considerable size and shape variation in the design of hatchet heads. This is because suitable stone materials are obtained as large pieces up to cobble size, and they are amenable to the full range of shaping methods – flaking, pecking and grinding – which allows precise three-dimensional modelling. The plan-shape of hatchet heads is often roughly rectangular, but there are sometimes notable regional variations in the size, shape and degree of finish. Among the most interesting variations in south-eastern Australia are large pecked and grooved hatchets. Some Victorian hatchet heads have one or two encircling grooves and one or more median or diagonal grooves which extend round the butt to join the encircling grooves. Although these were certainly designed to facilitate the firm attachment of a handle, there is no historical evidence of hafted specimens, and the type is prehistoric.

Another unusual feature of these hatchets is their large size and weight (some weigh more than two kilograms) which raises the possibility that they may be true axe heads and not hatchet heads. There are other distinctive and elegant types, including a cylindrical one and a pecked oval type made from dolerite outcrops near Cloncurry and Mount Isa in Queensland. These were keenly sought by the Aborigines inhabiting the Lake Eyre region, who exchanged the narcotic-like drug pituri for them. One common, 'garden variety' hatchet head common throughout south-eastern Australia was fashioned from a waterworn cobble, minimally flaked to rough out the cutting edge, and ground a little on the flaked area, often only on one side. So-called 'Wiradjuri style' hatchet heads are fully pecked (see McCarthy 1976).

Hard indenter fracture impact damage

One or more fractures caused by an impact of a very hard object (called ‘hard indenter’) such as stone or steel. Hard-indenter impact occurs in both nature and in stone-tool making. A partial Hertzian cone crack initiation (producing a conchoidal flake) is one type of hard-indenter fracture damage on fine grained or crystalline siliceous stone. Compression fracture is another form of hard-indenter impact and is a diagnostic feature in identifying Aboriginal bipolar-knapping débitage.

Hammerstone

Hammerstones are stones used for striking flakes from a core. These simple tools are most often quartzite pebbles and cobbles. The defining attribute is hammer-impact damage in the form of concentrated abrasion pits on the side of at least one end of the stone. Often, repeated hammer impacts has created a distinct bevel with a rough surface.

Most hammerstones retain cobble cortex over most of their surface. One distinctive type is the ‘baton hammer’ in the Upper Murray River region (Witter and Kelly 2002:25, 28; see also Kamminga *et al*. 2008). Baton hammers are elongate or rod-shaped cobbles that had been held at one end to strike a glancing blow on the core. Replicative experimental work by Kelly indicates that schist baton hammers was effective as a ‘soft hammer’ in flaking quartz which tends to fracture internally when stuck with a harder material. He also notes that it may use a retoucher possibly working quartz.

Pounder

Pounders display impact fractures and more general abrasive wear from repeated hard-indenter impact. Pestles are a category of pounding stone, but the more general term is applied when it is not evident that it had been used on a mortar with a spherical wear depression.

Saprolite

A chemically weathered rock (literally, it means "rotten rock").

Subconchoidal fracture

A fracture that is partly or vaguely conchoidal in shape.

REFERENCES

Clarke, David L. 1978. *Analytical archaeology*. Second edition. Methuen, London.

Cotterell, Brian and Johan Kamminga 1979. The mechanics of flaking. In B. Hayden (Ed.), *Lithic use-wear analysis*. Academic Press, New York, pp. 97-112.

Cotterell, Brian and Johan Kamminga 1987. The formation of flakes, *American Antiquity*, 52:675-708.

Cotterell, Brian and Johan Kamminga 1992. *Mechanics of pre-industrial technology. An introduction to the mechanics of ancient and traditional material culture*. Chapter 6, pp. 126-59. Cambridge University Press, Cambridge.

Eggleton, Richard A., Chris Foudoulis, and Dane Varkevisser 1987. Weathering of basalt: changes in rock chemistry and mineralogy, *Clays and clay minerals*, 35:161-169.

EHA 2008. Tweed district water supply augmentation options study input to Stage 1 – identification of feasible options - groundwater supply. Report prepared by Environmental Hydrology Associates (EHA Pty Ltd) for MWH Australia Pty Ltd. Report Number GW-08-02-REP-001 Rev. A. 22 July 2008.

