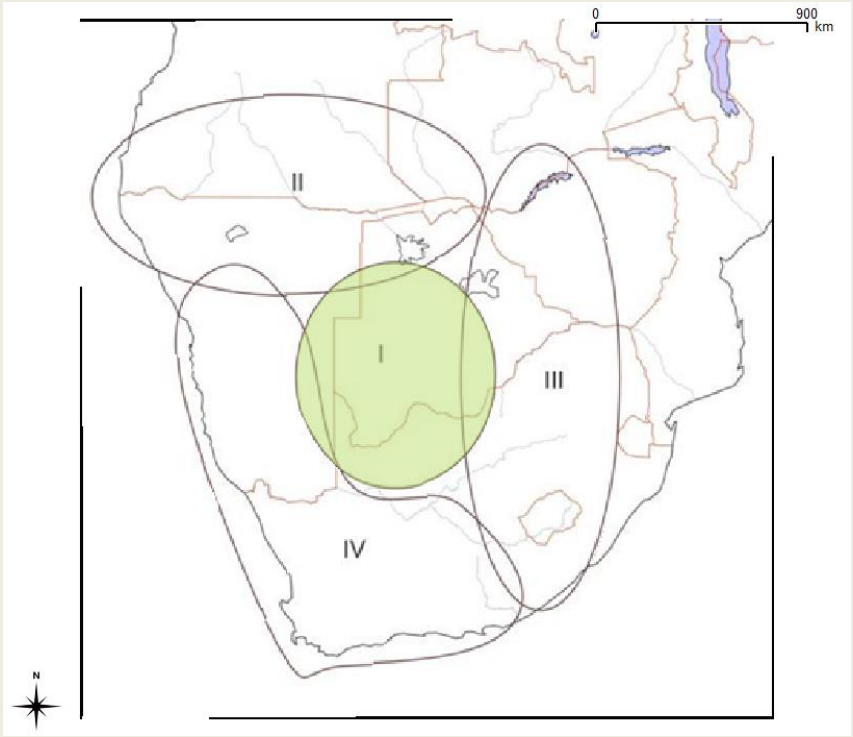
1st Day (Thursday, May 14): Survey panels according to disciplines

- I: Dry Kalahari in eastern Namibia, southwestern Botswana, and north-central RSA



- 11:30-12:40: Panel (2)

- Archaeology: Sadr

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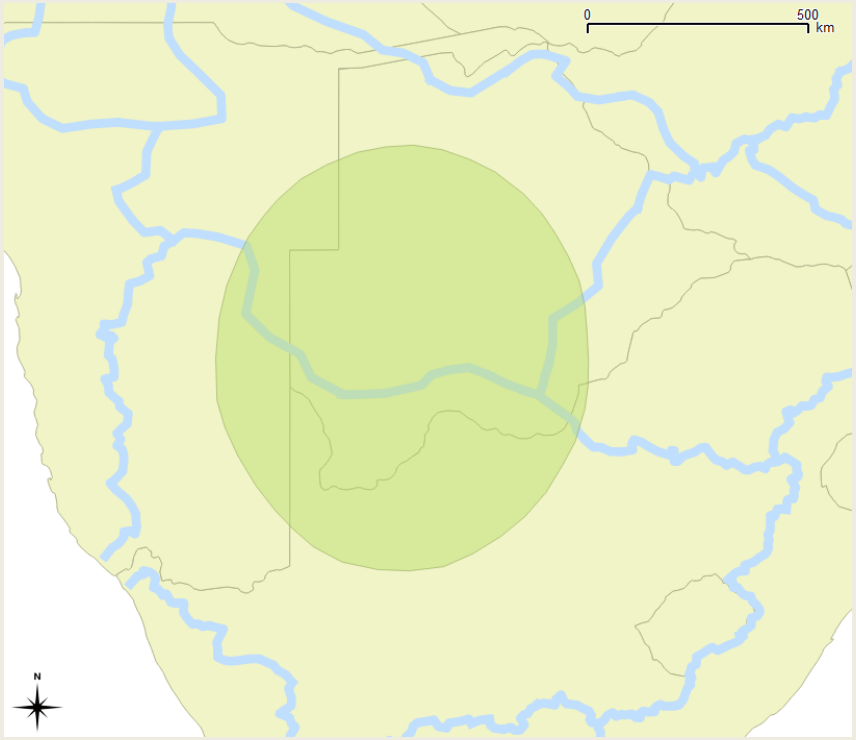
I: Dry Kalahari in eastern Namibia, southwestern Botswana, and north-central RSA

- Southern half of Kalahari (drainage) basin
- Northern portion if Orange River basin
- Extreme west end of Limpopo River basin
- Time frame: Holocene



Blue lines indicate watersheds

Holocene Palaeo-climates

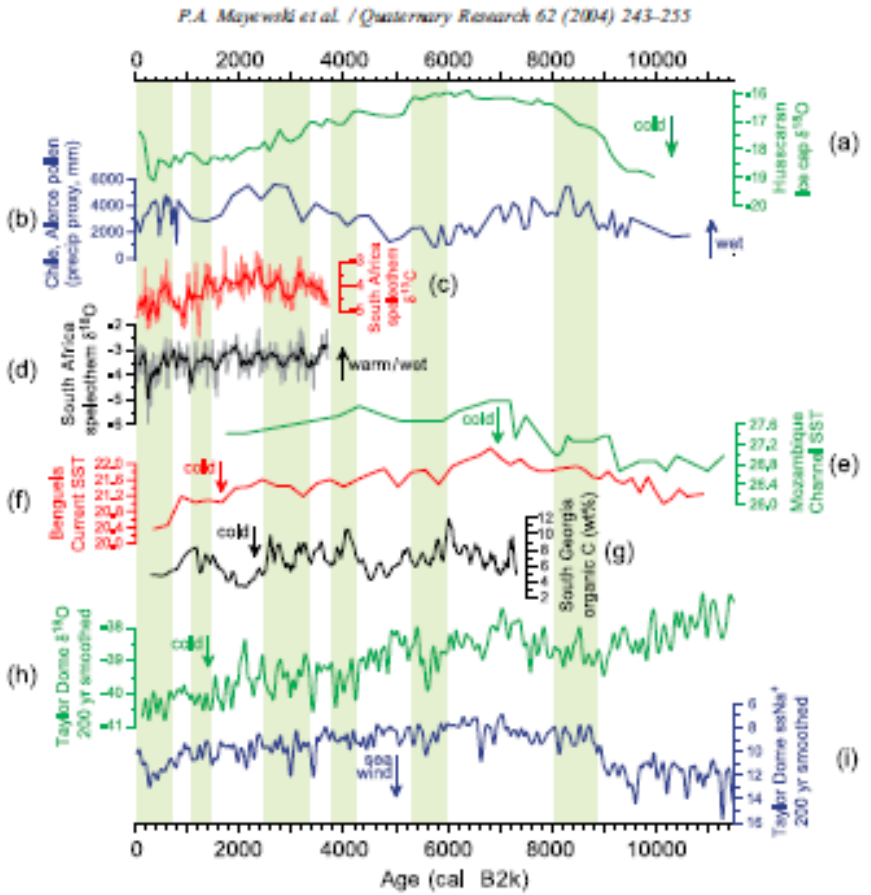
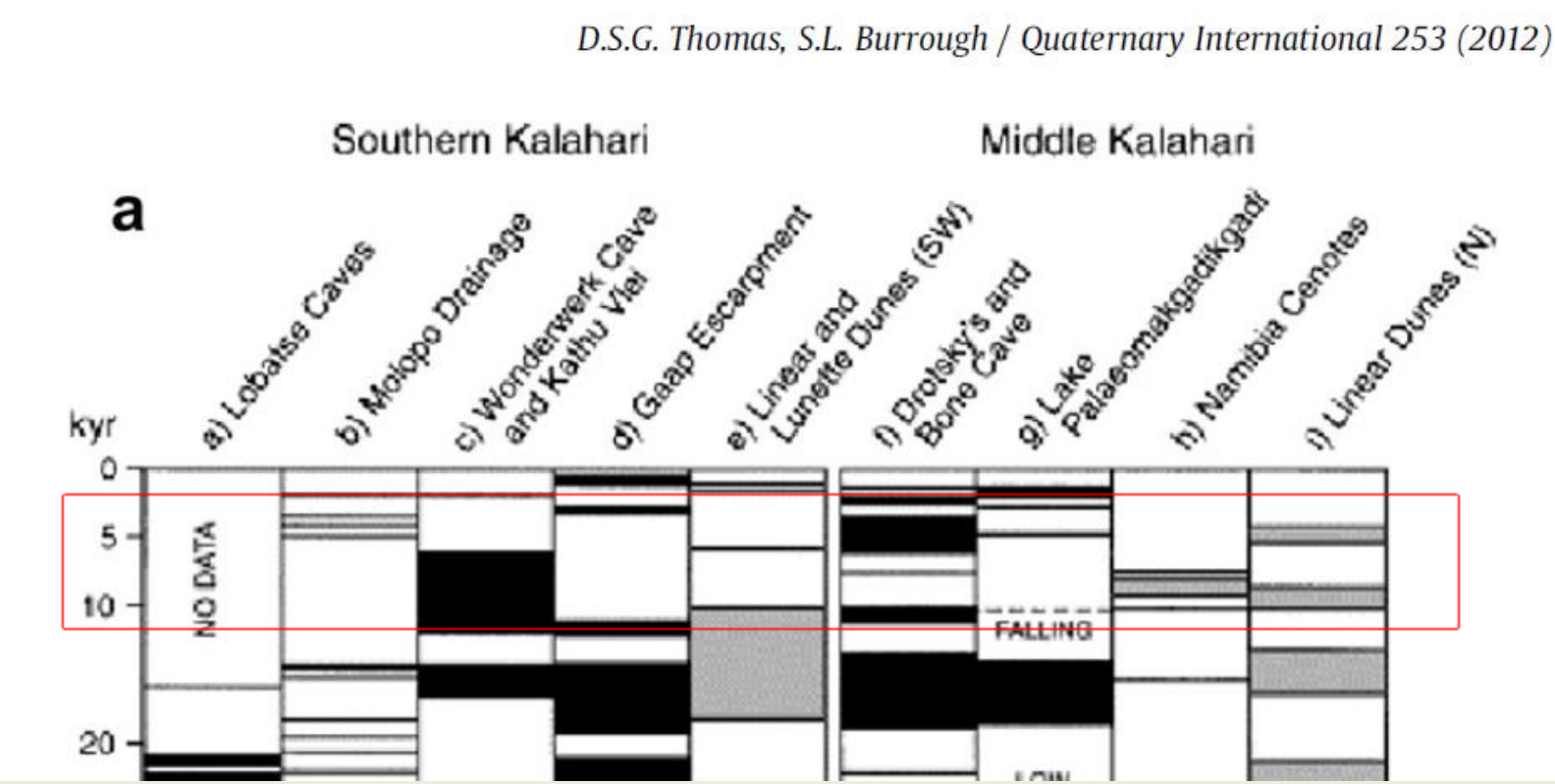


