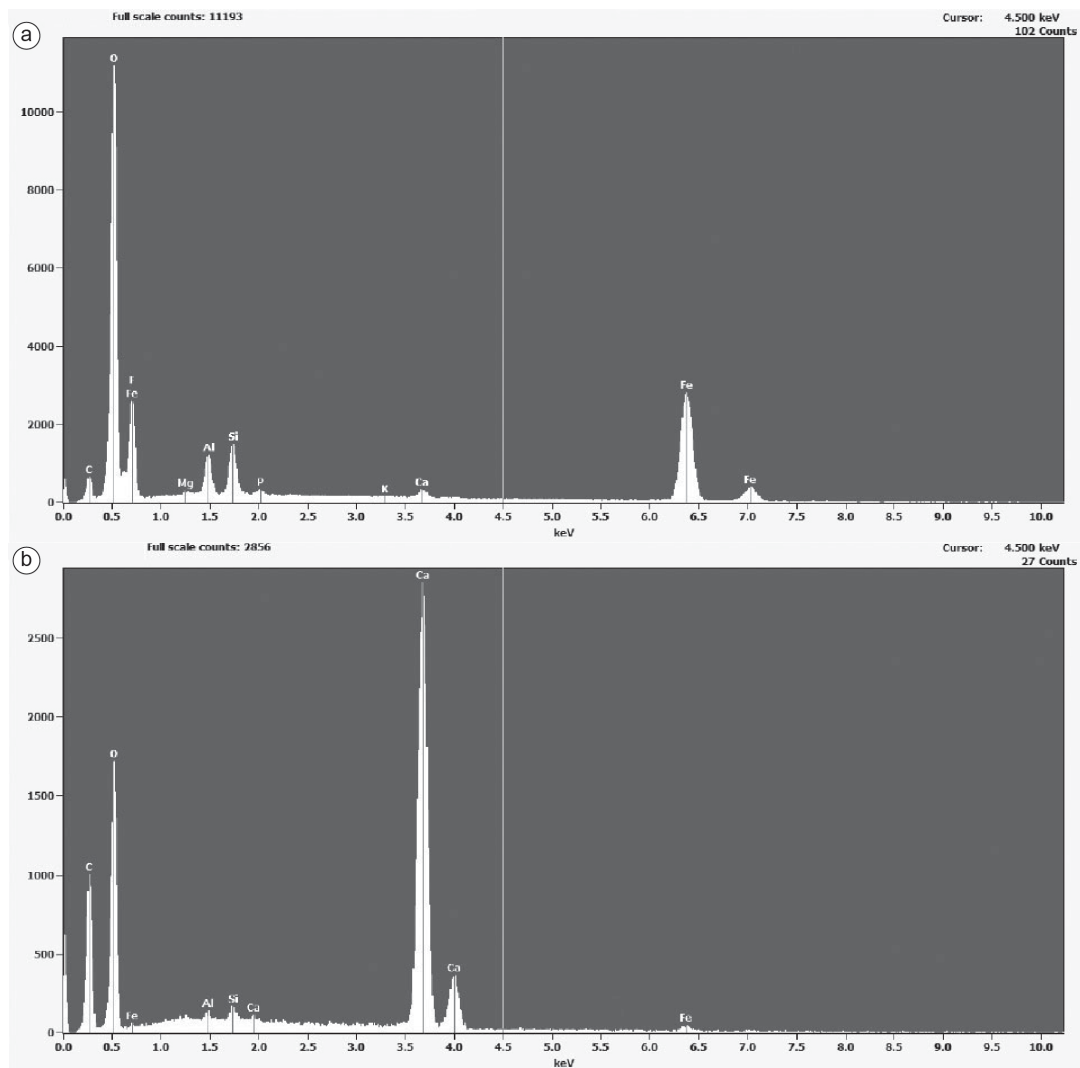


# **Ichnological evidence for meiofaunal bilaterians from the terminal Ediacaran and earliest Cambrian of Brazil**

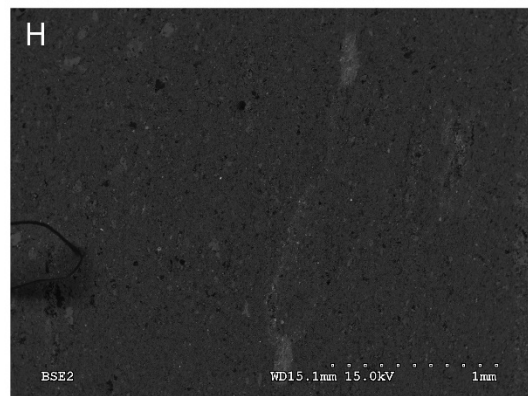
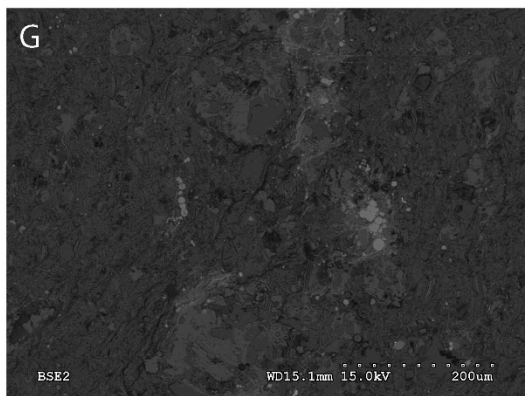