Hayden, Brian 1980. Confusion in the bipolar world: bashed pebbles and splintered pieces, *Newsletter of Lithic Technology*, 9(1):2-7.

HMC 2011. Preliminary Site Contamination Investigation (Site History). Location: Lot 33 DP 1073293, Kirkwood Road, Tweed Heads South. Report prepared for Proportional Property Investments Ltd atf PPI Wholesale Property Unit Trust No. 1. Report: HMC 2011.029. November 2011.

Kamminga, Johan 1985. The pirri graver, *Australian Aboriginal Studies*, 1985/II:2-25.

Kamminga, Johan 1993. Assessment of disturbance of unregistered Aboriginal site PH13, Gungahlin, ACT. Report to Estate Development Section, ACT Government, March 1993.

Kamminga, Johan 2010. Archaeological inspection of a quartz vein exposure near Nimmitabel, NSW. National Heritage Consultants report to Country Energy. November 2010.

Kamminga, Johan, Christine Kenyon, Beth Gott, Julie Dibden, Armand Mijares and Nimal H. Perera. 2008. *Lake Hume Aboriginal heritage study*. National Heritage Consultants, Canberra.

Kuskie, Peter & Johan Kamminga 2000. Salvage of Aboriginal archaeological sites in relation to the F3 Freeway near Lenaghans Drive, Black Hill, New South Wales. Report by Southeast Archaeology to Major Projects, Northern Region, Roads and Traffic Authority of NSW. (3 vols).

McCarthy, F.D. 1976. *Australian Aboriginal stone tools*. Australian Museum, Sydney.

Morand, D.T. 1996. *Soil Landscapes of the Murwillumbah – Tweed Heads 1:100000 Sheet*. Department of Land and Water Conservation NSW.

Mulvaney, John and Johan Kamminga 1999. *Prehistory of Australia*. Allen and Unwin, Sydney.

Niemuth Implement Co. 2010. Brillion equipment - chisel plow. http://www.niemuthimp.com/equipment.php?comid=41&type=Chisel_Plow. Niemuth Implement Co. Inc. (Accessed 20 November 2010).

Oostwoud-Wijdenes, D., J. Poesen, L. Vandekerckhove and E. de Luna 1997. Chiselling effects on the vertical distribution of rock fragments in the tilled layer of a Mediterranean soil, *Soil &Tillage Research*, 44:55–66.

Poesen J., B. van Wesemael, G. Govers, J. Martinez-Fernandez, P. Desmet, K. Vandaele, T.A. Quine and G.Degraer 1997. Patterns of rock fragment cover generated by tillage erosion, *Geomorphology*, 18:183-197.

Sokal, R.R. and P.H.A. Sneath 1963. *Principles of numerical taxonomy*. W.H. Freeman, London.

van Wesemaela, Bas, Xavier Rambauda, Jean Poesenb, Mark Muliganc, Erik Cammeraatd and Antoine Stevensa 2006. Spatial patterns of land degradation and their impacts on the water balance of rainfed treecrops: A case study in South East Spain, *Geoderma*, 133:43-56.

Witter, Dan and Terrence J. Kelly 2002. Lake Hume foreshore archaeological survey, analysis and risk assessment. Draft report for the Mungabareena Aboriginal Corporation, Wodonga, by Terrence J. Kelly Archaeological Consultants in association with National Environment Centre, Riverina Institute of TAFE.

Figure 1: Location of the River Heights Project Area

PHOTOGRAPHS

Figure 2: View of scattering of natural weathered basalt rubble (clasts) on ridge crest within River Heights Project Area (with northeast vista of Tweed River valley).

Figure 3: Contemporary cache of rocks deposited at base of in proposed River Heights Project Area.

Figure 4: View of Rock 1.

Figure 5: Opposing face of Rock 1.

Figure 6: View of Rock 2.

Figure 7: View of Rock 3. Note groove on left hand side of rock consistent with plough tine damage

Figure 8: Rock 3. Note groove on left hand side of rock consistent with plough tine damage and also 'fresh' non-conchoidal fracture damage on lower margin of clast.

Figure 9: Side view of Rock 3 showing 'fresh' non-conchoidal fracturing.

