

SUPPLEMENTARY MATERIAL: Yanes et al., “50 ka of Pleistocene-Holocene environmental change in the Canary Archipelago as inferred from stable isotopes in land snail shells” QR

Supplementary Figures

Fig. S1. Simplified composite stratigraphy of the studied Late Quaternary Eolian Deposits from the Eastern Canary Islands. AAR nominal ages estimated by Ortiz et al. (2006) are shown for each sampled shell bed.

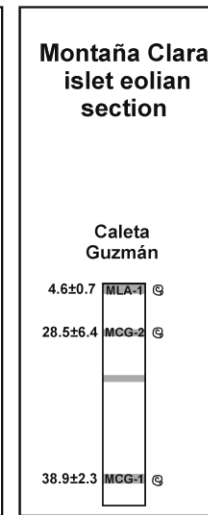
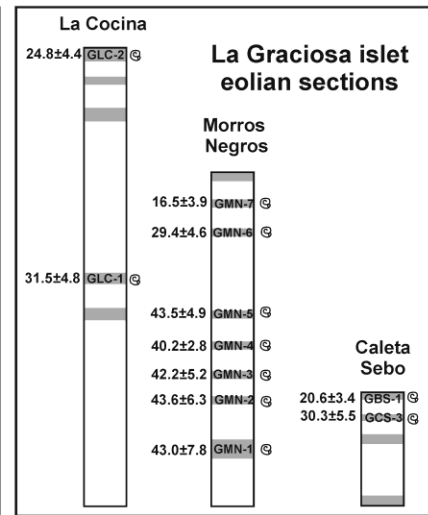
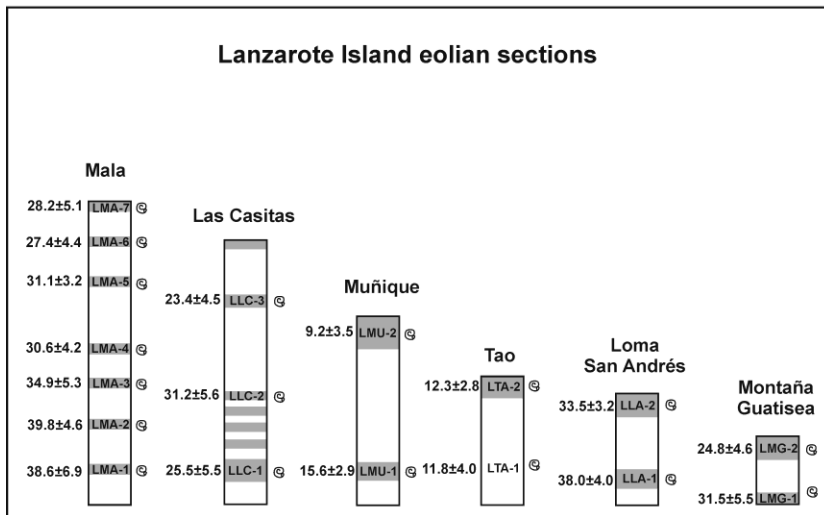
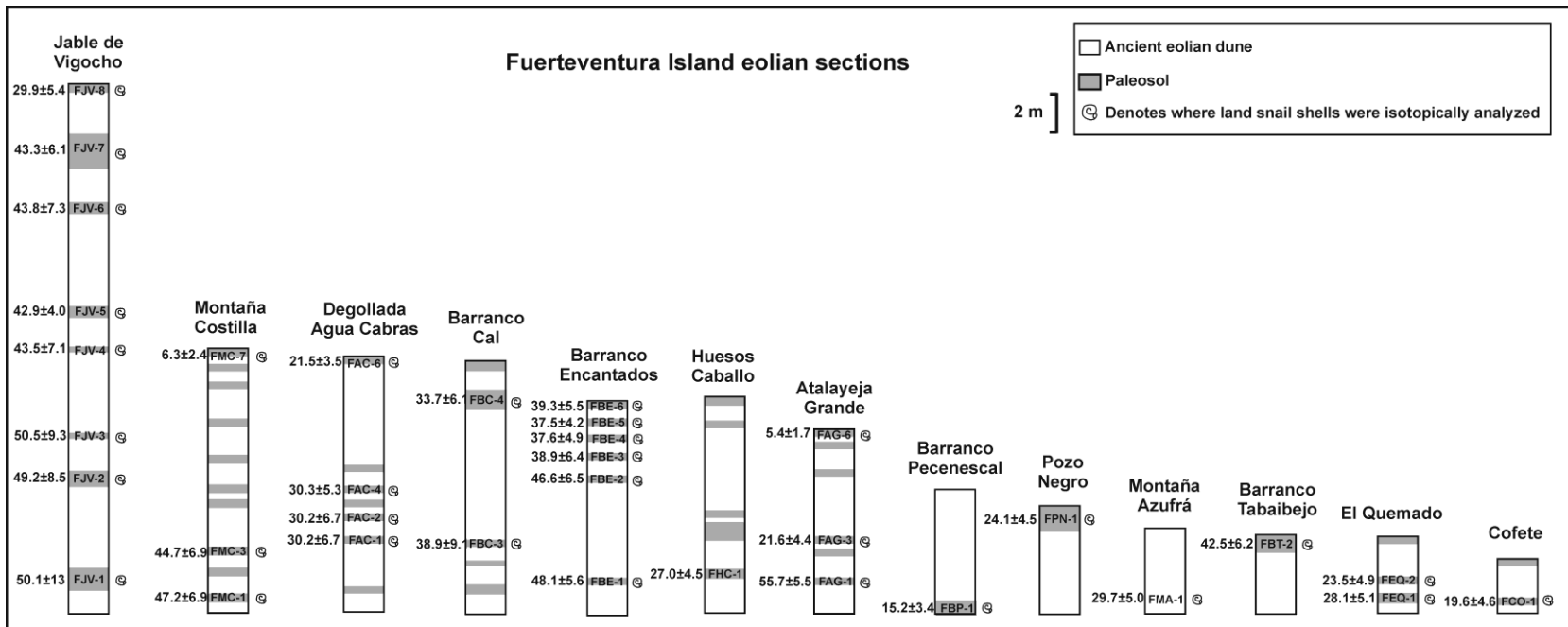