Figure 3. Southern Hemisphere paleoclimate series, arranged generally by latitude (north, top), with state of climate proxy noted. Green bands represent timing of RCC, tuned to high-resolution GISP2 record. (a) $\delta^{18}O$ record (‰) for Huascaran ice-cap, Peru (Thompson et al., 1995). (b) Pollen-ratio based reconstruction of precipitation (mm) for Lake Alerce, Chile (Heusser and Streeter, 1980). (c) $\delta^{13}C$ record (‰) for speleothem in Cold Air Cave, South Africa (Lee-Thorp et al., 2001). (d) $\delta^{18}O$ record (‰) for speleothem in Cold Air Cave, S Africa (Lee-Thorp et al., 2001). (e) Alkenone-based SST record (°C) for core from the Mozambique Channel (MD79257) (Bard et al., 1997). (f) Alkenone-base sea surface temperature record (°C) for core from the Benguela Current (Kim et al., 2002). (g) Organic carbon (%) in a core from Block Lake South Georgia (Roqvist and Schuber, in press). (h) Gaussian smoothed (200 yr) $\delta^{18}O$ record (‰) for Taylor Dome, Antarctica (Steig et al., 2000). Taylor Dome Holocene time scale (Monnin et al., in press). (i) Gaussian smoothed (200 yr) sea-salt Na^+ (ppb) record for Taylor Dome, Antarctica (Mayewski et al., 1996). Taylor Dome Holocene time scale (Monnin et al., in press).

Kalahari Palaeo-climates



Black=more humid; Grey=more arid

Kalahari Palaeo-lakes

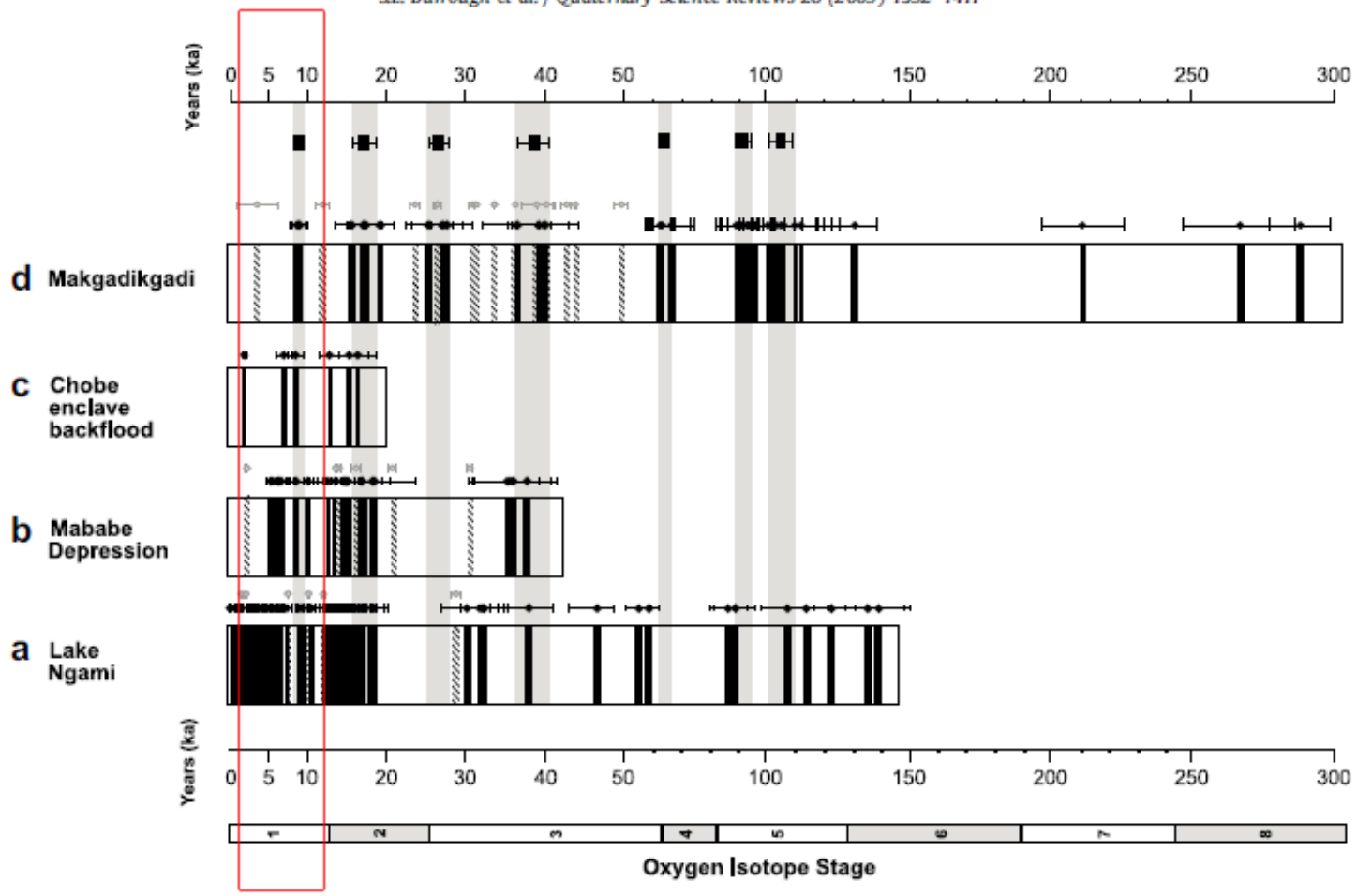
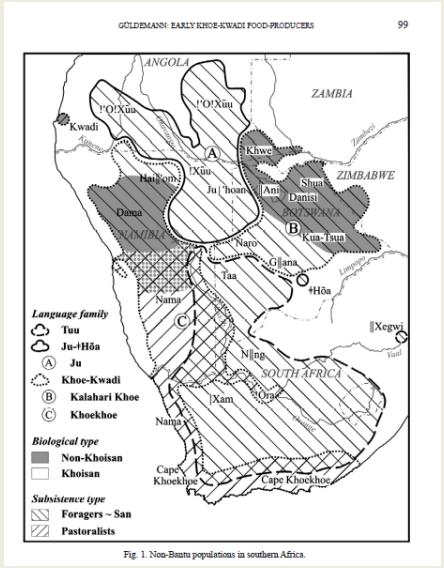
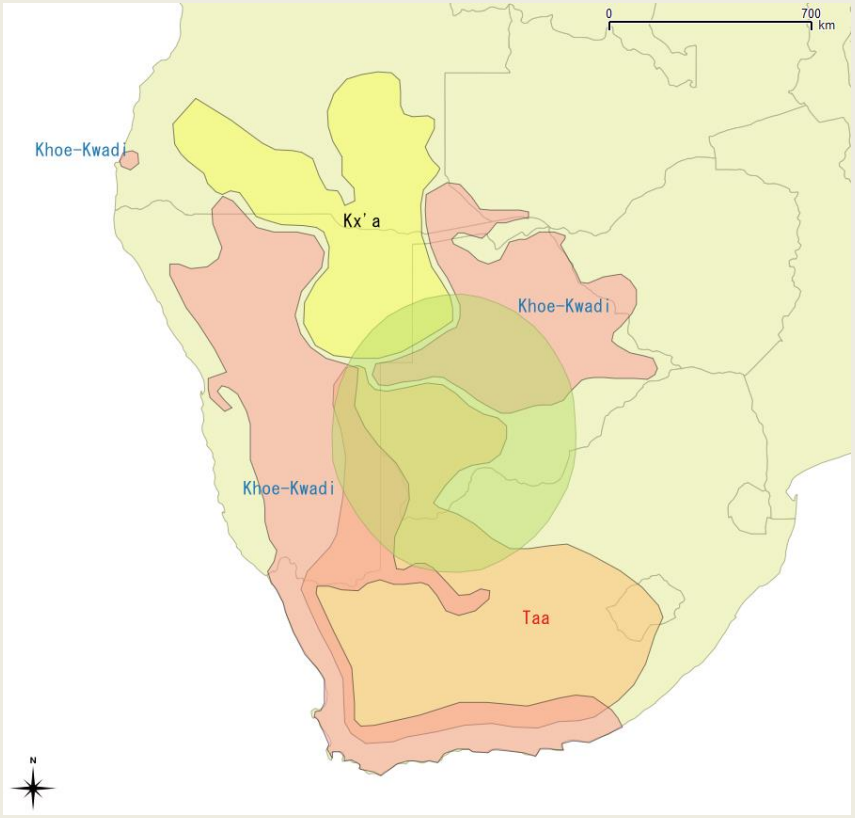


Fig. 6. Lake occupancy chronologies in the Palaeolake Makgadikgadi sub-basins. (Inferred palaeo-mega-lake phases shaded in grey – see Section 5.1 for details) Black bars within columns refer to dated shoreline ridge accumulation periods. Actual dates and their associated errors (given to 1 standard error) are plotted adjacent to these columns in black (also see Table 3). a) Lake Ngami high-stands (Burrough et al., 2007) b) Mababe Depression lake high-stands (Burrough and Thomas, 2008); c) Chobe Enclave backfloods (Burrough and Thomas, 2008). Hatched bars indicate dated periods of calcrete formation within the basins and shorelines (refer to Table 1), the ages and associated errors are shown adjacent to these columns in grey.