Figure 10: View of Rock 4

Figure 11: View of Rock 5

Figure 12: View of opposite side of Rock 5

Figure 13: View of Rock 6.

Figure 14: View of Rock 7.

Figure 15: Opposite view of Rock 7.

Figure 16: View of Rock 8.

Figure 17: View of opposite face of Rock 8.

Figure 18: Sub-conchoidal fracture face of Rock 9. Note the 'fresh' appearance of the fracture initiation area and the primary fracture surface.

Figure 19: View of opposite minimally weathered cortex face on Rock 9. Note marginal crushing and minor fracturing along the margin of the fracture initiation surface.

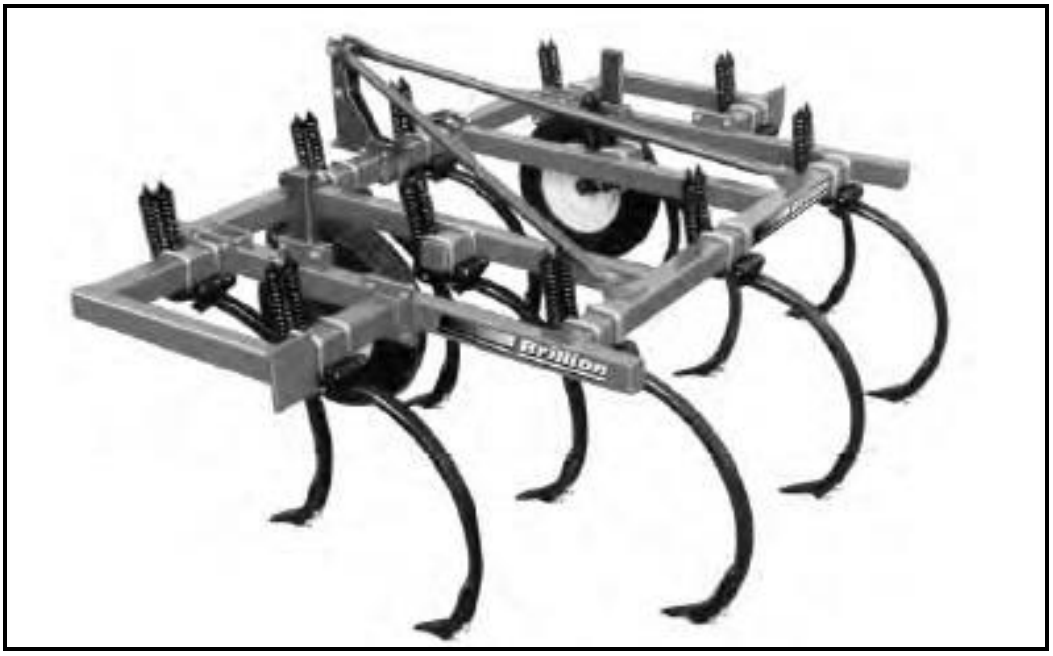

Figure 20: Example of a heavy-duty chisel plough with spring loaded tines.

Résume

Johan Kamminga

Dr Jo Kamminga is the longest practicing consultant archaeologist in Australia with over 40 years experience in archaeological research and Aboriginal heritage consulting. He is recognised internationally as one of Australia's leading prehistorians and is an authority on stone artefacts. His consultancy clients include government departments and agencies, universities, museums, Aboriginal corporations, and a wide range of private sector development and mining companies. Currently he is Principal of National Heritage Consultants, visiting fellow in the Department of Archaeology and Natural History, ANU, and faculty member of the Archaeology Research Centre, University of the Philippines.

Dr Kamminga's areas of professional specialisation include:

- Australian prehistory and archaeology.
- Cultural heritage management, conservation and tourism plans.
- Archaeological field surveys, excavations and heritage assessment.
- Aboriginal stone technology.
- Aboriginal community consultation and liaison.