Figure S2

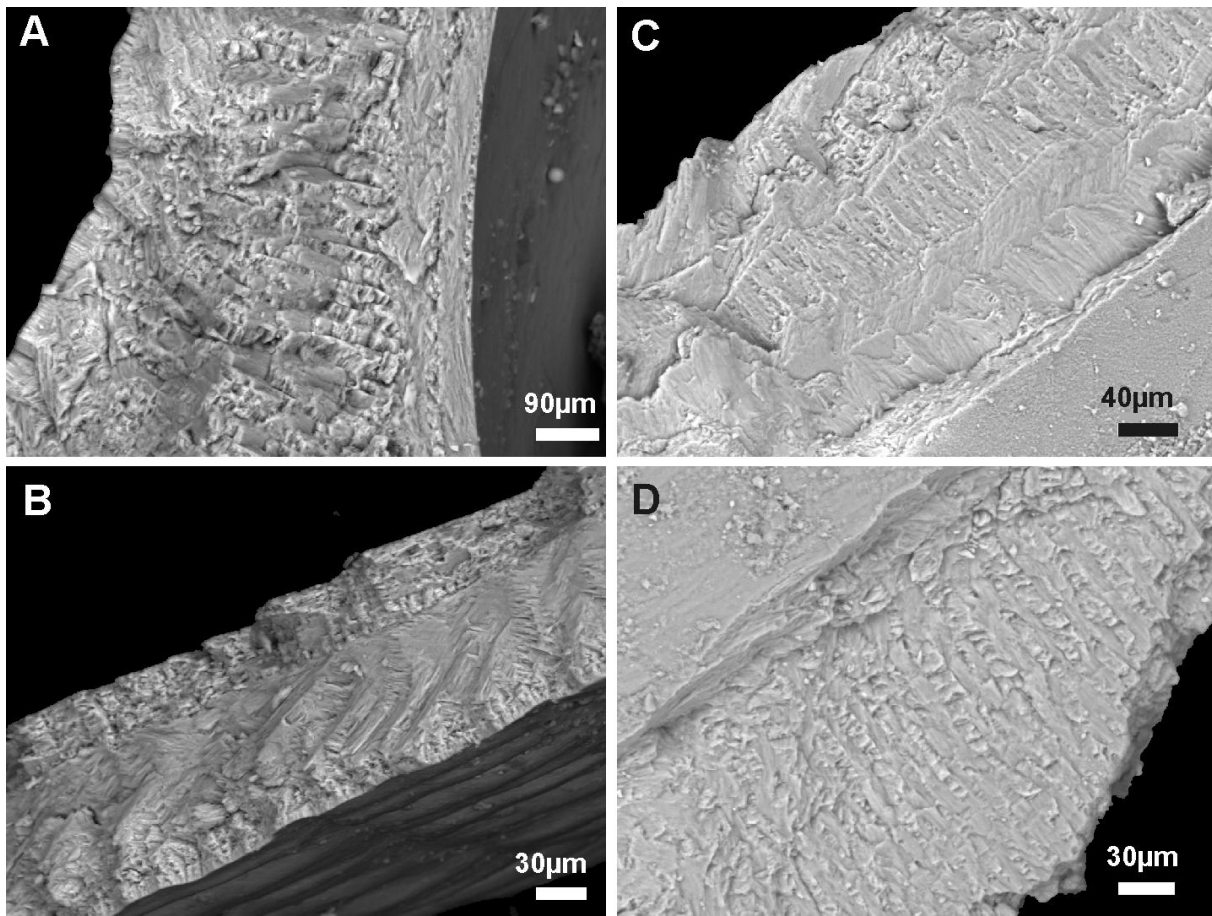


Fig S2. SEM micrographs of a modern (A-B) and ~56 kyr BP old (C-D) shell fragment of the helicid *Theba geminata*. Note that there is no evidence of re-crystallization or secondary overgrowths.

Figure S3

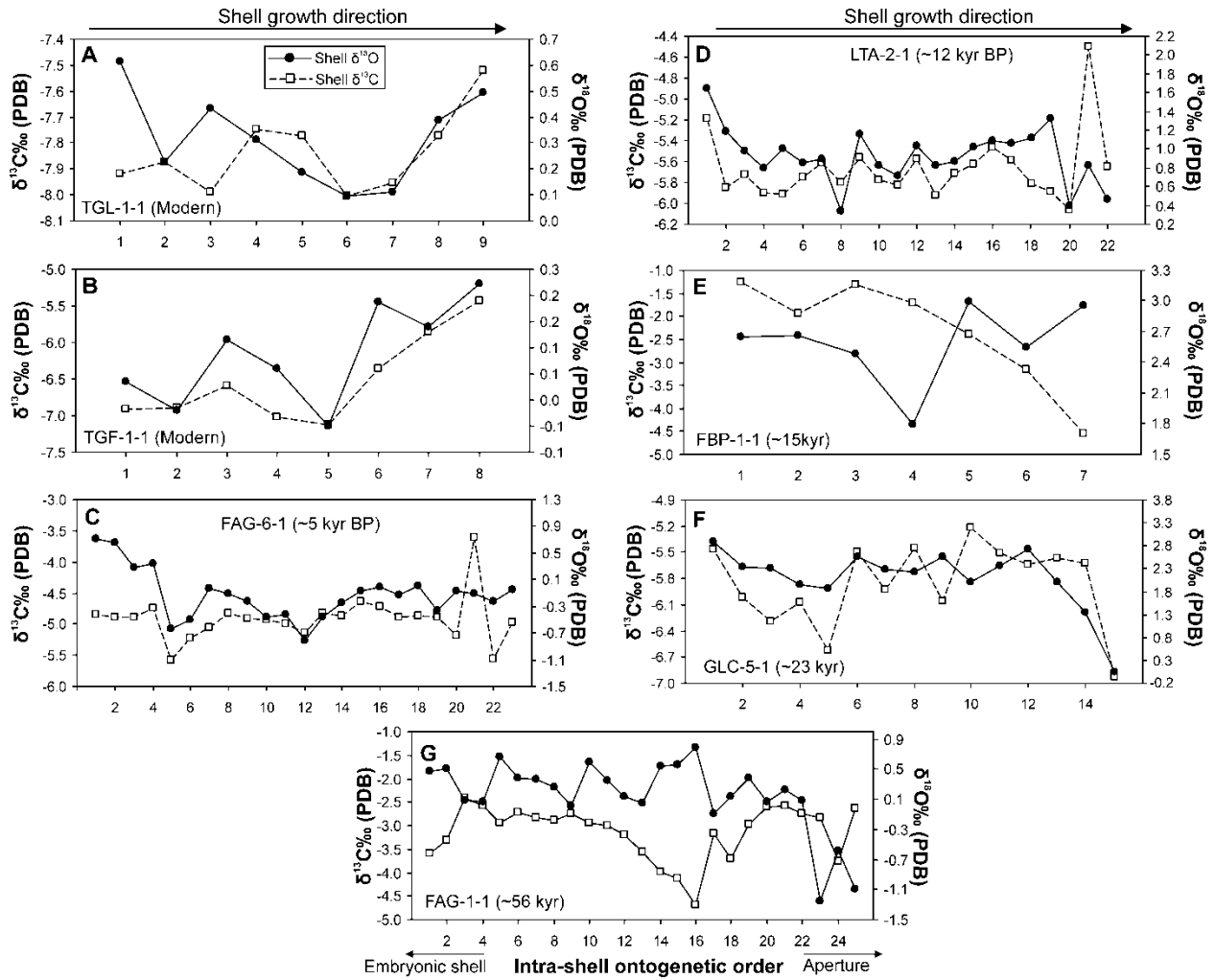


Fig. S3. Intra-shell carbon and oxygen isotopic variability of modern (A-B) and fossil (C-F) shells of the helcid *Theba geminata* from the eastern Canary Islands.