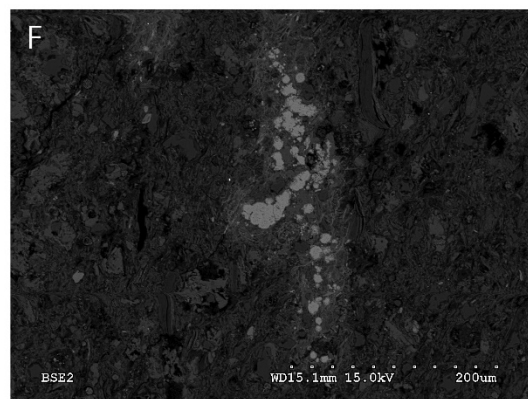
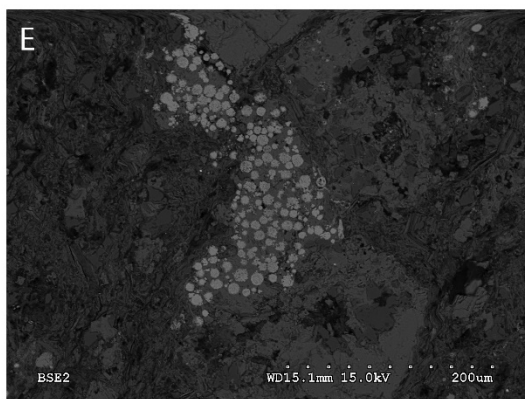
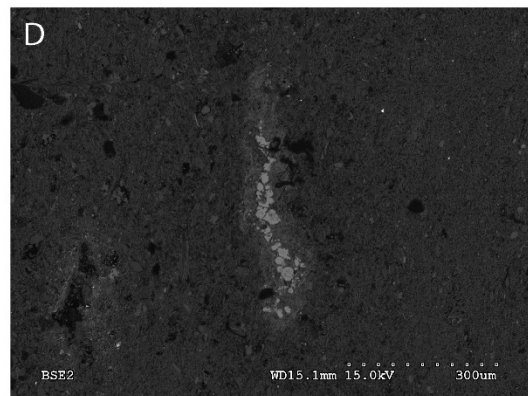
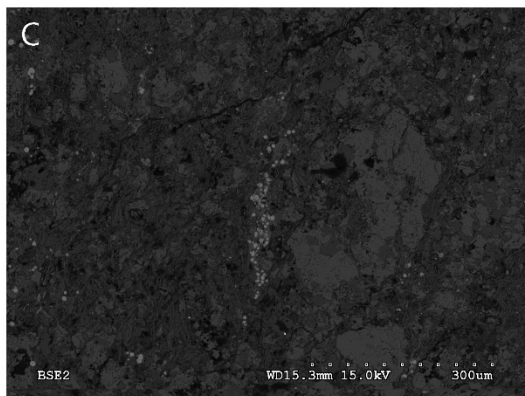
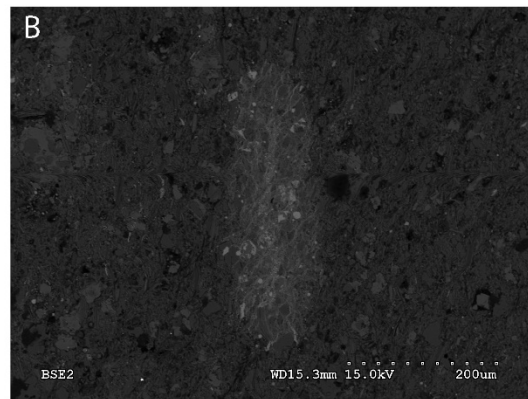
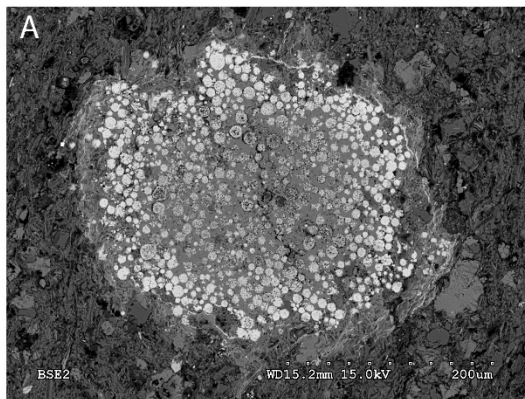
Luke Parry, Paulo C. Boggiani, Daniel Condon, Russell Garwood, Juliana de M. Leme, Duncan McIlroy, Martin D. Brasier, Ricardo Trindade, Ginaldo A. C. Campanha, Mírian L.A.F. Pacheco, Cleber Q.C. Diniz, and Alexander G. Liu