In 1972 he gained a BA Honours (1st class with graduation prize) and in 1980 his PhD in prehistoric archaeology from the University of Sydney. He has more than 50 publications to his name, including the co-authored books *Prehistory of Australia* and *Mechanics of pre-industrial technology*, and an authoritative work on the mechanical basis of stone flaking, *'Formation of flakes'*. His research findings have been published in a wide range of journals such as *Nature*, *American Antiquity*, *Australian Aboriginal Studies*, *Journal of Human Evolution* and *Journal of Archaeological Science*. A number of his publications have been translated and reprinted in Chinese, Japanese and Turkish. He was also advisory editor for the award-winning *Encyclopaedia of Aboriginal Australia*.

His field experience in Australia is extensive, and includes the eastern seaboard and Hunter Valley, Victorian Mallee, Nullarbor Plain, western NSW, central Australia, central Queensland, Cape York Peninsula and Arnhem Land. His fieldwork overseas includes Bhutan, Canada, Philippines Papua New Guinea, Sri Lanka, and Thailand.

In the early 1970s Dr Kamminga was director of the Archaeological Survey of the Alligator Rivers Region in Arnhem Land sponsored by the Federal Government and the Mining Industries Council of Australia. His report on the archaeological resources of the region and his participation as a member on the Alligator Rivers Fact-Finding Study Scientific Committee contributed to the case for declaring Kakadu National Park and its subsequent World Heritage listing. Today Kakadu ranks as one of Australia's most valued tourist destinations. He also carried out archaeological fieldwork for the Australian Museum in New Guinea and discovered the notable obsidian technology at Talasea on the island of New Britain. Talasea has since become a primary focus of field research by scientists at the Australian Museum.

In the 1980s, Dr Kamminga directed research projects on stone technology and engineering applications to archaeology at La Trobe University, Sydney University and the Australian National University. He also taught courses in Indigenous material culture in Australia and contributed to postgraduate classes at the University of the Philippines.

Dr Kamminga's current research projects include the archaeology and prehistory of Bhutan, the 'cold case' of the missing Peking Man fossils, and preparation of a field manual on Australian Aboriginal stone tools. He continues his longstanding supervision of Australian and Asian postgraduate students at the ANU and other Australian universities. Most recently Jo was an on-screen contributor to the China episode of the BBC TV documentaries 'The Incredible Human Journey' and 'The Human Journey' which explore the spread of modern humanity across the globe.

He is a foundation member of the Australian Archaeological Association, member of the Australian Institute of Aboriginal & Torres Strait Islander Studies since 1972, and member of the Centre for Archaeological Research, ANU.

SELECTION OF PUBLICATIONS:

BOOKS AND MONOGRAPHS

Lance, A, E. Dyer, M. Grist and Johan Kamminga 2012. *Procedure for the management of Indigenous cultural heritage sites. A handbook for personnel and contractors*. (Third edition). Santos Ltd, Adelaide.

Brian Cotterell & Johan Kamminga 2002. *Endüstri Öncesi Teknolojilerin Mekaniği*. Literatür Yayinlari, Istanbul. (Revised paperback edition of 'Mechanics of pre-industrial technology' in Turkish language).

John Mulvaney & Johan Kamminga 1999. *Prehistory of Australia*. Allen and Unwin, Sydney. Hardcover edition. Paperback edition reprinted 2000, 2004, 2008. (Hardcover edition also published by the Smithsonian Institution Press, Washington D.C. Australian Award for Excellence in Educational Publishing (2000) finalist. Australian Cultural Studies Centre Award (1999) finalist).

Brian Cotterell & Johan Kamminga 1990. *Mechanics of pre-industrial technology*. *An introduction to the mechanics of ancient and traditional material culture*. Cambridge University Press, Cambridge. (hardcover edition 1990, softcover edition 1992).

Johan Kamminga, Christine Kenyon, Beth Gott, Julie Dibden, Armand Mijares & Nimal H. Perera 2008. *Lake Hume Aboriginal heritage study*. National Heritage Consultants, Canberra.

M. Fletcher, M. Higgins, Johan Kamminga & L. Kennet 1993. *The heritage of the Australian alps*. Australian Heritage Commission Bibliography Series, No. 9. (Original softcover edition). Available online through AUSTRALIS and OZLINE computer bibliography services).

Johan Kamminga 1982. *Over the edge. Functional analysis of Aboriginal stone tools*. Occasional Papers in Anthropology, Anthropology Museum No. 12, University of Queensland. (Original paperback; 2007 Digitized edition ISBN 0909611378, 9780909611378).