Supplementary Tables

Table S1. Summary of the geographical location of the Late Quaternary sampled localities.

Island	Section name	Section ID	Latitude	Longitude	Elevation (m a.s.l.)	Nominal AAR Age (ka) ¹
Fuerteventura	Huesos del Caballo	FHC	28°10'17''N	14°14'33''W	100	23-27
	Barranco de los Encantados	FBE	28°38'12''N	13°59'04''W	153	38-48
	Montaña de la Costilla	FMC	28°41'16''N	13°58'09''W	55	6-47
	Barranco del Pecenescal	FBP	28°07'42''N	14°16'49''W	95	15
	Atalaya Grande	FAG	28°08'53'' N	14°17'18''W	237	5-56
	Montaña Azufrá	FMA	28°05'41'' N	14°27'52''W	90	30
	Degollada de Agua Cabras	FAC	28°06'02''N	14°28'09''W	35	22-30
	Barranco de la Cal	FBC	28°39'35''N	13°57'43''W	110	34-39
	Barranco del Tabaibejo	FBT	28°18'13''N	14°10'09''W	240	43
	Corralejo	FCO	28°43'25''N	13°50'42''W	5	20
	El Quemado	FEQ	28°40'34''N	13°54'32''W	85	24-28
	Jable de Vigocho	FJV	28°18'58''N	14°10'40''W	180	30-51
Pozo Negro	FPN	28°19'21''N	13°53'52''W	5	24	
Lanzarote	Montaña Guatisea	LMG	28°59'37''N	13°37'40''W	360	25-32
	Muñique	LMU	29°04'04''N	13°27'02''W	155	9-35
	Las Casitas	LLC	29°05'08''N	13°33'51''W	100	23-31
	Lomo de San Andrés	LLA	29°2'12''N	13°36'48''W	280	34-38
	Tao	LTA	29°2'36''N	13°36'51''W	247	12
	Mala	LMA	29°5'43''N	13°27'38''W	25	27-40
La Graciosa	Morros Negros	GMN	29°15'22''N	13°29'16''W	10	17-44
	Caleta del Sebo	GCS	29°13'38''N	13°30'12''W	2	21-31
	La Cocina	GLC	29°13'8''N	13°32'06''W	25	25-32
Montaña Clara	Caleta de Guzmán	MCG	29°16'35''N	13°31'46''W	3	5
Alegranza	Montaña Lobos	AML	29°23'20''N	13°30'10''W	30	10

¹Age data taken from Ortiz et al. (2006)

Appendix S1. Carbon and oxygen isotopic composition of fossil land snail shells measured for this work.

Sample ID	Species	Nominal AAR Age (ka) ¹	$\delta^{13}\text{C}$ ‰(PDB)	$\delta^{18}\text{O}$ ‰(PDB)
MLA-1-11	<i>Theba geminata</i>	4.6	-3.0	0.7
MLA-1-1	<i>Theba geminata</i>	4.6	-1.6	0.8
MLA-1-10	<i>Theba geminata</i>	4.6	-5.7	0.9
MLA-1-2	<i>Theba geminata</i>	4.6	-3.8	2.0
MLA-1-3	<i>Theba geminata</i>	4.6	0.1	2.6
MLA-1-4	<i>Theba geminata</i>	4.6	-4.5	0.9
MLA-1-5	<i>Theba geminata</i>	4.6	-5.2	1.7
MLA-1-6	<i>Theba geminata</i>	4.6	-3.1	0.7
MLA-1-7	<i>Theba geminata</i>	4.6	-4.9	1.8
MLA-1-8	<i>Theba geminata</i>	4.6	-5.8	0.5
MLA-1-9	<i>Theba geminata</i>	4.6	-4.7	0.5
FAG-6-1	<i>Theba geminata</i>	5.4	-7.0	0.1
FAG-6-10	<i>Theba geminata</i>	5.4	-2.0	0.9
FAG-6-2	<i>Theba geminata</i>	5.4	-4.7	-0.1
FAG-6-3	<i>Theba geminata</i>	5.4	-1.7	1.4
FAG-6-4	<i>Theba geminata</i>	5.4	-1.6	1.2
FAG-6-5	<i>Theba geminata</i>	5.4	0.8	1.0
FAG-6-6	<i>Theba geminata</i>	5.4	-2.2	0.8
FAG-6-7	<i>Theba geminata</i>	5.4	-7.7	-1.7
FAG-6-8	<i>Theba geminata</i>	5.4	-0.2	0.8
FAG-6-9	<i>Theba geminata</i>	5.4	-0.8	0.6
FMC-7-1	<i>Theba arinagae</i>	6.3	-5.3	-0.1
FMC-7-2	<i>Rumina decollata</i>	6.3	-7.6	0.3
FMC-7-3	<i>Hemicycla sarcostoma</i>	6.3	-7.4	0.2
FMC-7-4	<i>Pomatias lanzarotensis</i>	6.3	-6.2	-0.5
LMU-2-1	<i>Theba geminata</i>	9.2	-3.8	0.6
LMU-2-2	<i>Theba geminata</i>	9.2	-7.7	0.0
LMU-2-3	<i>Theba geminata</i>	9.2	-6.6	-0.2
LMU-2-4	<i>Theba geminata</i>	9.2	-5.2	-0.2
LMU-2-5	<i>Theba geminata</i>	9.2	-7.1	0.9
AML-1-1	<i>Theba geminata</i>	10.1	-5.5	1.4
AML-1-11	<i>Theba geminata</i>	10.1	0.9	0.4
AML-1-10	<i>Theba geminata</i>	10.1	-2.5	1.1
AML-1-2	<i>Theba geminata</i>	10.1	2.5	0.4
AML-1-12	<i>Theba geminata</i>	10.1	2.5	0.4
AML-1-3	<i>Theba geminata</i>	10.1	0.0	0.8
AML-1-4	<i>Theba geminata</i>	10.1	-5.6	1.1
AML-1-5	<i>Theba geminata</i>	10.1	-0.2	0.8
AML-1-6	<i>Theba geminata</i>	10.1	-3.6	1.3
AML-1-7	<i>Theba geminata</i>	10.1	2.8	0.6
AML-1-8	<i>Theba geminata</i>	10.1	-5.1	-0.1
AML-1-9	<i>Theba geminata</i>	10.1	0.2	0.5
LTA-1-1	<i>Theba geminata</i>	11.8	-7.0	-1.9
LTA-1-2	<i>Theba geminata</i>	11.8	-3.6	0.3
LTA-2-1	<i>Theba geminata</i>	12.3	-6.5	0.8
LTA-2-11	<i>Theba geminata</i>	12.3	-5.5	-0.1
LTA-2-10	<i>Theba geminata</i>	12.3	-4.6	0.2
LTA-2-12	<i>Theba arinagae</i>	12.3	-5.5	0.5
LTA-2-2	<i>Theba geminata</i>	12.3	-7.2	-0.1
LTA-2-3	<i>Monilearia monilifera</i>	12.3	-1.5	0.6
LTA-2-13	<i>Theba geminata</i>	12.3	-7.7	-1.1
LTA-2-4	<i>Theba geminata</i>	12.3	-6.4	0.9

¹Age data taken from Ortiz et al. (2006)

Appendix S1. Continued.