## **Supplementary Information File**



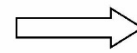
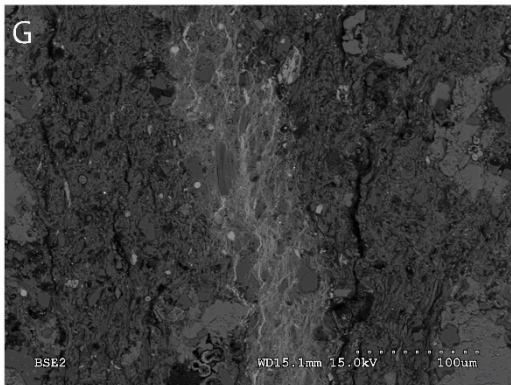
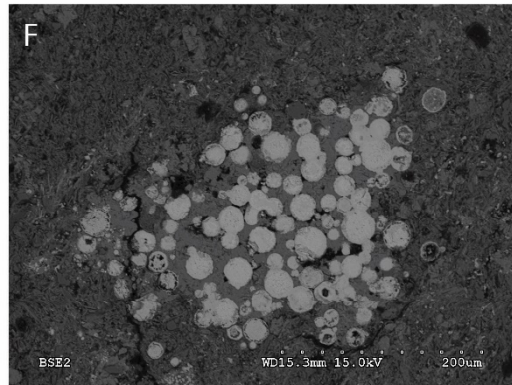
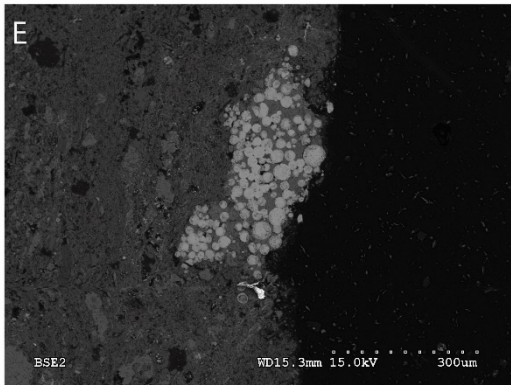
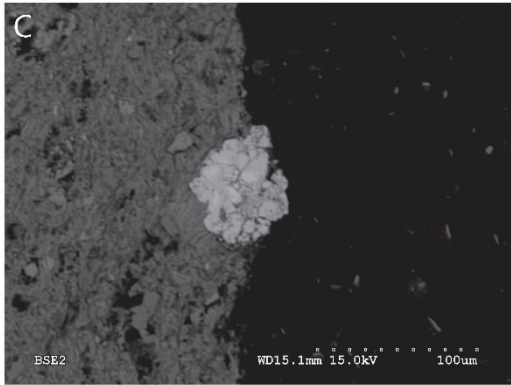
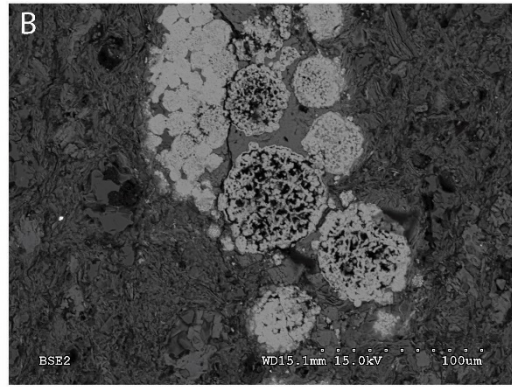
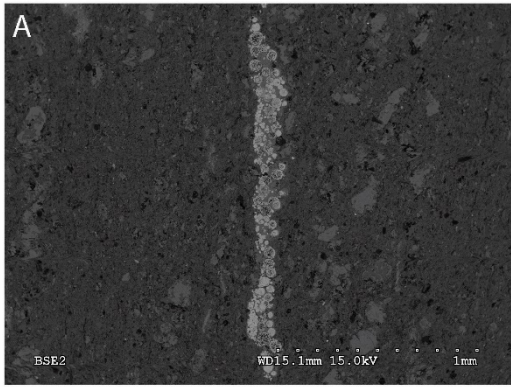
**Supplementary Figure 1.** Representative SEM EDX of burrow fill mineralogies from polished carbon coated thin sections. **(a)** Spectrum from framboids infilling