I: Dry Kalahari in eastern Namibia, southwestern Botswana, and north-central RSA

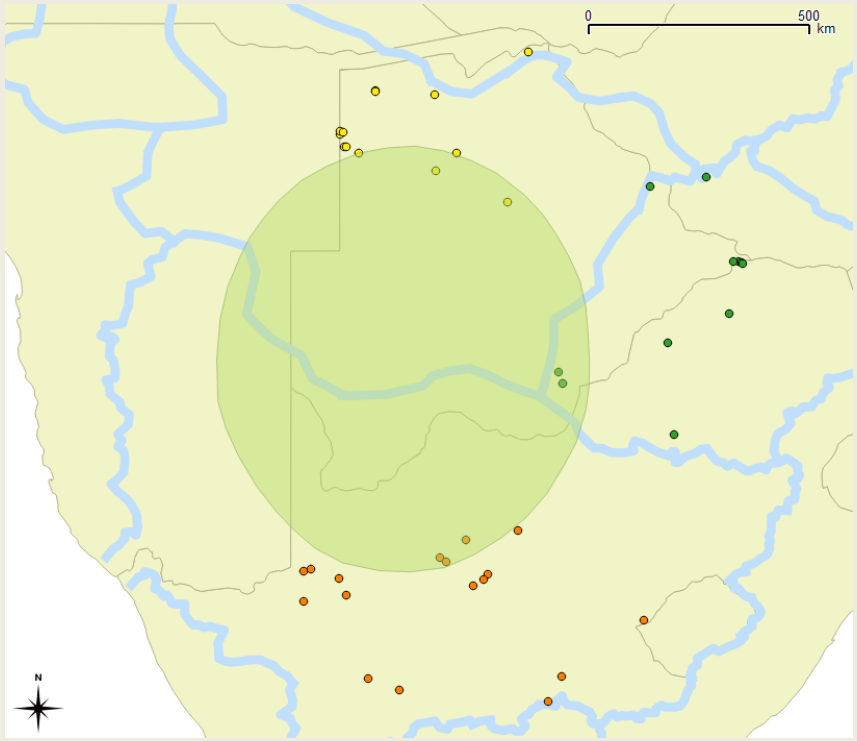
- Today includes portions of all three Khoisan language families





I: Dry Kalahari in eastern Namibia, southwestern Botswana, and north-central RSA

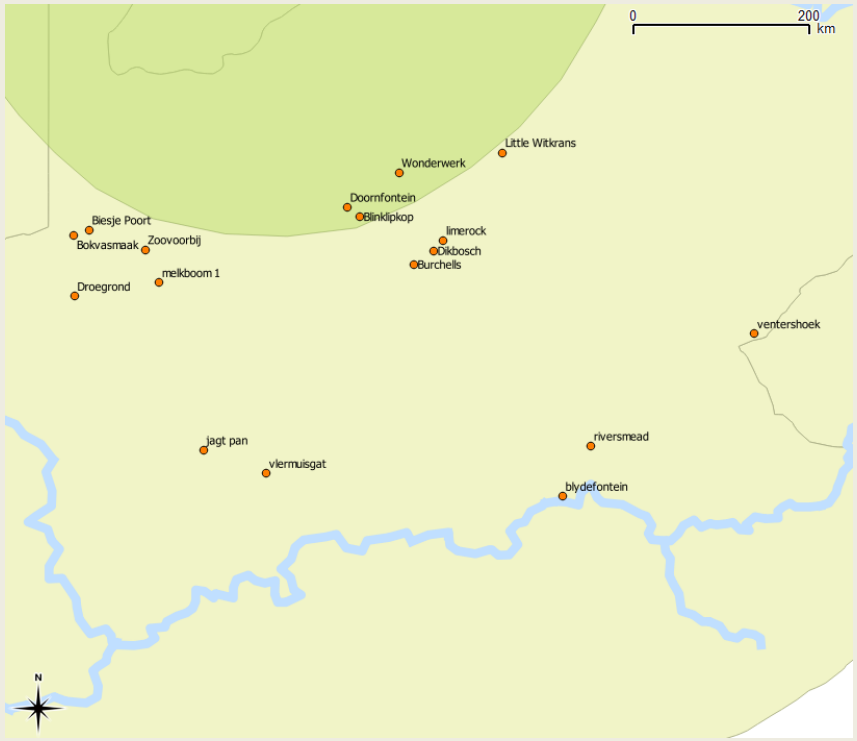
- Zone with few archaeological sites, except at the edges.
- Focus on three areas:
  - South (Orange River Basin)
  - East (Limpopo River Bain)
  - North (Kalahari Basin)



Blue lines represent watersheds
Dots are archaeological sites

Sites in the South (ORB)

1. Biesje Poort
2. Blinkklipkop
3. Blydefontein
4. Bokvasmaak
5. Burchells
6. Dikbosh
7. Doornfontein
8. Droegrond
9. Jagtpan
10. Limerock
11. Melkboom
12. Riversmead
13. Ventershoek
14. Vlermuisgat
15. Witkrans
16. Wonderwerk
17. Zoovoorbij

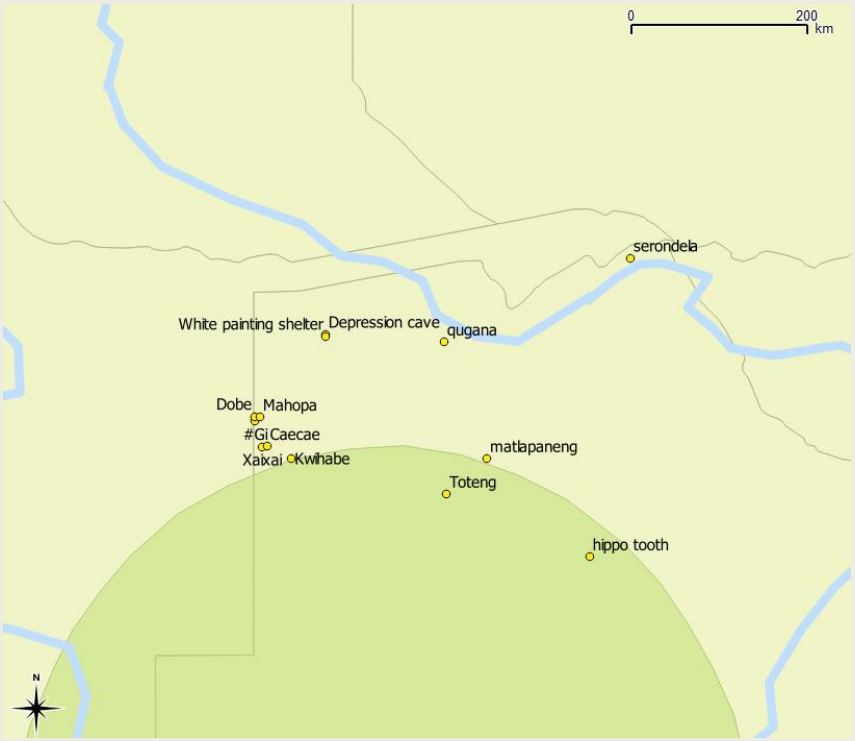


Sites in the East (LRB)

1. Balerno
2. Bambata
3. Dzombo
4. Jubilee
5. Magagarape
6. Mantenga
7. Mphekwane
8. Olieboomspoort
9. Radiepolong
10. Thamaga
11. Tshisiku
12. Tuli Lodge

Sites in the North (KB)

1. Caecae
2. Depression Cave
3. Dobe
4. Gi
5. Hippo Tooth
6. Kwihabe
7. Mahopa
8. Matlapaneng
9. Qugana
10. Serondela
11. Toteng
12. White Painting Shelter
13. Xaixai



Phase 1: Late Pleistocene/Early Holocene

	South (ORB)	East (LRB)	North (KB)	comment
sites	Dikbosch 1a; Wonderwek;	Cave of Bees; Pomongwe: Nswatugi; Jubilee; Mphekwane;	Depresssion; White painting?; Gwihabe;	wide variety of sites: aggregation/dispersal?
dates	10-12.5 kya	9.2-15.2 kya	10.9-14.7 kya	late pleistocene/early holocene
Lithics	scraper dominates, macrolithic, oakhurst	micro in earlier maleme dates; oakhurst pomongwan in later dates; oakhurst south	few backed microlithic and segments in bladelet-rich Tsodilo; unretouched macro flakes and bladelets in Gwihabe	Northern sites' lithics link to fartrher north (Nachikufan)? East and South macrolithic links to Namibian post-MSA?
Fauna	Equus capensis, Megalotragus, small antelopes, much ground game	hunting, trapping, snaring small antelope, more exploitation of r-adapted species such as dassies and rodents than in previous period.	tortoise to buffalo	much diversity
Flora	none	marula systematically exploited	mongongo	fruits 'n nuts
Other	decorated oes		no clear evidenc eof bone harpoons and fish although they were in Tsodilo in earlier phase	bone points and beads more common than before 12kya: hxaro?
climate	grassland	increased rainfall c. 10kya; drier earl	in nw bBotswana drier already 11.5 kya; central hi lake till 11kya; drier by 10kya; wetter than today by 7kya; megalake Makgadikgadi 8-10 kya	younger dryas, produced more arid conditions in many parts
comment	except extinctions wild fauna remains same through sequence			

Phase 2: Mid-Holocene

	South (ORB)	East (LRB)	North (KB)	comment
sites	dikbosh; witkrans; wonderwerk; zoovoorbij; jagt pan; blydefontein; riversmead;	Radiepolong; Thamaga; Jubilee: Kruger; Tshisiku; Mphekwane; bambta; olieboomspoort; balerno;	depression; lotshitshi; mahopa; rhino; toteng; whit epainting; xaixai	
dates	1.9-8.1 kya	2.1-7.0 kya	2.1-7.1 kya	
Lithics	hi proportion formal tools; type proportions vary scr>bck, bck>scr	hi proportion formal tools; generally scr>bck	hi proportion formal tools; type proportions bck>>scr;	growing regional diversity in lithic assemblages
Fauna	large medium grazers, ground game, smaller bovids	mostly small game, fish in some sites, much oes in some sites; mopane worms	fish, antelopes	increase in exploitation of smaller r-selected resources
Flora		marula seeds and nuts common in jubilee, bambata	mongongo	
Other	decorated oes, tanged points	storage pits	bone harpoons, pit traps	
climate	Molopo drainage indicates scattered more humid phases; Ghaap escarpment indication of humid period towards end of this phase.		Gwihabe cave indicates more humid period; palaeolake Makgadikgadi active in second half of this phase.	
comment	decorated oes links to Namibia		bone harpoons link to central Africa	