Sample ID	Species	Nominal AAR Age (ka) ¹	$\delta^{13}\text{C}$ ‰(PDB)	$\delta^{18}\text{O}$ ‰(PDB)
LTA-2-5	<i>Theba geminata</i>	12.3	-6.0	0.8
LTA-2-6	<i>Theba geminata</i>	12.3	-7.7	1.3
LTA-2-7	<i>Theba geminata</i>	12.3	-5.3	0.1
LTA-2-8	<i>Theba geminata</i>	12.3	-6.1	0.7
LTA-2-9	<i>Theba geminata</i>	12.3	-5.1	0.6
FBP-1-1	<i>Theba geminata</i>	15.2	-1.9	1.4
FBP-1-11	<i>Theba geminata</i>	15.2	-8.0	2.0
FBP-1-10	<i>Theba geminata</i>	15.2	-7.1	2.2
FBP-1-2	<i>Monilearia monilifera</i>	15.2	0.5	1.7
FBP-1-12	<i>Theba geminata</i>	15.2	-6.8	2.1
FBP-1-3	<i>Monilearia granostriata</i>	15.2	2.2	1.7
FBP-1-13	<i>Theba geminata</i>	15.2	-1.4	1.1
FBP-1-4	<i>Caracollina lenticula</i>	15.2	-1.2	0.5
FBP-1-14	<i>Theba geminata</i>	15.2	-2.4	2.5
FBP-1-5	<i>Rumina decollata</i>	15.2	-4.9	-1.1
FBP-1-15	<i>Theba geminata</i>	15.2	3.8	3.8
FBP-1-6	<i>Theba geminata</i>	15.2	-7.6	2.0
FBP-1-7	<i>Theba geminata</i>	15.2	2.6	2.6
FBP-1-8	<i>Theba geminata</i>	15.2	-0.9	2.6
FBP-1-9	<i>Theba geminata</i>	15.2	-5.8	4.5
LMU-1-1	<i>Theba geminata</i>	15.6	-5.1	2.0
LMU-1-2	<i>Theba geminata</i>	15.6	-4.2	0.8
LMU-1-3	<i>Theba geminata</i>	15.6	-3.1	1.9
LMU-1-4	<i>Theba geminata</i>	15.6	-1.5	1.7
LMU-1-5	<i>Theba geminata</i>	15.6	-4.0	1.6
GMN-7-1	<i>Theba geminata</i>	16.5	-4.0	1.1
GMN-7-2	<i>Theba arinagae</i>	16.5	-4.7	0.9
GMN-7-3	<i>Monilearia monilifera</i>	16.5	-2.7	2.7
GMN-7-4	<i>Rumina decollata</i>	16.5	-3.0	2.0
FCO-1-1	<i>Theba geminata</i>	19.6	-3.5	1.4
FCO-1-2	<i>Theba geminata</i>	19.6	-2.4	2.0
FCO-1-3	<i>Theba geminata</i>	19.6	-1.4	2.0
FCO-1-4	<i>Theba geminata</i>	19.6	-3.9	0.9
FCO-1-5	<i>Theba geminata</i>	19.6	-3.1	1.3
GCS-2-1	<i>Theba geminata</i>	20.6	-3.2	1.1
GCS-2-2	<i>Theba arinagae</i>	20.6	-0.5	2.3
GCS-2-3	<i>Rumina decollata</i>	20.6	-6.4	2.0
GCS-2-4	<i>Pomatias lanzarotensis</i>	20.6	-3.5	2.3
GCS-2-5	<i>Hemicycla sarcostoma</i>	20.6	-4.3	1.3
FAC-6-1	<i>Theba geminata</i>	21.5	-4.2	1.3
FAC-6-2	<i>Theba geminata</i>	21.5	-2.6	1.5
FAC-6-3	<i>Theba geminata</i>	21.5	-1.8	1.2
FAC-6-4	<i>Theba geminata</i>	21.5	-0.4	2.1
FAC-6-5	<i>Theba geminata</i>	21.5	-1.1	1.9
FAG-2-1	<i>Theba geminata</i>	21.6	-1.1	2.1
FAG-2-2	<i>Theba geminata</i>	21.6	-2.1	1.1
FAG-2-3	<i>Monilearia monilifera</i>	21.6	-4.3	1.0
FAG-3-1	<i>Theba arinagae</i>	21.6	-4.8	0.5
FAG-3-1	<i>Theba geminata</i>	21.6	-3.9	1.3
FAG-3-10	<i>Theba geminata</i>	21.6	-6.4	1.3
FAG-3-2	<i>Theba geminata</i>	21.6	2.8	2.6
FAG-3-3	<i>Theba geminata</i>	21.6	-2.4	1.9
FAG-3-4	<i>Theba geminata</i>	21.6	1.8	2.5

¹Age data taken from Ortiz et al. (2006)

Appendix S1. Continued.