Johan Kamminga & Harry Allen 1973. *Report on the archaeological survey for the Alligator River Fact-Finding Study*. Government Printer, Darwin.

Book Chapters & Sections

Brian Cotterell & Johan Kamminga 2009. The formation of flakes, *American Antiquity*, 52:675-708. Reprinted in George H. Odell (compiler) 2009. *Archaeological lithic analysis: readings from American Antiquity and Latin American Antiquity*. Society for American Archaeology Press, Washington, pp.37-72. [Reprint in student reader on stone technology studies].

Johan Kamminga 2007. Reinterpretation of the Hoabinhian at Sai Yok, Thailand. In (Mokhtar Saidin & Stephen Chia, eds), *Archaeological heritage of Malaysia*, (*Warisan Arkeologi Malaysia*). No 1. Chapter 3, pp. 40-60. Centre for Archaeological Research, Universiti Sains Malaysia and Pusat Penyelidikan Arkeologi Malaysia, Kuala Lumpur.

Johan Kamminga 2001. Panaramitee art. In *Microsoft Encarta Encyclopaedia*, Websters International Publishers Ltd & Microsoft Corporation.

Johan Kamminga 2001. Devils Lair. In *Microsoft Encarta Encyclopaedia*, Websters International Publishers Ltd & Microsoft Corporation.

Johan Kamminga 2001. Kow Swamp. In *Microsoft Encarta Encyclopaedia*, Websters International Publishers Ltd & Microsoft Corporation.

Johan Kamminga 1995. Prehistory of the Snowy Mountains, southeastern Australia. In *Ancient peoples and landscapes*. E. Johnson (ed.), Museum of Texas Tech University, Lubbock, pp. 153-171.

Johan Kamminga 1994. 'Australian Aboriginal Technology', and other entries. In *Encyclopaedia of Aboriginal Australia* (2 vols). D.R. Horton (Ed.), Australian Institute of Aboriginal and Torres Strait Islander Studies, Canberra. Hardcover and as CDROM edition.

Johan Kamminga 1992. Aboriginal settlement and prehistory of the Snowy Mountains. In *Cultural Heritage of the Australian Alps*. B. Scougall (Ed.), Australian Alps National Parks Liaison Committee, Canberra, pp. 101-24.

Johan Kamminga 1992. New interpretations of the Upper Cave, Zhoukoudian. In *The Evolution and Dispersal of Modern Humans in Asia*. T. Akazawa, K. Aoki & T. Kimura (eds), Hokusen-sha Publishing Co, Tokyo, pp. 379-400.

Johan Kamminga 1984. A recent prehistoric bone point from Site LR-1. In *Coastal Southwest Tasmania. The prehistory of Louisa Bay and Maatsuyker Island*, by R.L. Vanderwal & D.R. Horton. Terra Australis, 9. (Appendix).

Johan Kamminga 1980. Analysing stone tools. Experimental determination of stone tool use, *Science*, 210:58-59.

Brian Hayden & Johan Kamminga 1979. Introduction to lithic analysis: the first CLUW. In *Lithic use-wear analysis*. Brian Hayden (ed.), Academic Press, New York, pp. 1-13, (with Brian Hayden).

Brian Cotterell & Johan Kamminga 1979. The mechanics of flaking. In *Lithic use-wear analysis*. Brian Hayden (Ed.), Academic Press, New York, pp. 97-112,

Brian Cotterell, Brian Hayden & Johan Kamminga 1979. The Ho Ho classification and nomenclature committee report. In *Lithic use-wear analysis*. B. Hayden (ed.), Academic Press, pp. 133-37.

Johan Kamminga. 1979. The nature of polish on prehistoric stone tools; and 'Commentary on tool design and microscopic residues'. In *Lithic use-wear analysis*. Brian Hayden (ed.), Academic Press, New York, pp. 143-57.

Johan Kamminga 1979. 'Commentary on use-wear, tool design and residues'. In *Lithic use-wear analysis*. Brian Hayden (Ed.), Academic Press, New York, pp. 141, 189, 190, 191, 192, 193, 283, 286, 287, 369-70, 371, 372.