Phase 3: First Millennium AD

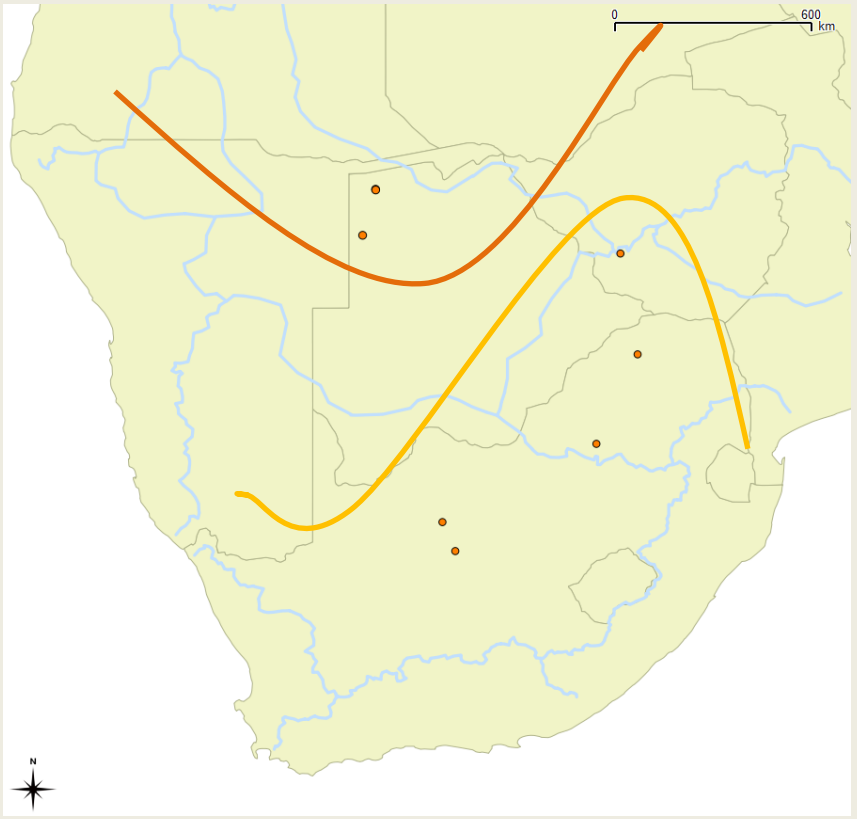
	South (ORB)	East (LRB)	North (KB)
sites	biesje poort; blinklipkop; dikbosh; doornfontein; witkrans; wonderwerk; limerock; blydefontein; riversmead;	thamaga; mphekwane; bambata; jubilee; tshisiku; olieboomspoort; balerno; dzombo; tuli lodge; mantenga;	depression; lotshitshi; mahopa; toteng; white painting; xaixai; nqoma; serondela; hippo tooth; qugana; matlapaneng;
dates	0.7-1.8 kya	1.0; 2.1 kya	1.0-1.9 kya
Lithics	formal tool proportions sometimes higher than before. Scr>bck	ft higher than before; usually scr>bck, occasionally >>, or scr=bck	ft higher than before; bck>scr, except in the bambata level of toteng where bck>scr
Pottery	thin undecorated mineral and grass temp; spout at BP;	bambata, thin, mainly in north, rare rippled, iron age pottery, mineral tempered	bambata thin, no rippled, iron age pottery, charcoal temper
Fauna	occasional sheep by 1.2 ka, maybe even 1.6 ka at limerock, large to small ungulates	wild game as before plus occasional sheep	occasional sheep and cattle plus wild game, fish
Flora		marula seeds and nuts common in jubilee,	
Other	decorated oes, possible stone-walled kraal at limerock, tanged arrowheads, specularite mining	one piece decorated oes in jubilee; metal working at tuli lodge, glass beads, tanged arrowhead in balerno and tshisiku	metal in various sites; barbed bone harpoons in tsodilo,
climate	Molopo drainage and wonderwerk indicate more humid at beginning of this phase. Ghaap escarpment inidcates more		Gwihabe and Makgadikgadi lakeshore indicate more humid at beginning of this phase
comment	fiber temp pottery (BP), tanged point (DK) stone kraal (limerock) all link to Karoo	rare tanged arrowheads and decorated oes link to ORB	iron age pottery shows links to north and to east, as do bambata sherds at toteng

Phase 4: Second Millennium AD

	South (ORB)	East (LRB)	North (KB)
Site	biesje poort; blinklipkop; bokvasmaak; burchell; blydefontein; dikbosh; droegrond; jagt pan; melkboom; ventershoek; vlermuisgat; wonderwerk;	balerno; dzombo; mphekwane; olieboompoort; radiepolong; tuli;	depression; gi; mahopa; rhino; toteng; white painting; xaixai;
ka	0.1-0.8 kya	0.1-1.0 kya	0.0-1.0 kya
Lithics	tanged pressure flaked arrowheads; some sites bck>scr, others scr>bck;	scr>bck	bck>>scr;
Pottery	thin walled grass and mineral tempered; lugs; porcelain; spout frag? At ventershoek;	middle and late iron age types;	iron age pots; some chroacoal temp; lugs;
metal	iron frags and beads;	copper smelting at tuli;	iron copper artefacts
Fauna	wide range of wild; significant number of livestock at blinklipkop and bosvasmaak; sheep hair;	much tortoise and small bovids; fish; some sheep;	large to small wild game; occasional livestock;
Flora		marula;	maize in white painting; mongongo;
Other	specularite mining; vitrified dung at bosvasmaak; glass beads; stone structure; decorated oes; flaked glass;	glass beads;	cowrie shell; glass beads;
climate	Ghaap escarpment suggests more humid conditions		Lake Ngami suggests more humid conditions
comment			game trap pits at Gi; lithic links to Namibia rather than east; homogeneity in stone tools since mid holocene in ngamiland;

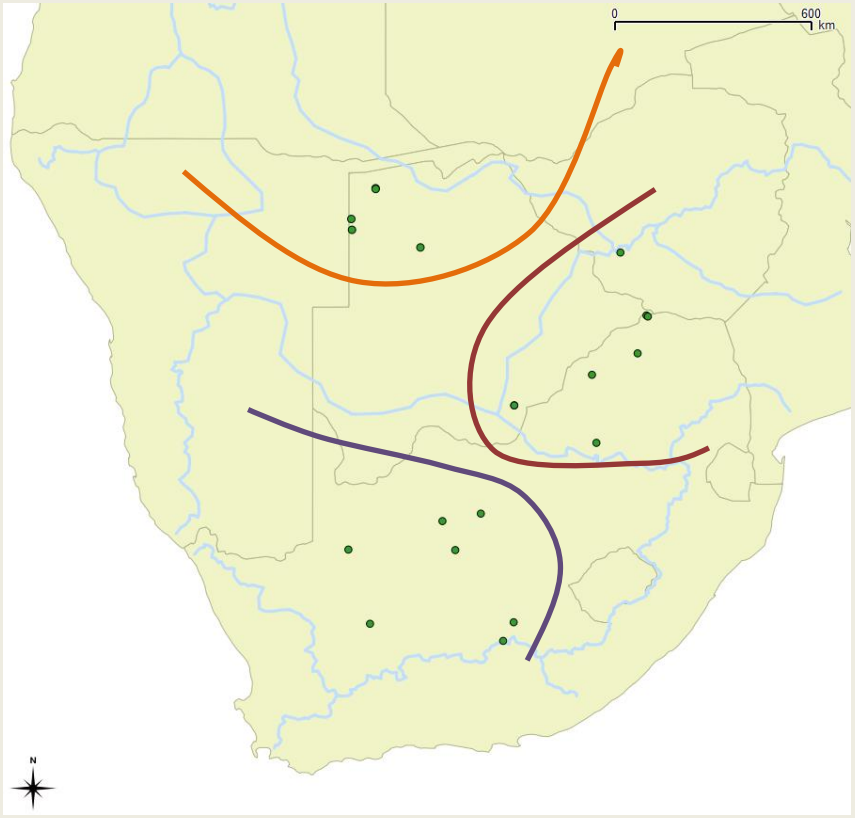
Phase 1: Late Pleistocene/Early Holocene

- Microlithic KB, link to central Africa
- Macrolithic (Oakhurst) in ORB and LRB, link to south and west



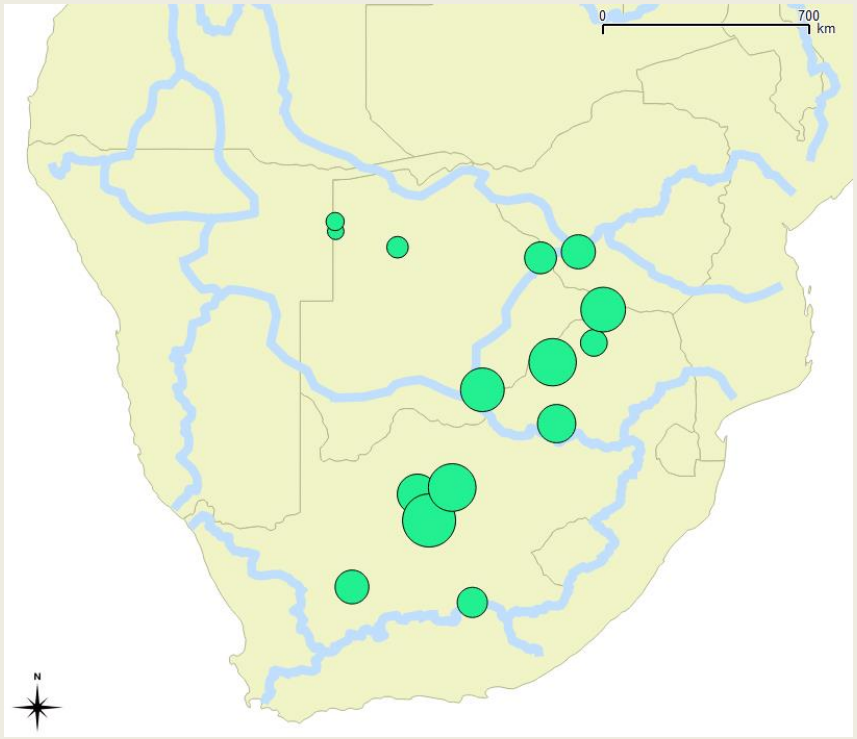
Phase 2: Mid-Holocene

- KB proportion of bck>scr, and bone harpoons link to central Africa
- ORB variable proportions of back and scr, decorated ostrich eggshell (oes) links to southern Namibia
- LRB proportions generally scr>bck.