Sample ID	Species	Nominal AAR Age (ka) ¹	$\delta^{13}\text{C}$ ‰(PDB)	$\delta^{18}\text{O}$ ‰(PDB)
FAG-3-5	<i>Theba geminata</i>	21.6	-7.4	1.7
FAG-3-6	<i>Theba geminata</i>	21.6	2.3	1.6
FAG-3-7	<i>Theba geminata</i>	21.6	-0.4	1.6
FAG-3-8	<i>Theba geminata</i>	21.6	-2.4	2.2
FAG-3-9	<i>Theba geminata</i>	21.6	-6.3	1.2
LLC-3-1	<i>Theba geminata</i>	23.4	-3.4	-0.1
LLC-3-2	<i>Theba geminata</i>	23.4	-3.4	0.7
LLC-3-3	<i>Theba geminata</i>	23.4	-2.2	0.9
LLC-3-4	<i>Theba geminata</i>	23.4	-1.3	0.9
LLC-3-5	<i>Theba geminata</i>	23.4	0.1	0.6
FEQ-2-1	<i>Theba geminata</i>	23.5	0.0	1.4
FEQ-2-2	<i>Theba geminata</i>	23.5	-0.9	2.1
FEQ-2-3	<i>Theba geminata</i>	23.5	-4.3	1.8
FEQ-2-4	<i>Theba geminata</i>	23.5	-4.0	1.2
FEQ-2-5	<i>Theba geminata</i>	23.5	-3.6	2.0
FPN-1-1	<i>Theba geminata</i>	24.1	-2.0	0.2
FPN-1-2	<i>Theba geminata</i>	24.1	-3.0	0.3
FPN-1-3	<i>Theba geminata</i>	24.1	0.5	1.4
FPN-1-4	<i>Theba geminata</i>	24.1	-2.2	0.4
FPN-1-5	<i>Theba geminata</i>	24.1	-3.1	0.4
GLC-2-1	<i>Theba arinagae</i>	24.8	-4.7	2.0
LMG-2-1	<i>Theba geminata</i>	24.8	-5.1	0.7
LMG-2-2	<i>Theba geminata</i>	24.8	-0.8	0.4
LMG-2-3	<i>Theba geminata</i>	24.8	-7.2	0.6
LMG-2-4	<i>Theba geminata</i>	24.8	0.0	0.4
LMG-2-5	<i>Theba geminata</i>	24.8	2.0	0.3
LLC-1-1	<i>Theba geminata</i>	25.5	-3.2	1.1
LLC-1-2	<i>Theba geminata</i>	25.5	-5.0	0.3
LLC-1-3	<i>Theba geminata</i>	25.5	-2.2	0.7
LLC-1-4	<i>Theba geminata</i>	25.5	-5.9	0.3
LLC-1b-5	<i>Theba geminata</i>	25.5	-4.4	0.7
LMA-6-1	<i>Theba arinagae</i>	27.4	-4.1	3.2
LMA-6-2	<i>Monilearia monilifera</i>	27.4	-4.7	2.4
LMA-6-3	<i>Rumina decollata</i>	27.4	-3.8	0.7
FEQ-1-1	<i>Theba geminata</i>	28.1	-1.1	0.8
FEQ-1-2	<i>Theba geminata</i>	28.1	1.0	0.7
FEQ-1-3	<i>Theba geminata</i>	28.1	-3.0	1.6
FEQ-1-4	<i>Theba geminata</i>	28.1	-2.5	1.3
FEQ-1-5	<i>Theba geminata</i>	28.1	-2.2	1.2
LMA-7-1	<i>Theba arinagae</i>	28.2	-3.5	1.5
LMA-7-2	<i>Monilearia monilifera</i>	28.2	-1.8	1.4
LMA-7-3	<i>Rumina decollata</i>	28.2	-4.7	0.3
MCG-2-1	<i>Theba geminata</i>	28.5	-1.8	1.9
GMN-6-1	<i>Theba geminata</i>	29.4	-7.0	0.9
GMN-6-10	<i>Hemicycla sarcostoma</i>	29.4	-1.2	1.7
GMN-6-2	<i>Theba geminata</i>	29.4	-8.7	-0.2
GMN-6-3	<i>Rumina decollata</i>	29.4	-2.9	0.0
GMN-6-4	<i>Theba arinagae</i>	29.4	-2.9	0.1
GMN-6-5	<i>Hemicycla sarcostoma</i>	29.4	-1.9	1.4
GMN-6-6	<i>Pomatias lanzarotensis</i>	29.4	-6.2	-0.7
GMN-6-7	<i>Theba geminata</i>	29.4	-4.8	-0.5
GMN-6-8	<i>Theba geminata</i>	29.4	-0.9	-1.1
GMN-6-9	<i>Rumina decollata</i>	29.4	-4.6	0.3

¹Age data taken from Ortiz et al. (2006)

Appendix S1. Continued.

Sample ID	Species	Nominal AAR Age (ka) ¹	$\delta^{13}\text{C}$ ‰(PDB)	$\delta^{18}\text{O}$ ‰(PDB)
FMA-1-1	<i>Theba geminata</i>	29.7	-2.9	0.5
FMA-1-2	<i>Monilearia granostrata</i>	29.7	-3.9	0.2
FMA-1-3	<i>Theba geminata</i>	29.7	-1.9	1.2
FMA-1-4	<i>Theba geminata</i>	29.7	-5.6	1.7
FJV-8-1	<i>Theba geminata</i>	29.9	-7.0	-1.7
FJV-8-2	<i>Theba geminata</i>	29.9	-0.8	0.2
FJV-8-3	<i>Theba geminata</i>	29.9	0.3	1.9
FJV-8-4	<i>Theba geminata</i>	29.9	-4.6	-1.1
FJV-8-5	<i>Theba geminata</i>	29.9	-2.7	0.2
FAC-1-1	<i>Theba geminata</i>	30.2	-4.6	0.1
FAC-1-2	<i>Theba geminata</i>	30.2	-2.5	0.9
FAC-1-3	<i>Theba geminata</i>	30.2	-2.8	0.9
FAC-2-1	<i>Theba geminata</i>	30.2	-5.0	1.1
FAC-2-2	<i>Theba geminata</i>	30.2	-4.2	1.0
FAC-2-3	<i>Theba geminata</i>	30.2	-5.3	-0.1
FAC-2-4	<i>Theba geminata</i>	30.2	-2.3	0.0
FAC-2-5	<i>Theba geminata</i>	30.2	-2.8	0.0
FAC-4-1	<i>Theba geminata</i>	30.3	-5.2	1.6
FAC-4-2	<i>Theba geminata</i>	30.3	-2.6	-0.4
FAC-4-3	<i>Theba geminata</i>	30.3	-4.6	1.0
FAC-4-4	<i>Theba geminata</i>	30.3	-5.8	0.8
FAC-4-5	<i>Theba geminata</i>	30.3	-6.2	0.6
GCS-1-1	<i>Rumina decollata</i>	30.3	-2.8	1.9
GCS-1-2	<i>Hemicycla sarcostoma</i>	30.3	-5.0	0.5
GCS-1-3	<i>Theba geminata</i>	30.3	-1.6	1.8
GCS-1-4	<i>Rumina decollata</i>	30.3	-3.0	1.8
GCS-1-5	<i>Theba geminata</i>	30.3	-4.3	0.3
LMA-4-1	<i>Theba geminata</i>	30.6	-2.1	2.0
LMA-5-1	<i>Theba geminata</i>	31.1	-5.3	1.1
LMA-5-2	<i>Theba impugnata</i>	31.1	-4.3	1.6
LMA-5-3	<i>Pomatias lanzarotensis</i>	31.1	-6.7	1.8
LMA-5-4	<i>Canariella plutonia</i>	31.1	-6.3	1.8
LLC-2-1	<i>Theba geminata</i>	31.2	-8.8	-0.2
LLC-2-2	<i>Theba geminata</i>	31.2	-1.9	0.1
LLC-2-3	<i>Theba geminata</i>	31.2	-0.9	0.6
LLC-2-4	<i>Theba geminata</i>	31.2	-2.6	0.5
LLC-2-5	<i>Theba geminata</i>	31.2	-4.3	0.1
GLC-1-1	<i>Pomatias lanzarotensis</i>	31.5	-5.5	0.4
GLC-1-2	<i>Monilearia monilifera</i>	31.5	-3.9	0.5
GLC-1-4	<i>Theba arinagae</i>	31.5	-0.6	0.6
GLC-1-5	<i>Rumina decollata</i>	31.5	-2.1	0.5
GLC-1-6	<i>Theba geminata</i>	31.5	-2.8	1.7
LMG-1-1	<i>Theba geminata</i>	31.5	-5.2	0.2
LMG-1-2	<i>Theba geminata</i>	31.5	-4.9	0.1
LMG-1-3	<i>Theba geminata</i>	31.5	-3.7	0.3
LMG-1-4	<i>Theba geminata</i>	31.5	-2.3	0.7
LMG-1-5	<i>Theba geminata</i>	31.5	-4.1	0.3
LLA-2-1	<i>Theba geminata</i>	33.5	-1.3	-0.3
LLA-2-2	<i>Theba geminata</i>	33.5	1.5	2.6
LLA-2-3	<i>Theba arinagae</i>	33.5	-5.6	1.3
LLA-2-4	<i>Rumina decollata</i>	33.5	-8.9	0.1
FBC-4-1	<i>Theba geminata</i>	33.7	-3.6	0.9
FBC-4-2	<i>Theba geminata</i>	33.7	-6.1	0.5