Johan Kamminga 1977. Functional study of Australian tool type. In *Stone tools as cultural markers: Change, evolution and complexity*. R. V. S. Wright (ed.), Australian Institute of Aboriginal Studies, Canberra, pp. 205-12.

Johan Kamminga 1974. Report on the edge wear on stone tools from the Clarence River site. In *Aboriginal prehistory in New England*, by I. McBryde. University of Sydney Press, pp. 371-372 (Appendix).

Journal Articles & Reviews

Perera, N, N. Kourampas: I.A. Simpson, S.U. Deraniyagala, D. Bulbeck, J. Kamminga, J. Perera, K. Szabó, N.V. Oliveira & D. Fuller 2011. People of the ancient rainforest: late Pleistocene foragers at the Batadomba-lena rockshelter, Sri Lanka, *Journal of Human Evolution*, 61:254-269.

Johan Kamminga & Judith Field 2005. Rhys Jones Medal for outstanding contribution to Australian archaeology. Emeritus Professor John Mulvaney AO CMG (1925-), *Australian Archaeology*, 60:69-70.

Johan Kamminga 2005. Media Liaison Officer report, *Australian Archaeology*, 60:89.

Brian Cotterell & Johan Kamminga 1993. The formation of flakes, *Journal of Chinese Antiquity*, 3:80-98. (In Chinese, translated and republished from *American Antiquity*, 52:675-708).

Brian Cotterell & Johan Kamminga 1989. The formation of flakes, *Kyusekki Kokogaku*, [*Palaeolithic Archaeology*], 39. (In Japanese, translated and republished from *American Antiquity*, 52:675-708).

Johan Kamminga & R. V. S. Wright 1988. The Upper Cave at Zhoukoudian and the origins of the Mongoloids, *Journal of Human Evolution*, 17:739-67.

Johan Kamminga 1988. Wood artefacts: a checklist of plant species utilised by the Australian Aborigines, *Australian Aboriginal Studies*, 1988/2:26-59.

Brian Cotterell & Johan Kamminga. 1987. The formation of flakes, *American Antiquity*, 52:675-708. (Translated and republished in *Journal of Chinese Antiquity*, 1993, vol. 3, pp. 80-98. and republished in *Kyusekki Kokogaku* [Japanese *Palaeolithic Archaeology*], 1989, vol. 39. Reprinted in George H. Odell (compiler) 2009. *Archaeological lithic analysis: readings from American Antiquity and Latin American Antiquity*. Society for American Archaeology Press, Washington, pp.37-72).

Brian Cotterell & Johan Kamminga 1986. Finials on stone flakes, *Journal of Archaeological Science*, 13:451-61.

Brian Cotterell, F.P. Dickson & Johan Kamminga 1986. Ancient Egyptian water-clocks – A reappraisal, *Journal of Archaeological Science*, 13:31-50.

Johan Kamminga 1985. The pirri graver, *Australian Aboriginal Studies*, 1985/II:2-25.

Brian Cotterell Johan Kamminga & F.P. Dickson 1985. The essential mechanics of conchoidal flaking, *International Journal of Fracture*, 29:205-21. Translated by M. Shimura & S. Yamada and republished in Japanese journal *Kyusekki Kokogaku* [Palaeolithic Archaeology], 1989, vol. 39, under the title 'Fracture mechanics of stone tools'.

Johan Kamminga & Brian Cotterell 1984. The pollen record and Easter Island statues, *Nature*, 312:289.

Johan Kamminga & Richard Fullagar 1984. Use-wear analysis in Australia. In G. K. Ward (ed.), *Archaeology at ANZAAS Canberra, 1984*. Appendix 2 (abstracts), pp. 258-59.

Johan Kamminga 1981. Comment on Research and development in the Stone Age: technological transitions among hunter-gatherers, by Brian Hayden, *Current Anthropology*, 22:535-36.

Johan Kamminga 1981. The bevelled pounder: an Aboriginal tool type from southeast Queensland, *Proceedings of the Royal Society of Queensland*, 92:31-34.

Johan Kamminga 1980. [Review of Stone Age cultures of Central India by R.V. Joshi]. Deccan College, Poona, 1978. In *Archaeology in Oceania*, 15:180-81.