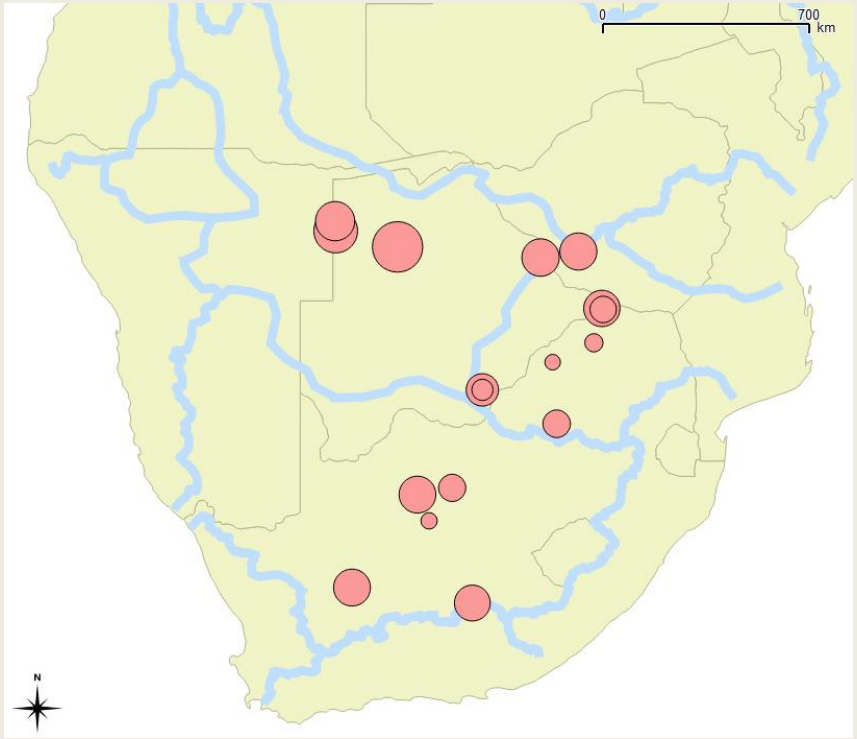


Phase 2: Mid-Holocene

Scraper %



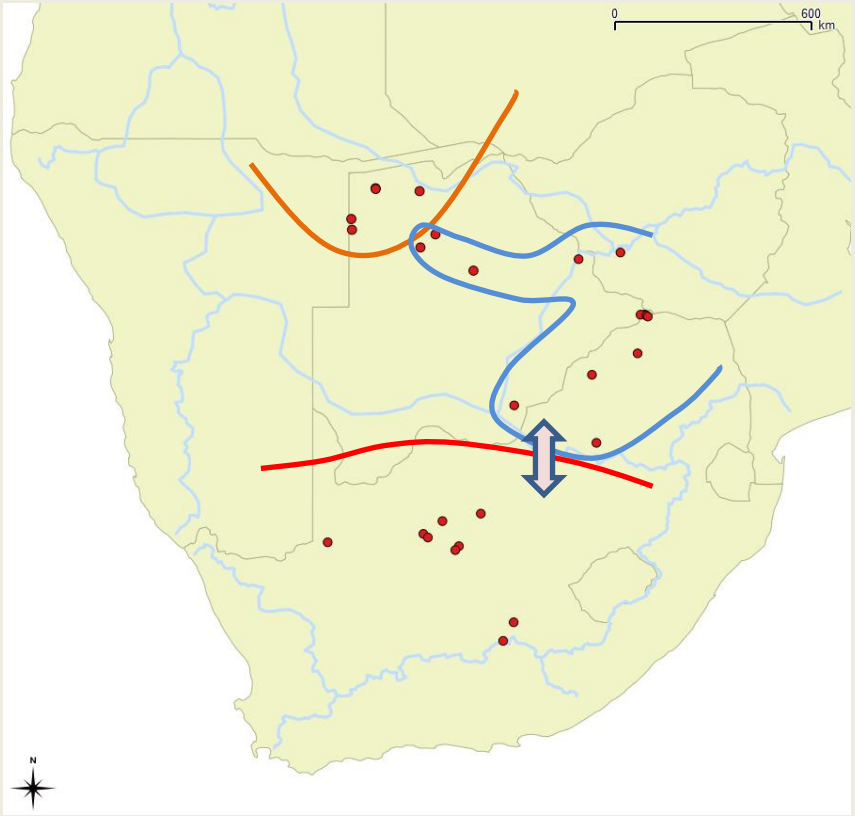
Backed %



NB only showing sites with FT samples > 25

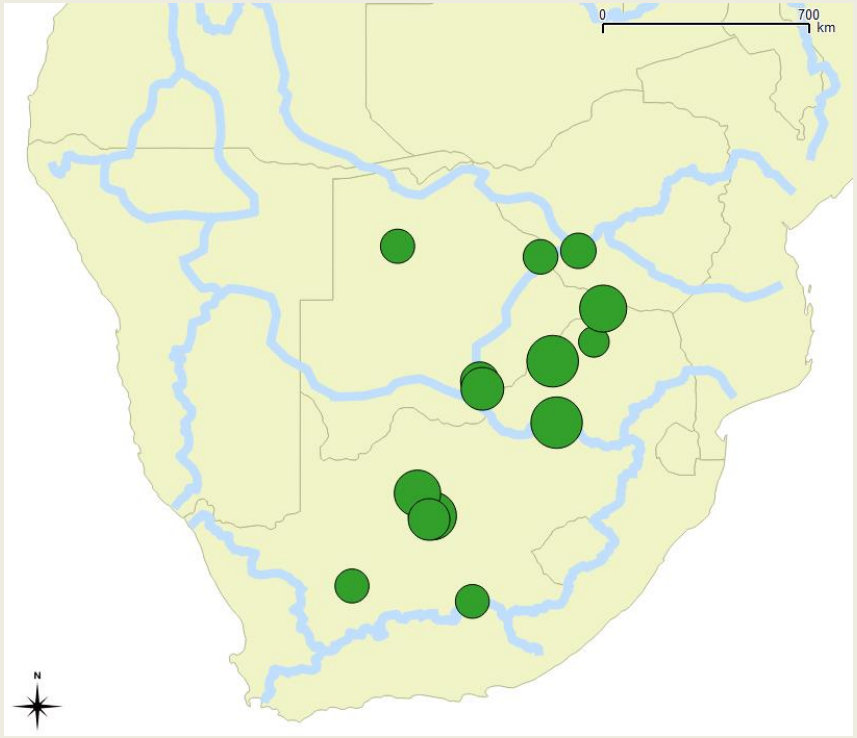
Phase 3: First Millennium AD

- KB bck>scr, bone harpoons and iron age pottery link to north, but Bambata pottery and scraper-rich lithics at Toteng link to LRB
- LRB scr>bck as in phase 2
- ORB decorated oes link to Namibia; grass tempered pottery and bifacial tanged arrowheads local. Scr>bck link to LRB, as well as few decorated oes and tanged stone arrowsheads.



Phase 3: First Millennium AD

Scraper %



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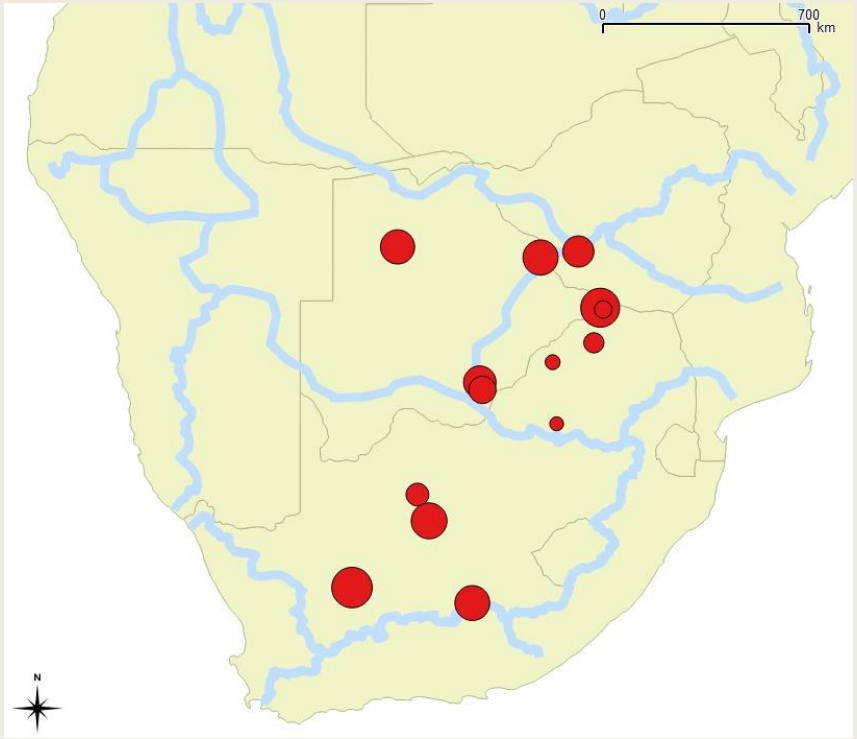
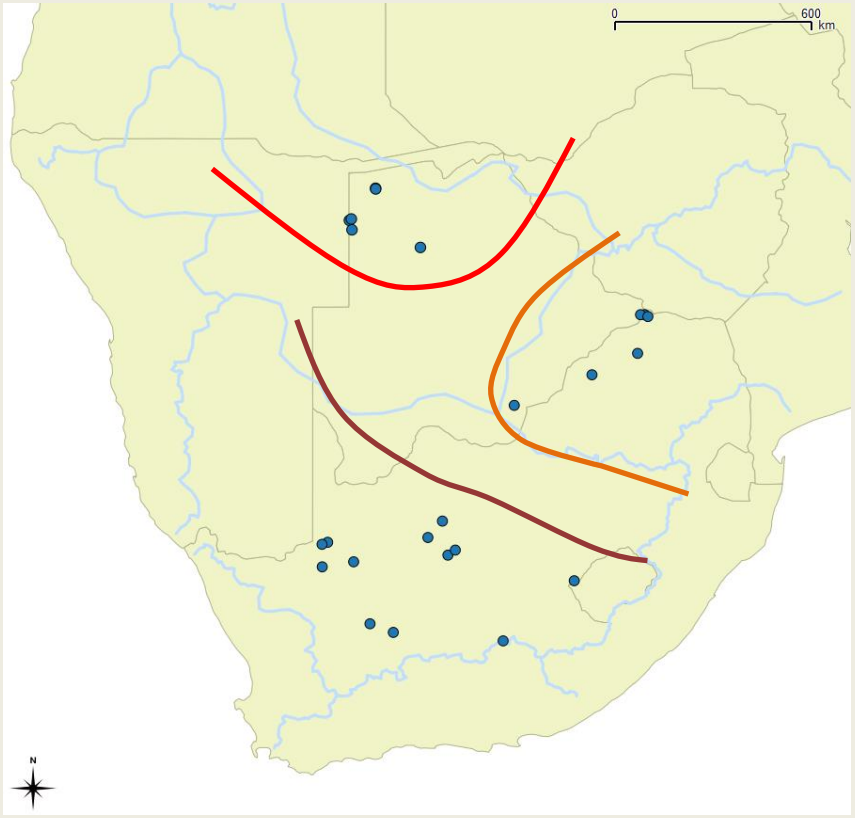