¹Age data taken from Ortiz et al. (2006)

Appendix S1. Continued.

Sample ID	Species	Nominal AAR Age (ka) ¹	$\delta^{13}\text{C}$ ‰(PDB)	$\delta^{18}\text{O}$ ‰(PDB)
FBC-4-3	<i>Theba geminata</i>	33.7	-5.5	2.4
FBC-4-4	<i>Theba geminata</i>	33.7	-5.4	-0.7
FBC-4-5	<i>Theba geminata</i>	33.7	-6.3	0.8
LMU-1-1	<i>Theba geminata</i>	34.9	-5.0	1.0
LMU-1-2	<i>Theba geminata</i>	34.9	-4.4	1.6
LMU-1-3	<i>Theba geminata</i>	34.9	-3.8	2.1
LMU-1-4	<i>Theba geminata</i>	34.9	-3.8	1.8
LMU-1-5	<i>Theba geminata</i>	34.9	-4.9	1.1
LMA-3-1	<i>Theba geminata</i>	34.9	-2.2	2.2
FBE-6-1	<i>Theba geminata</i>	37.5	-3.9	0.0
FBE-5-1	<i>Theba geminata</i>	37.6	-3.8	0.3
FBE-5-2	<i>Hemicycla sarcostoma</i>	37.6	-3.5	1.1
FBE-5-3	<i>Canariella plutonia</i>	37.6	-5.0	1.3
FBE-5-4	<i>Pomatias lanzarotensis</i>	37.6	-5.3	-0.4
LLA-1-1	<i>Theba geminata</i>	38.0	-4.6	-0.2
LLA-1-2	<i>Theba arinagae</i>	38.0	-5.5	-0.4
LLA-1-3	<i>Hemicycla sarcostoma</i>	38.0	-3.9	-0.3
LLA-1-4	<i>Rumina decollata</i>	38.0	-3.1	-0.1
LLA-1-5	<i>Ferussacia fritschi</i>	38.0	-4.1	-0.6
LLA-1-7	<i>Monilearia monilifera</i>	38.0	-7.6	-0.5
LMA-1-1	<i>Theba arinagae</i>	38.6	-4.7	0.7
LMA-1-2	<i>Theba geminata</i>	38.6	-1.8	1.9
FBC-3-1	<i>Theba geminata</i>	38.9	-7.0	-0.2
FBC-3-2	<i>Theba geminata</i>	38.9	-7.1	1.6
FBC-3-3	<i>Theba geminata</i>	38.9	-4.5	0.4
FBC-3-4	<i>Theba geminata</i>	38.9	-6.4	-0.5
FBE-4-1	<i>Theba geminata</i>	38.9	-6.1	0.7
LMA-2-1	<i>Theba geminata</i>	39.8	-1.4	2.6
LMA-2-2	<i>Theba arinagae</i>	39.8	-1.5	2.0
GMN-4-1	<i>Theba geminata</i>	40.2	-4.7	1.7
GMN-4-2	<i>Theba arinagae</i>	40.2	-4.8	-0.4
GMN-4-3	<i>Pomatias lanzarotensis</i>	40.2	-7.8	-0.5
MCG-1-1	<i>Rumina decollata</i>	40.2	-3.5	0.1
MCG-1-2	<i>Rumina decollata</i>	40.2	-2.3	0.8
MCG-1-3	<i>Theba geminata</i>	40.2	2.0	0.5
MCG-1-4	<i>Theba arinagae</i>	40.2	-3.3	0.8
MCG-1-5	<i>Pomatias lanzarotensis</i>	40.2	0.4	1.2
GMN-3-1	<i>Theba geminata</i>	42.2	-1.5	0.5
GMN-3-2	<i>Theba arinagae</i>	42.2	-0.2	2.2
GMN-3-3	<i>Hemicycla sarcostoma</i>	42.2	-0.9	0.7
GMN-3-4	<i>Pomatias lanzarotensis</i>	42.2	-6.4	2.2
FBT-2-1	<i>Theba geminata</i>	42.5	-4.4	-0.4
FBT-2-2	<i>Theba geminata</i>	42.5	-5.9	0.0
FBT-2-3	<i>Theba geminata</i>	42.5	-5.7	1.0
FBT-2-4	<i>Theba geminata</i>	42.5	-4.7	-0.3
FJV-5-1	<i>Theba geminata</i>	42.9	0.2	-0.3
FJV-5-2	<i>Theba geminata</i>	42.9	-4.4	-0.3
FJV-5-3	<i>Theba geminata</i>	42.9	-3.0	0.2
FJV-5-4	<i>Theba geminata</i>	42.9	-1.2	0.4
FJV-5-5	<i>Theba geminata</i>	42.9	-1.4	0.2
GMN-1-1	<i>Theba geminata</i>	43.0	-0.7	1.7
GMN-1-2	<i>Theba arinagae</i>	43.0	-2.1	1.6
GMN-1-3	<i>Theba geminata</i>	43.0	-3.3	1.5

¹Age data taken from Ortiz et al. (2006)

Appendix S1. Continued.