Johan Kamminga. 1980. A functional investigation of Australian microliths, *The Artefact*, 5:1-18.

Brian Hayden & Johan Kamminga 1973. Gould, Koster & Sontz on microscopic analysis: a critical review, *Lithic Technology*, 2:1-16. (Reprinted: Bobbs-Merrill Module in Anthropology No. A495).

Other Publications

Internet Publications

Johan Kamminga 2002. Australian Aboriginal timber Quick Search. ASEDA (Aboriginal Studies Electronic Data Archive), Australian Institute of Aboriginal & Torres Strait Island Studies, Canberra. http://coombs.anu.edu.au/ SpecialProj/ ASEDA.

David Frankel & Johan Kamminga 1994. *Careers in Archaeology*. First published 1981; revised editions 1984, 1993. Graduate Careers Council of Australia, Melbourne.

SELECTION OF CONSULTANCIES & REPORTS:

2013. Identification and audit of Aboriginal objects at Tibooburra, Sturt National Park, Mutawintji National Park, Broken Hill, and Kinchega National Park. National Heritage Consultants. May 2013. (Client: NSW Office of Environment and Heritage).

2013. Report on the archaeological salvage (mechanical scrapes and collection of lithic items) at AHIMS Site 52-5-437, Shell Cove, NSW. Heritage Consulting Australia Pty Ltd. May 2013. (Client: Australand Corporation (NSW) Pty Ltd).

2011-2012 (ongoing). Presentation of cultural heritage inductions for APLNG contractors in Queensland locations including Brisbane, Roma, Miles, Chinchilla, Spring Gully Camp, and Curtis Island. (Client: Heritage Consulting Australia Pty Ltd & Origin Energy).

2011. Aboriginal cultural heritage advice for a proposed Moruya town feeder transmission lines upgrade. National Heritage Consultants. September 2011. (Client: Essential Energy).

2011. Order of magnitude estimate of the number of prehistoric Aboriginal stone artefacts in Australia. National Heritage Consultants. November 2011. (Client: Essential Energy).

2011. Aboriginal cultural heritage advice. Proposed Moruya to Moruya North Feeder Line (FDR 7704) Upgrade. National Heritage Consultants. November 2011. (Client: Essential Energy).

2011. Cultural heritage assessment of Wetlands #3 and #5, Shell Cove, NSW. National Heritage Consultants. March 2011. (Client: Australand Corporation).

2010. Aboriginal Heritage Induction Kit. Contractor Induction Program for Shell Cove Boat-harbour and Marina Project, National Heritage Consultants. February 2010. (Client: Australand Corporation).

2010. Archaeological inspection of a quartz vein exposure near Nimmitabel, NSW. National Heritage Consultants report to Country Energy. November 2010. (Client: Country Energy).

2010. Cultural heritage assessment, Stage 9, Shell Cove, NSW. National Heritage Consultants. August 2010. (Client: Australand Corporation).

2010. Aboriginal stone technology in Yanga National Park, NSW. Report to the Culture & Heritage Division of the NSW Department of Environment, Climate Change & Water. National Heritage Consultants, Canberra. May 2010. (Client: NSW DECCW, now OEH).

2009. Cultural heritage inspection of Baboon-1 and 20 Mile Well-1 Leases in the Galilee Basin, Central Queensland. Report To Heritage Consulting Australia Pty Ltd. National Heritage Consultants, Canberra. October 2009. (Client: HCA Pty Ltd).

2009. Cultural heritage review. Conceptual Master Plan for the proposed Boatharbour Precinct Lands, Shell Cove, NSW. National Heritage Consultants report to Australand Corporation (NSW) Pty Ltd. June 2009. (Client: Australand Corporation).

2009. Inspection & assessment of Aboriginal lithic scatter AHIMS 37-2-2350 (Site D10), Lot 1 DP1095515, Liddell Power Station, Hunter Valley, NSW. National Heritage Consultants report to Macquarie Generation. March 2009. (Client: Macquarie Generation).

2009. Cultural heritage assessment report of Sussex Inlet residential and recreational development proposed by Lucas Properties Group Pty Ltd at Sussex Inlet, NSW. National Heritage Consultants report to Lucas Properties Group. May 2009. (Client: Lucas Properties Group Pty Ltd).