- 12 burrow, revealing iron oxide mineralogy. **(b)** Spectrum demonstrating a calcium
- 13 carbonate matrix surrounding the framboids within a burrow.



15    **Supplementary Figure 2.** SEM back-scatter electron images of cross sections  
16    through *Multina minima* burrows from the Guaicurus Formation, Laginha Mine,  
17    Corumbá region, Brazil. Younging direction is to the right.



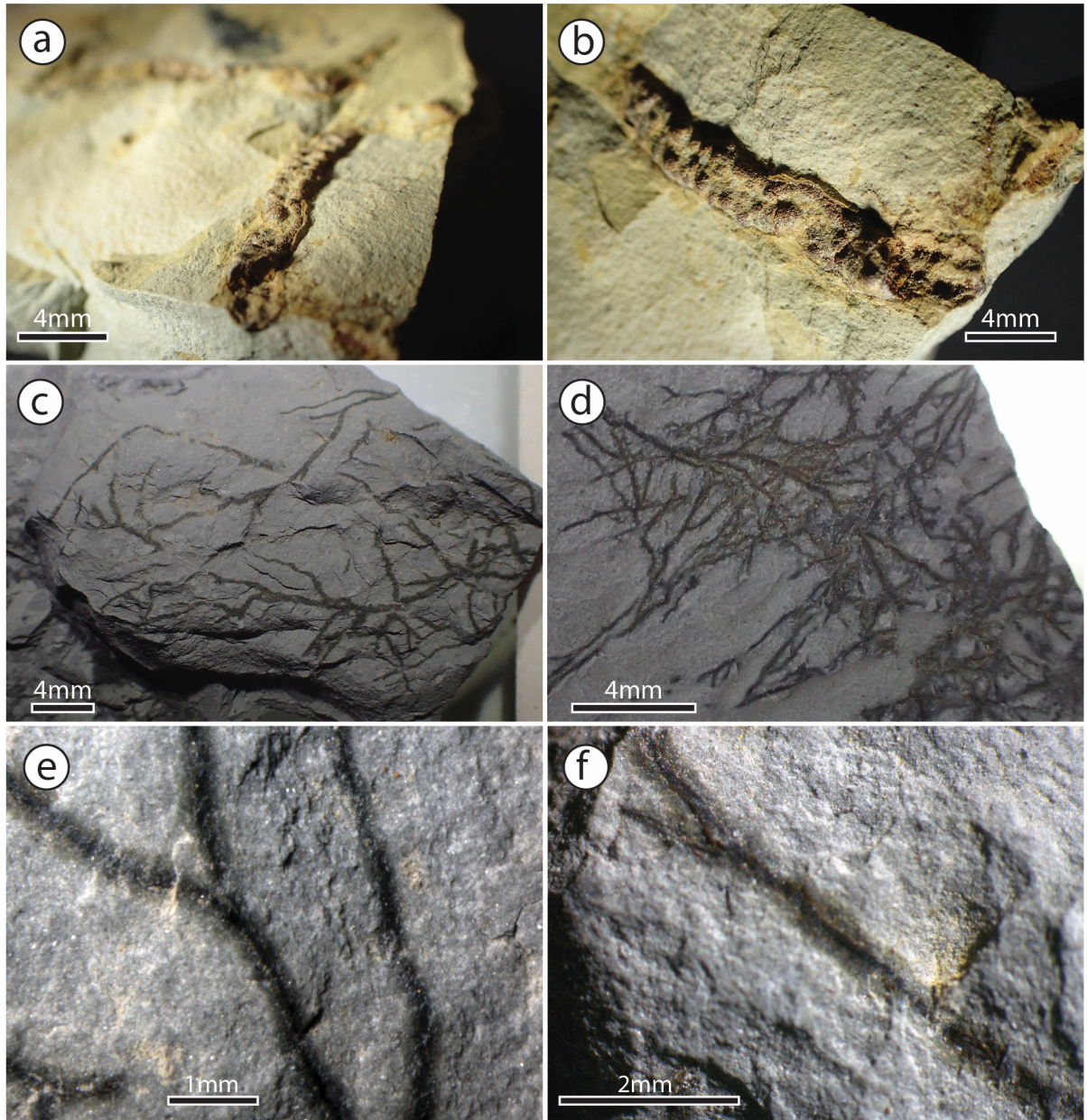


**Supplementary Figure 3.** – Additional SEM back-scatter figures of burrow fills in the Guaicurus Formation from Laginha Mine, Corumbá, Brazil. The arrow indicates the younging direction.



**Supplementary Figure 4.** The Porto Morrinhos tuff (white band), within the Bocaina Formation, from which our geochronology sample was collected. Field locality is situated at S: 19° 30' 24.6", W: 057° 25' 53.4". Image: A. Liu, 2016.





**Supplementary Figure 5.** (a,b) additional images of *Didymaulichnus lyelli* in oblique view showing bilobed morphology, Tamengo Formation. (c,d,e,f) specimens of algal compression fossil from the Guaicurus Formation (Laghina Mine locality), comparable in morphology to *Eoholynia corumbensis* also from the Guaicurus Formation but without evidence of terminal sporangia. (e,f) show close ups of the

35 black carbon films preserving the gross morphology of the algae. (c,e,f) GPIE11077F  
 36 (d) GPIE11077E.

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### 38 **Parameters of CT scan data**

Specimen	Acc. voltage (kV)	Current (μA)	Filtration	Projections	Exposure (ms)	Voxel size (μm)
11004b	187	57	None	3141	1000	11.1
LP1	210	195	0.5mm Cu	3142	708	41.9
LP2	210	200	0.5mm Cu	3142	354	21.7
LP3	195	170	1.5mm Cu	3142	708	48.1

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### 41 **Additional statistics for burrow measurements**