Sample ID	Species	Nominal AAR Age (ka) ¹	$\delta^{13}\text{C}$ ‰(PDB)	$\delta^{18}\text{O}$ ‰(PDB)
GMN-1-4	<i>Theba arinagae</i>	43.0	-1.8	1.7
GMN-1-5	<i>Hemicycla sarcostoma</i>	43.0	-2.8	0.3
FJV-7-1	<i>Theba geminata</i>	43.3	-5.0	-0.9
FJV-7-2	<i>Theba geminata</i>	43.3	-5.6	-0.1
FJV-7-3	<i>Theba geminata</i>	43.3	-5.5	0.6
FJV-7-4	<i>Theba geminata</i>	43.3	-4.5	0.5
FJV-7-5	<i>Theba geminata</i>	43.3	-4.3	-0.1
FJV-4-1	<i>Theba geminata</i>	43.5	-3.7	0.0
FJV-4-2	<i>Theba geminata</i>	43.5	0.2	0.6
FJV-4-3	<i>Theba geminata</i>	43.5	-1.5	0.2
FJV-4-4	<i>Theba geminata</i>	43.5	-3.1	-1.0
FJV-4-5	<i>Theba geminata</i>	43.5	-3.6	0.4
FJV-4-6	<i>Theba geminata</i>	43.5	-5.2	-0.5
GMN-5-1	<i>Theba arinagae</i>	43.5	-7.5	0.2
GMN-2-1	<i>Theba arinagae</i>	43.6	-3.9	2.1
GMN-2-2	<i>Theba geminata</i>	43.6	-4.8	0.2
GMN-2-3	<i>Hemicycla sarcostoma</i>	43.6	-0.9	1.3
GMN-2-4	<i>Pomatias lanzarotensis</i>	43.6	-5.1	2.0
FJV-6a-1	<i>Theba geminata</i>	43.8	-6.9	-0.4
FJV-6a-2	<i>Theba geminata</i>	43.8	-3.9	-0.3
FJV-6a-3	<i>Theba geminata</i>	43.8	-2.5	0.4
FJV-6a-4	<i>Theba geminata</i>	43.8	-1.8	-0.5
FJV-6a-5	<i>Theba geminata</i>	43.8	-5.0	-0.5
FJV-6b-1	<i>Theba geminata</i>	43.8	-4.8	0.2
FJV-6b-2	<i>Theba geminata</i>	43.8	0.1	-0.2
FJV-6b-3	<i>Theba geminata</i>	43.8	-6.0	0.4
FJV-6b-4	<i>Theba geminata</i>	43.8	-5.2	-0.5
FJV-6b-5	<i>Theba geminata</i>	43.8	-2.1	0.0
FMC-3-1	<i>Theba arinagae</i>	44.7	-4.5	1.1
FMC-3-2	<i>Theba arinagae</i>	44.7	-5.0	0.8
FMC-3-3	<i>Monilearia monilifera</i>	44.7	-0.9	1.8
FMC-3-4	<i>Candidula ultima</i>	44.7	-1.1	1.4
FBE-3-1	<i>Theba arinagae</i>	46.6	-6.5	0.1
FMC-1-1	<i>Theba geminata</i>	47.2	-4.7	0.2
FMC-1-2	<i>Theba arinagae</i>	47.2	-6.5	-0.1
FBE-2-1	<i>Theba geminata</i>	47.8	-4.6	0.1
FBE-2-2	<i>Theba geminata</i>	47.8	-4.8	0.8
FBE-1-1	<i>Theba geminata</i>	48.1	-0.3	0.9
FJV-2-1	<i>Theba geminata</i>	49.2	-0.5	1.0
FJV-2-2	<i>Theba geminata</i>	49.2	-1.2	0.8
FJV-2-3	<i>Theba geminata</i>	49.2	-2.9	0.4
FJV-2-4	<i>Theba geminata</i>	49.2	-3.2	0.5
FJV-2-5	<i>Theba geminata</i>	49.2	2.5	0.7
FJV-1-1	<i>Theba geminata</i>	50.1	-3.8	0.7
FJV-1-2	<i>Theba geminata</i>	50.1	-4.9	-0.3
FJV-1-3	<i>Theba geminata</i>	50.1	-3.9	0.2
FJV-1-4	<i>Theba geminata</i>	50.1	-3.5	0.7
FJV-1-5	<i>Theba geminata</i>	50.1	-1.9	0.4
FJV-3-1	<i>Theba geminata</i>	50.5	-5.9	0.0
FJV-3-2	<i>Theba geminata</i>	50.5	-5.0	0.8
FJV-3-3	<i>Theba geminata</i>	50.5	-4.2	-0.5
FJV-3-4	<i>Theba geminata</i>	50.5	-6.2	-1.2

¹Age data taken from Ortiz et al. (2006)

Appendix S1. Continued.

Sample ID	Species	Nominal AAR Age (ka)¹	$\delta^{13}\text{C}$ ‰(PDB)	$\delta^{18}\text{O}$ ‰(PDB)
FJV-3-5	<i>Theba geminata</i>	50.5	-6.9	-0.8
FAG-1-1	<i>Theba geminata</i>	55.7	-5.6	0.3
FAG-1-11	<i>Theba geminata</i>	55.7	-6.7	0.7
FAG-1-10	<i>Theba geminata</i>	55.7	-7.3	0.7
FAG-1-2	<i>Theba geminata</i>	55.7	-0.5	1.5
FAG-1-12	<i>Theba geminata</i>	55.7	-6.9	1.0
FAG-1-3	<i>Theba geminata</i>	55.7	-1.6	-1.2
FAG-1-4	<i>Theba geminata</i>	55.7	-5.8	0.6
FAG-1-5	<i>Theba geminata</i>	55.7	-7.0	-1.8
FAG-1-6	<i>Theba geminata</i>	55.7	-5.1	0.3
FAG-1-7	<i>Theba geminata</i>	55.7	-4.5	-0.4
FAG-1-8	<i>Theba geminata</i>	55.7	-5.6	1.3
FAG-1-9	<i>Theba geminata</i>	55.7	-5.2	1.1

¹Age data taken from Ortiz et al. (2006)

Appendix S2. Intra-shell carbon and oxygen isotopic composition through ontogeny (from lip to embryonic shell) of two modern and five fossil shells of the dominant endemic helicid *Theba geminata*.