NB only showing sites with FT samples > 25

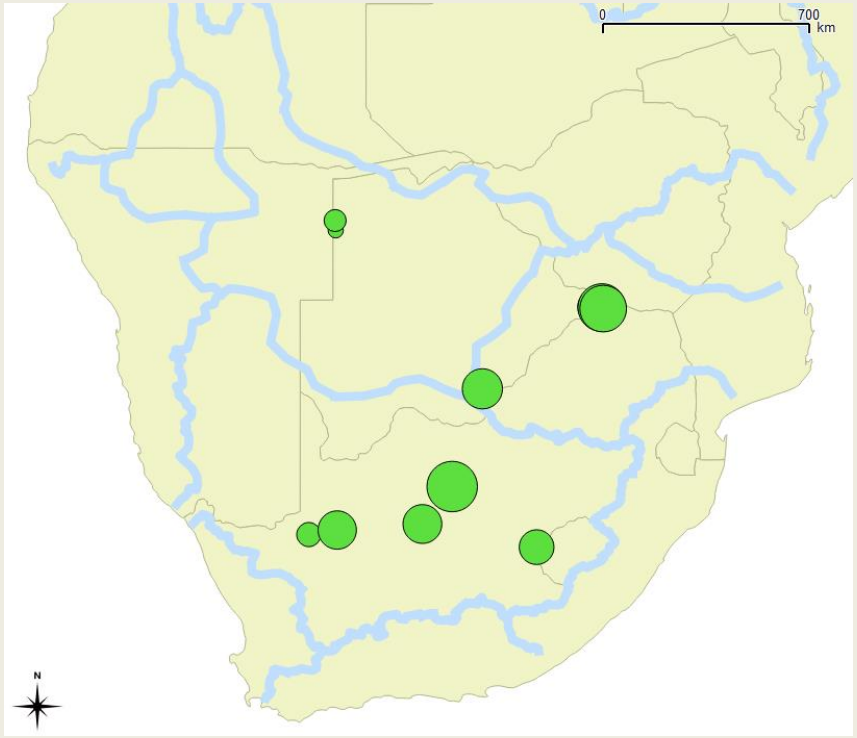
Phase 4: Second Millennium AD

- KB bck>>scr, cowrie shells link to north; lugged pots link to west and south.
- LRB much iron age influence; scr>bck as in ORB.
- ORB lugged pots and stone kraals link to Namibia.



Phase 4: Second Millennium AD

Scraper %



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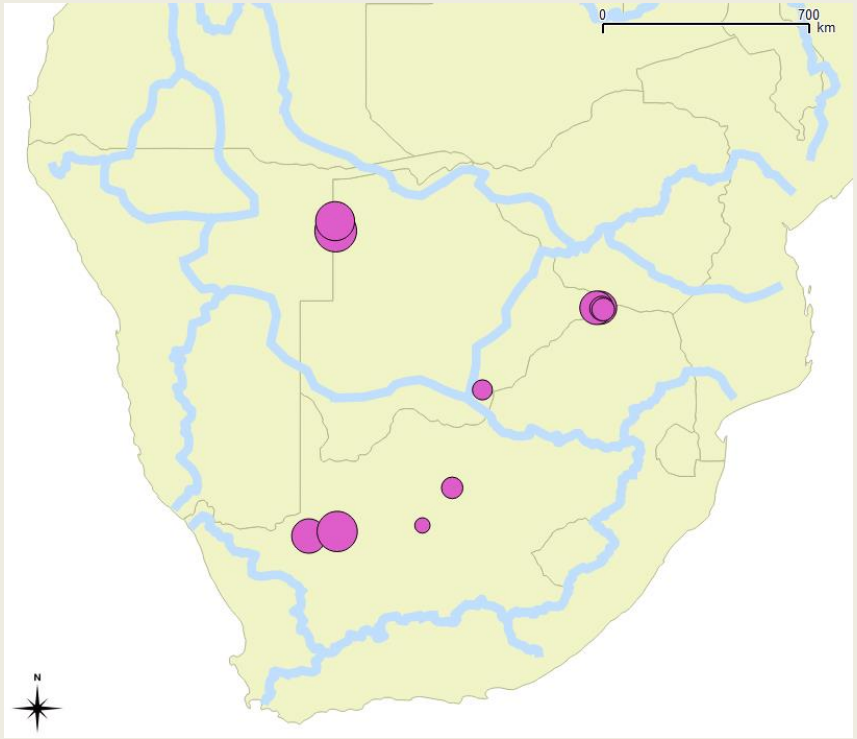


NB only showing sites with FT samples > 25

Lithic Continuity Before and After Pottery?

Discontinuity Model

- Lithic types associated with pottery bearing level differ from types in pre-pottery levels.
- May suggest arrival of new population with different lithic tradition.

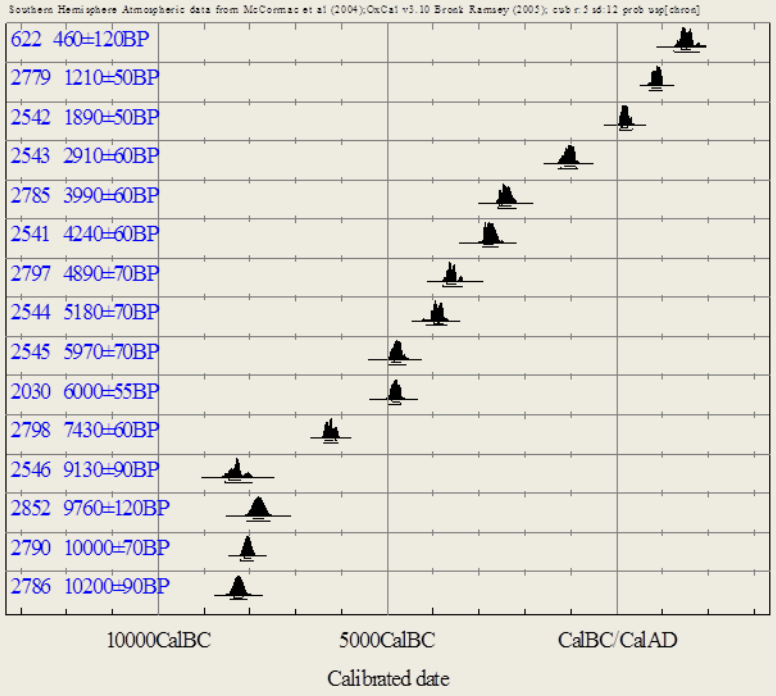
Continuity Model

- Lithic types associated with pottery bearing level similar to types in pre-pottery levels.
- May suggest same population carrying on.