2008. Report on lithic items from Hookina Creek 1, Southern Flinders Ranges, South Australia. Report to Archaeological Risk Assessment Services Pty Ltd National Heritage Consultants, Canberra. March 2008. (Client: A.R.A.S Pty Ltd).

2007. Lake Hume Aboriginal Heritage Conservation Management and Tourism Plan. (Client: Goulburn Murray Water, Albury). (See publications).

2006. Creation of replica Aboriginal artefacts for 'Museum-in-a-Case' Travelling Exhibition to Arnhem Land, 2006-2007. National Museum of Australia (see Garma gets it! Museum-in-a-Case, *Aboriginal and Torres Strait Islander News from the National Museum of Australia*, 2007, 4(1):8. (Client: National Museum of Australia).

2005. Conservation Plan of Management, Shell Cove Boatharbour and Marina, Shellharbour. Professional advice to Australand and Blake Dawson in relation to matters before the NSW Land & Environment Court (Client: Australand Corporation).

2004. Caledonia Valley Indigenous Cultural Heritage Study. National Heritage Studies report to Parks Victoria, Shepparton Office. (Client: Parks Victoria).

2003. Aboriginal prehistoric heritage study. Glenrock Lagoon Cultural Landscape. Conservation Management and Cultural Tourism Plan (Griffin NRM and National Heritage Consultants for NSW

National Parks and Wildlife Service). (Client: NSW NP&WS, now OEH). See http://www.environment.nsw.gov.au/parkmanagement/ GlenrockSCAGlenrockLagooncmp.htm

2002-3. Community consultation, heritage management planning, archaeological surveys, and site monitoring for the Lake Cowal Gold Project, central NSW. Professional advice to Blake Dawson in relation to legal proceedings in the NSW Land and Environment Court (Client: Blake Dawson).

2003. Independent expert evaluation of the Department of Environment & Conservation assessment associated with a proposed subdivision development at Barlings Beach. December 2003. National Heritage Consultants report to NSW Department of Environment & Conservation. (Client: NSW Office of Environment & Heritage).

2003. Aboriginal heritage study of Beachcomber Holiday Park, Eurobodalla National Park, NSW. National Heritage Consultants report to Far South Coast Region Office, Narooma, NSW National Parks & Wildlife Service. (Client: NSW NP&WS, now OEH).

2002. Review of collection and research. National Museum of Malaysia (Client: Department of Antiquities, Ministry of Culture, Malaysia).

2001. Expert review of the Integrated Research Plan, Rocky River Palaeontological and Archaeological site, Flinders Chase National Park, Kangaroo Island.' (Client: National Parks and Wildlife, South Australia).

2000. Yarriambiack Creek Aboriginal heritage study and conservation plan, Mallee region, Victoria (Client: Aboriginal Affairs Victoria).

1997. Cultural heritage management report. Australian Defence Industry (ADI) land release at St Marys. (report by J. McDonald, J. Kamminga and P. Mitchell) (Client: J McDonald P/L for ADI Ltd–Lend Lease Joint Venture).

1991. Review of the Archaeological Collections, National Museum of Australia (Client: National Museum of Australia).

1986. Evaluation of the potential for stone tool residue analysis and professional assistance in establishing a specialist lithics laboratory in the Department of Prehistory, Australian National University. (Client: Australian National University)

1980. Aboriginal historical, archaeological and mythological sites and places on the Todd River, Alice Springs (Client: Dames & Moore for the Northern Territory Department of Water Resources).

1979. Archaeological survey for Georgetown Uranium Mine, Cape York Peninsula (Client: Dames & Moore for Getty Oil).

1978. Archaeological survey for Drayton Open-Cut Coal Mine, Upper Hunter Valley. (Client: Dames and Moore for Thiess Bros and Shell Oil).

1977. Archaeological survey for Norwich Park Open-Cut Coal Mine, central Queensland. (Client: Dames and Moore for Utah Development Corporation).

1973-76. Archaeological survey and assessment of the Alligator Rivers region, preliminary to the declaration of Kakadu National Park (see publications). (Client: Australian Government & Mining Industries Council of Australia).