Sample ID	$\delta^{13}\text{C}\text{‰(PDB)}$	$\delta^{18}\text{O}\text{‰(PDB)}$	Sample ID	$\delta^{13}\text{C}\text{‰(PDB)}$	$\delta^{18}\text{O}\text{‰(PDB)}$
Modern shell			~12 ka old shell		
TGL-1-1=lip	-7.5	0.5	LTA-2-1=lip	-5.7	0.5
TGL-1-2	-7.8	0.4	LTA-2-2	-4.5	0.8
TGL-1-3	-8.0	0.1	LTA-2-3	-6.1	0.4
TGL-1-4	-8.0	0.1	LTA-2-4	-5.9	1.3
TGL-1-5	-7.8	0.2	LTA-2-5	-5.8	1.1
TGL-1-6	-7.7	0.3	LTA-2-6	-5.6	1.1
TGL-1-7	-8.0	0.4	LTA-2-7	-5.5	1.1
TGL-1-8	-7.9	0.2	LTA-2-8	-5.6	1.0
TGL-1-9=protoconch	-7.9	0.6	LTA-2-9	-5.7	0.9
Modern shell			LTA-2-10	-5.9	0.8
TGF-1-1=lip	-5.4	0.2	LTA-2-11	-5.6	1.0
TGF-1-2	-5.9	0.1	LTA-2-12	-5.8	0.7
TGF-1-3	-6.4	0.2	LTA-2-13	-5.8	0.8
TGF-1-4	-7.1	-0.1	LTA-2-14	-5.6	1.2
TGF-1-5	-7.0	0.1	LTA-2-15	-5.8	0.3
TGF-1-6	-6.6	0.1	LTA-2-16	-5.6	0.9
TGF-1-7	-6.9	0.0	LTA-2-17	-5.8	0.8
TGF-1-8=protoconch	-6.9	0.0	LTA-2-18	-5.9	1.0
~5 ka old shell			LTA-2-19	-5.9	0.8
FAG-6-1=lip	-5.0	-0.1	LTA-2-20	-5.7	1.0
FAG-6-2	-5.6	-0.2	LTA-2-21	-5.8	1.2
FAG-6-3	-3.6	-0.1	LTA-2-22=protoconch	-5.2	1.6
FAG-6-4	-5.2	-0.1	~15 ka old shell		
FAG-6-5	-4.9	-0.4	FBP-1-1=lip	-4.6	3.0
FAG-6-6	-4.9	0.0	FBP-1-2	-3.2	2.5
FAG-6-7	-4.9	-0.1	FBP-1-3	-2.4	3.0
FAG-6-8	-4.7	0.0	FBP-1-4	-1.7	1.8
FAG-6-9	-4.6	-0.1	FBP-1-5	-1.3	2.5
FAG-6-10	-4.9	-0.3	FBP-1-6	-1.9	2.7
FAG-6-11	-4.8	-0.5	FBP-1-7=protoconch	-1.2	2.6
FAG-6-12	-5.1	-0.8	~25 ka old shell		
FAG-6-13	-5.0	-0.4	GLC-2-1=lip	-6.9	0.0
FAG-6-14	-4.9	-0.5	GLC-2-2	-5.6	1.3
FAG-6-15	-4.9	-0.2	GLC-2-3	-5.6	2.0
FAG-6-16	-4.8	-0.1	GLC-2-4	-5.6	2.7
FAG-6-17	-5.0	0.0	GLC-2-5	-5.5	2.4
FAG-6-18	-5.2	-0.5	GLC-2-6	-5.2	2.0
FAG-6-19	-5.6	-0.6	GLC-2-7	-6.1	2.6
FAG-6-20	-4.7	0.3	GLC-2-8	-5.5	2.2
FAG-6-21	-4.9	0.3	GLC-2-9	-5.9	2.3
FAG-6-22	-4.9	0.7	GLC-2-10	-5.5	2.6
FAG-6-23=protoconch	-4.9	0.7	GLC-2-11	-6.6	1.9
			GLC-2-12	-6.1	2.0
			GLC-2-13	-6.3	2.3
			GLC-2-14	-6.0	2.3
			GLC-2-15=protoconch	-5.5	2.9

Appendix S2. Continued.

Sample ID	$\delta^{13}\text{C}\text{‰(PDB)}$	$\delta^{18}\text{O}\text{‰(PDB)}$
~56 ka old shell		
FAG-1-1=lip	-2.6	-1.1
FAG-1-2	-3.7	-0.6
FAG-1-3	-2.8	-1.3
FAG-1-4	-2.8	0.1
FAG-1-5	-2.6	0.2
FAG-1-6	-2.6	0.1
FAG-1-7	-3.0	0.4
FAG-1-8	-3.7	0.1
FAG-1-9	-3.2	-0.1
FAG-1-10	-4.7	0.8
FAG-1-11	-4.1	0.6
FAG-1-12	-4.0	0.5
FAG-1-13	-3.6	0.0
FAG-1-14	-3.2	0.1
FAG-1-15	-3.0	0.4
FAG-1-16	-3.0	0.6
FAG-1-17	-2.7	0.0
FAG-1-18	-2.9	0.3
FAG-1-19	-2.8	0.4
FAG-1-20	-2.7	0.4
FAG-1-21	-2.9	0.7
FAG-1-22	-2.6	0.1
FAG-1-23	-2.4	0.1
FAG-1-24	-3.3	0.5
FAG-1-25=protoconch	-3.6	0.5

Appendix S3. Carbon and oxygen isotopic composition of bulk paleosol and dune samples.

Sample ID	Sample type	Nominal AAR Age (ka) ¹	$\delta^{13}\text{C}\text{‰(PDB)}$	$\delta^{18}\text{O}\text{‰(PDB)}$
FAG-6B	paleosol	5.4	-0.2	1.0
FMC-7B	paleosol	6.3	-1.0	0.6
LTA-1B	paleosol	11.8	0.0	0.8
LTA-2B	paleosol	12.3	-1.5	0.3
FBP-1B	paleosol	15.2	-1.4	1.2
GMN-7B	paleosol	16.5	0.7	1.2
GBS-1B	paleosol	20.6	-0.3	0.4
FMC-3B	paleosol	23.2	-0.1	1.3
GLC-5B	paleosol	24.8	0.0	0.6
FHC-1B	paleosol	27.0	-0.6	0.4
LMA-6B	paleosol	27.4	0.2	1.3
LMA-7B	paleosol	28.2	-1.0	1.2
GMN-6B	paleosol	29.4	-0.3	1.0
FMA-1A	dune	29.7	0.1	1.0
GCS-3B	paleosol	30.3	-0.9	0.3
LMA-4B	paleosol	30.6	-0.1	1.0
LMA-5A	dune	31.1	-0.7	0.7
LMA-5B	paleosol	31.1	-1.2	0.8
GLC-2B	paleosol	31.5	-0.5	0.7
LLA-2B	paleosol	33.5	-2.5	0.2
LMA-3B	paleosol	34.9	0.2	0.8
FBE-6B	paleosol	37.5	-0.9	0.6
FBE-5A	dune	37.6	0.3	1.2
FBE-5B	paleosol	37.6	-1.4	0.6
LLA-1A	dune	38.0	-3.0	-0.5
LLA-1B	paleosol	38.0	-5.2	-0.5
LMA-1A	dune	38.9	-0.8	0.7
FAG-3B	paleosol	38.9	-0.1	1.0
LMA-1B	paleosol	38.9	-1.7	0.8
FBE-4B	paleosol	38.9	-2.1	0.2
LMA-2B	paleosol	39.2	-1.6	0.7
GMN-1B	paleosol	43.0	-0.6	0.4
FMC-3B	paleosol	44.7	0.0	1.1
FBE-3B	paleosol	46.6	-5.1	-1.0
FMC-1A	dune	47.2	-1.0	0.8
FMC-1B	paleosol	47.2	-1.8	0.5
FBE-2A	dune	47.8	0.0	0.9
FBE-2B	paleosol	47.8	0.4	1.0
FBE-1B	paleosol	48.1	-1.6	0.6
FAG-1B	paleosol	55.7	-1.4	0.3

¹Age data taken from Ortiz et al. (2006)