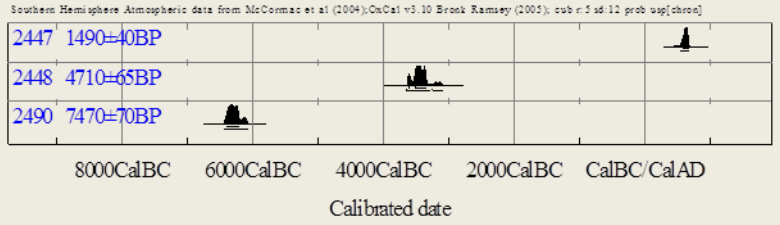
ORB: 3 sites with rich long sequences

ID	site	phase	layers	SCR%	BCK%	ADZ%	OTH%	FT%	FLK%	BLD%	N
1	wonderwerk	P	1a to 3b	69.65	16.73	4.78	13.63	3.16	58.03	4.09	35790
2	wonderwerk	PP	4a to 5b	52.68	43.90	1.95	3.41	1.77	62.74	3.62	57814
3	witkrans	P	0_30	82.35	14.97	0.00	2.67	3.27	87.72	2.46	5727
4	witkrans	PP	4 to 5	73.50	23.93	0.00	2.56	3.32	81.63	4.54	3523
5	jagtpan7	p	1	41.30	39.13	6.52	13.04	3.99	6.94	10.06	1153
6	jagtpan7	pp	2_4	32.50	47.50	12.50	7.50	3.44	6.62	14.35	1164

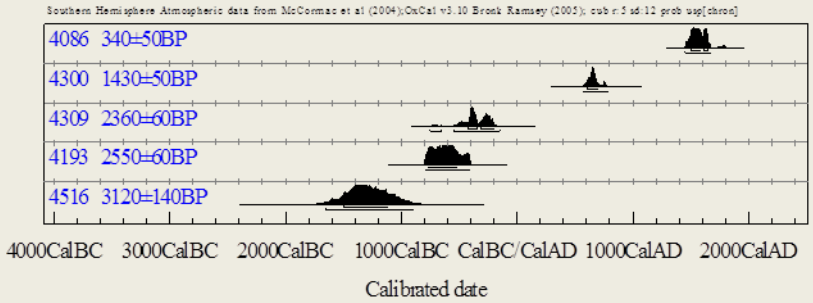
1&2



3&4

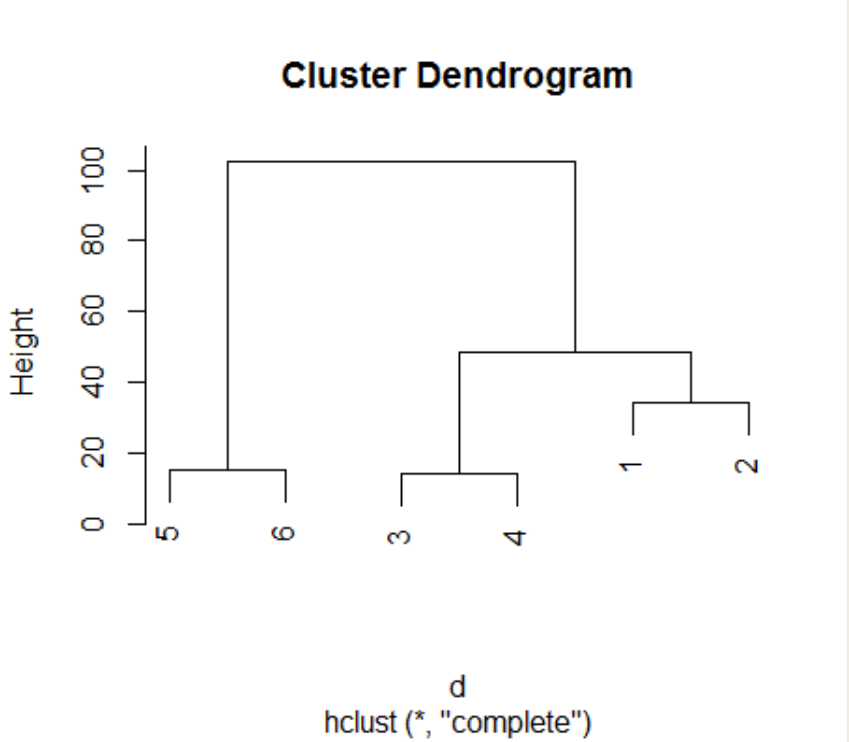


5&6



ORB: Intra-site lithic continuity evident

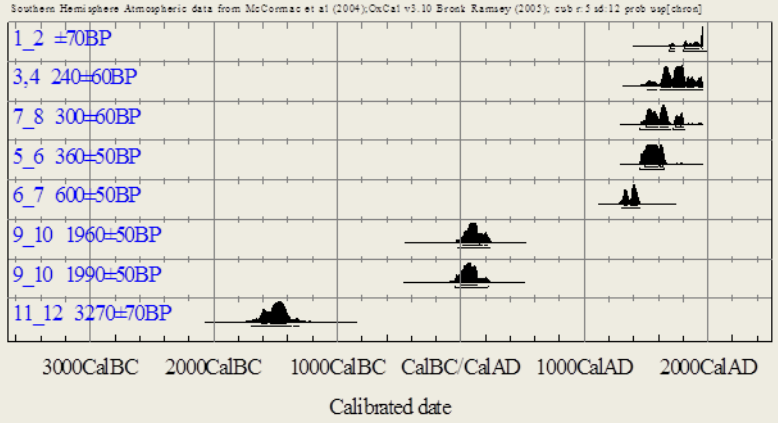
1	wonderwerkp	
2	wonderwerkpp	
3	witkrans	p
4	witkrans	pp
5	jagtpan7	p
6	jagtpan7	ppav



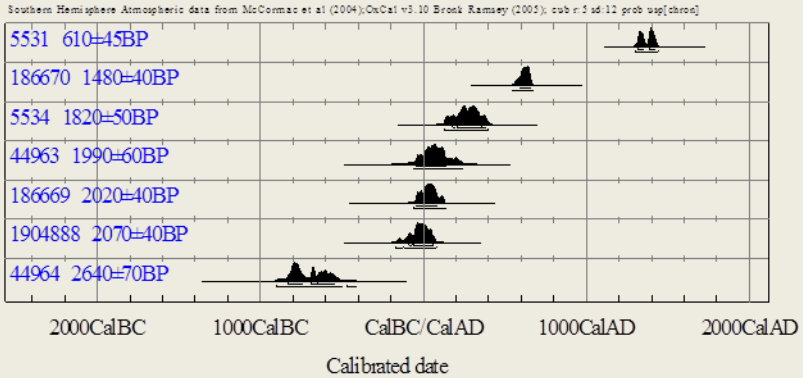
KB: 3 sites with rich long sequences

ID	site	exc	phase	layers	SCR	SCR%	BCK	BCK%	OTH	OTH%	FT
1	mahopa	M1	P	1_9	1	3.703704	16	59.25926	10	37.03704	27
2	mahopa	M1	PP	10_16	6	13.04348	21	45.65217	19	41.30435	46
3	mahopa	M2,3	P	1_9	9	15.78947	28	49.12281	20	35.08772	57
4	mahopa	M2,3	PP	10_16	18	10.77844	83	49.7006	66	39.52096	167
5	toteng	abc	P	40_140	16	40	13	32.5	11	27.5	40
6	toteng	abc	PP	140_200	5	15.15152	27	81.81818	1	3.030303	33
7	xaixai	2	P	1_8	4	7.54717	30	56.60377	19	35.84906	53
8	xaixai	2	PP1	9_18	7	7.216495	58	59.79381	32	32.98969	97
9	xaixai	2	PP2	19_27	10	8.849558	70	61.9469	33	29.20354	113

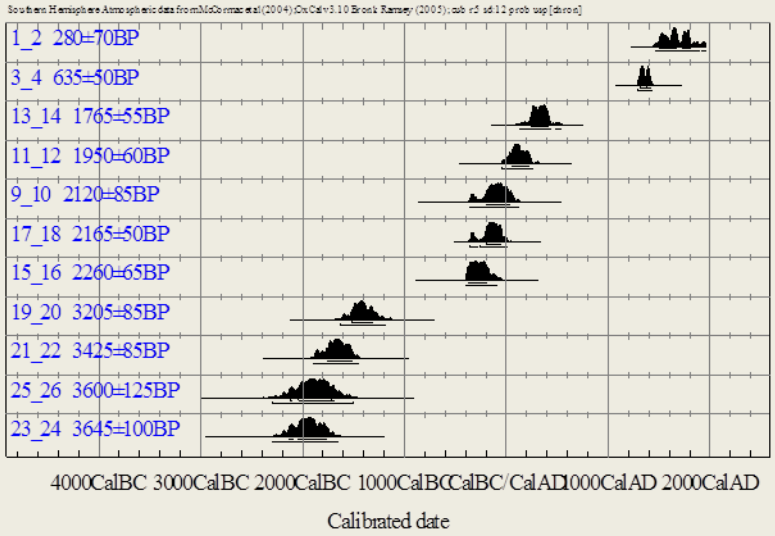
1-4



5,6

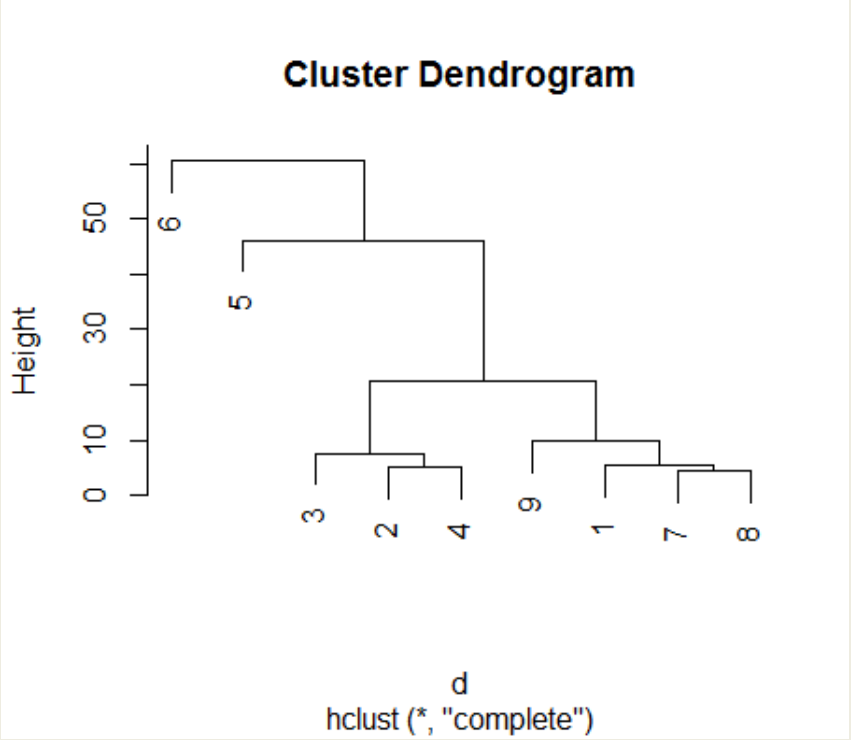


7-9



KB: Intra-site lithic continuity evident

ID	site	exc	phase
1	mahopa	M1	P
2	mahopa	M1	PP
3	mahopa	M2,3	P
4	mahopa	M2,3	PP
5	toteng	abc	P
6	toteng	abc	PP
7	xaixai	2	P
8	xaixai	2	PP1
9	xaixai	2	PP2

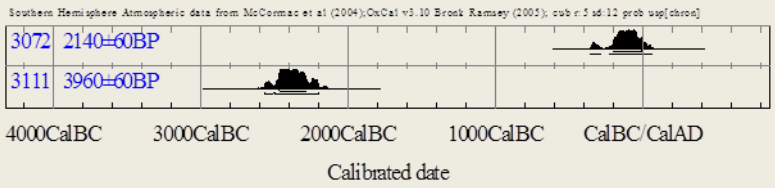


LRB: 5 sites with rich long sequences

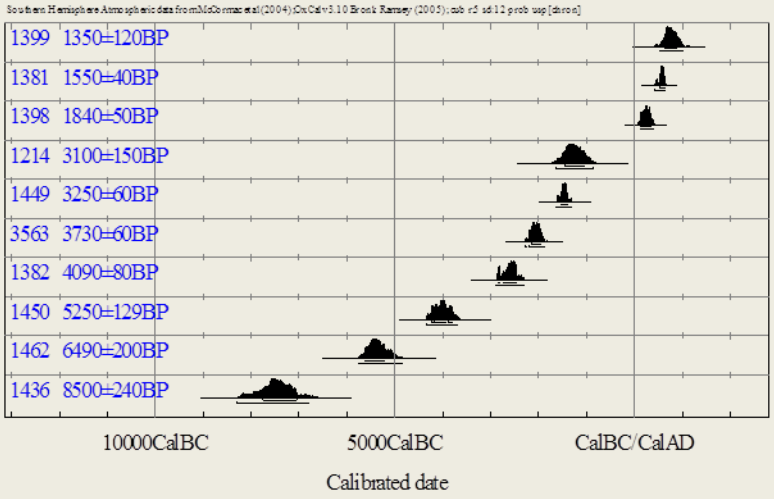
ID	site	phase	layers	SCR%	BCK%	ADZ%	OTH%	FT%	FLK%	BLD%	N
1	bambatan	P	3a-3ci	40.66	31.32	0.00	26.92	3.79	76.23	5.27	4800
2	bambatan	PP	3cii	34.34	37.37	0.00	30.30	5.28	73.55	7.95	1875
3	bambataq	P	3a,b	33.91	40.23	0.00	22.99	13.88	63.24	5.58	1254
4	bambataq	PP	3c	37.61	44.44	0.00	12.82	20.00	65.81	3.42	585
5	jubilee	pp1	bm-r	34.86	8.57	13.71	42.86	0.77	97.25	0.26	22703
6	jubilee	pp2	lyn5-kii	40.09	25.00	6.13	28.77	1.48	96.32	0.68	14339
7	jubilee	pp2	rl-g	50.35	25.35	4.86	19.44	2.06	94.72	0.82	13952
8	jubilee	pp2	lyn-lyn4	51.63	22.83	7.07	18.48	3.17	91.75	0.88	5809
9	jubilee	p	bb-grub	81.82	7.51	1.98	8.70	3.56	94.21	0.17	7103
10	jubilee	p	b-cash	90.08	5.16	0.79	3.97	3.04	95.41	0.25	8283
11	jubilee	p	mva-rr	82.43	5.41	2.70	9.46	3.26	94.84	0.35	2267
12	radiepolong	p1	sq1, 7_15	59.26	24.07	0.00	16.67	0.82	11.23	0.89	6607
13	radiepolong	pp	sq1, 16_27	61.76	14.71	2.94	20.59	2.28	42.67	2.69	1488
14	thamagao	P	0-40	38.64	7.95	0.00	53.41	6.36	48.23	4.56	1383
15	thamagao	PP	40_60	38.03	33.80	0.00	28.17	5.27	51.67	8.17	1347
16	tuli lodge	P2	abc	53.16	28.48	0.00	18.35	4.42	71.50	8.22	3576
17	tuli lodge	P1	def	40.82	43.27	0.00	15.92	4.35	73.31	8.97	5638

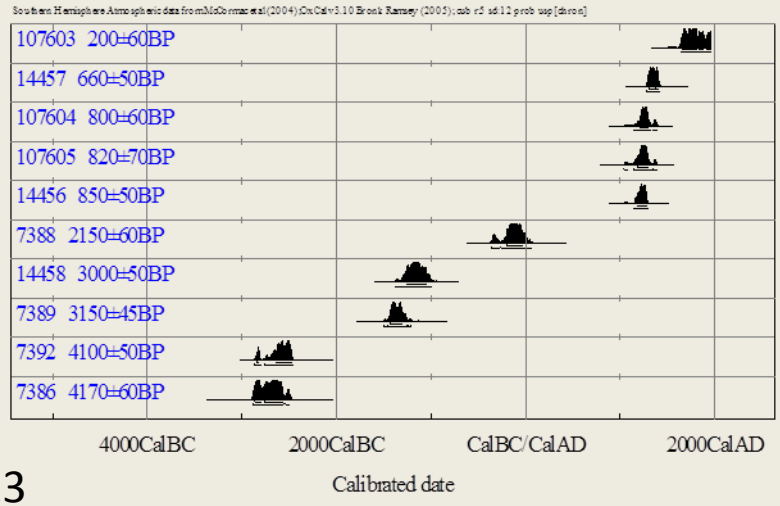
LRB: 5 sites with long sequences

1-4

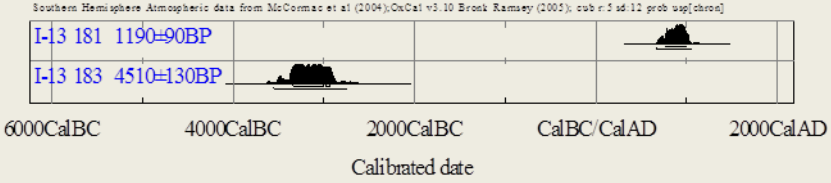


5-11

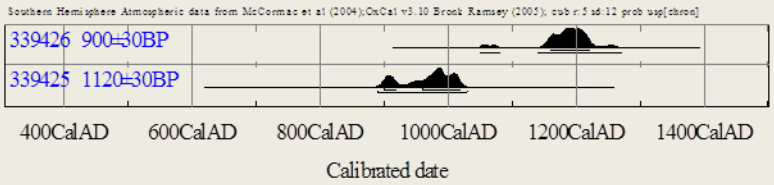




12&13



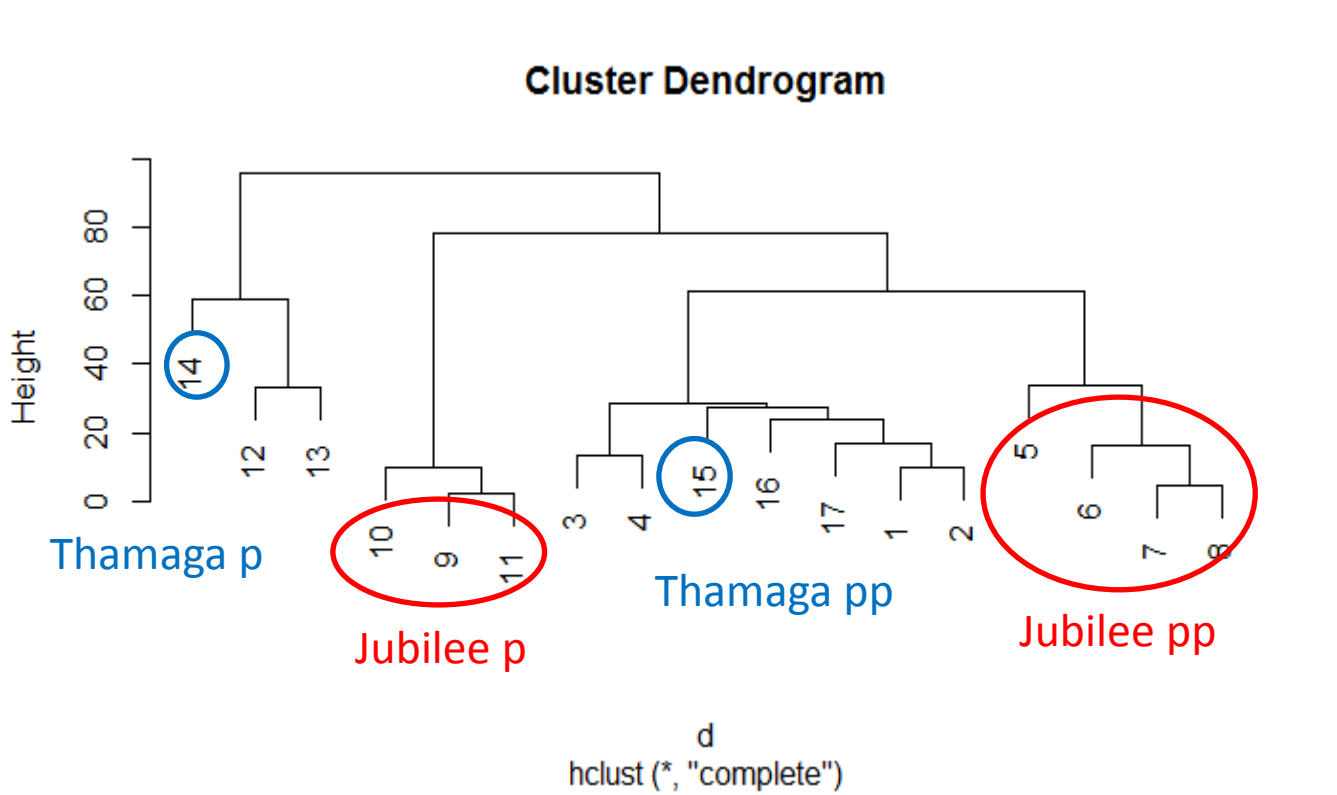
14&15



16&17

LRB: Intra-site lithic continuity less evident

1	bambatan	P
2	bambatan	PP
3	bambataq	P
4	bambataq	PP
5	jubilee	pp1
6	jubilee	pp2
7	jubilee	pp2
8	jubilee	pp2
9	jubilee	p
10	jubilee	p
11	jubilee	p
12	radiepolong	p1
13	radiepolong	pp
14	thamagao	P
15	thamagao	PP
16	tuli lodge	P2
17	tuli lodge	P1



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