42 Shapiro-Wilk normality test  $W = 0.89272$ ,  $p\text{-value} = 5.667e-16$

43

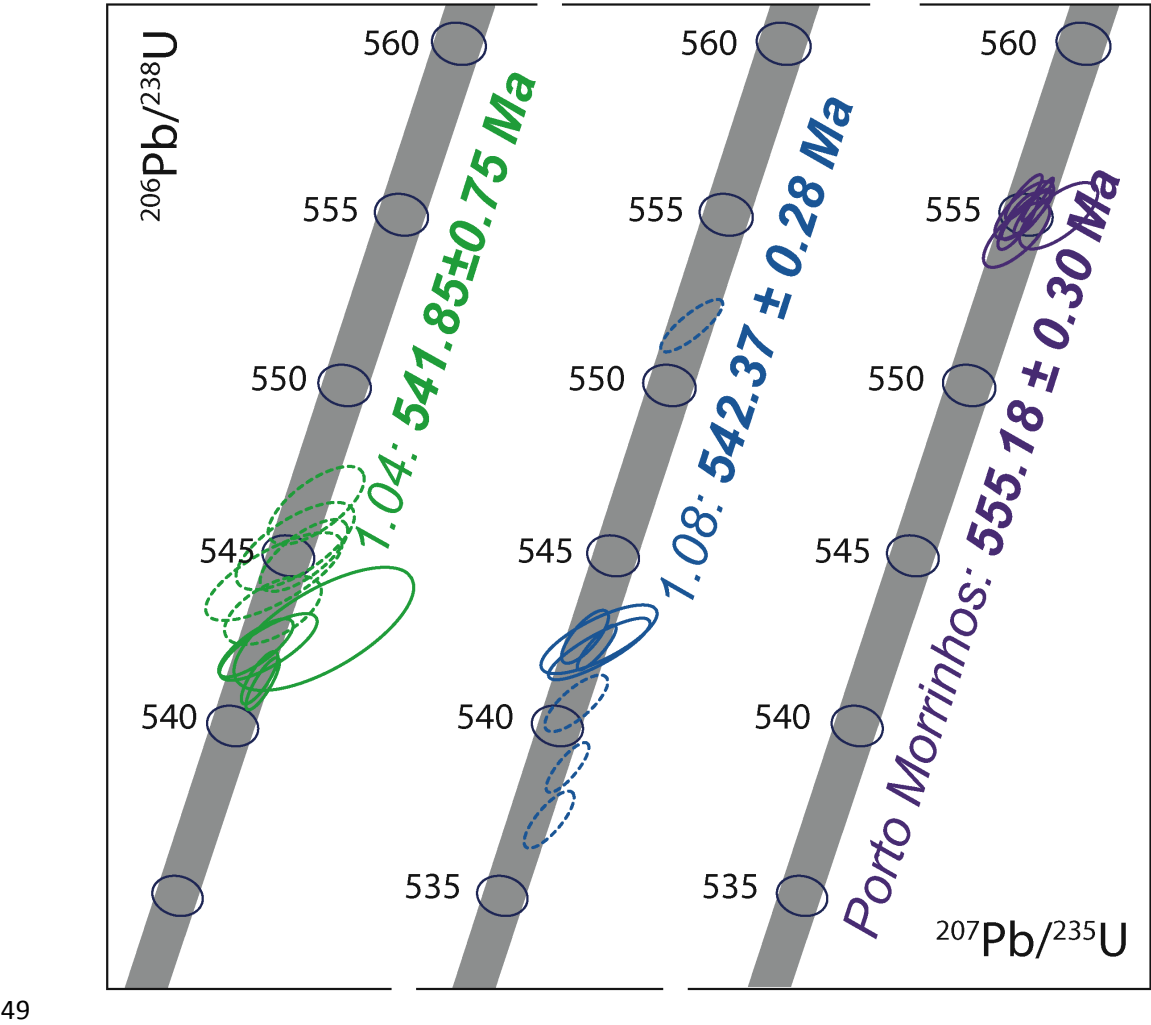
	<b>E</b>	<b>V</b>
<b>1</b>	-4717.851	-4717.851
<b>2</b>	-4612.028	-4606.354
<b>3</b>	-4624.125	-4600.061
<b>4</b>	-4615.962	-4612.453
<b>5</b>	-4628.021	-4628.584
<b>6</b>	-4641.087	-4643.94
<b>7</b>	-4652.085	-4649.414
<b>8</b>	-4664.492	-4679.505
<b>9</b>	-4662.065	-4663.386

44

**Table 1.** Negative log likelihood of different models using Bayesian Information Criterion (BIC) in mclust

V,3	V,2	E,2
-4600.061	-4606.354	-4612.028

**Table 2.** Negative log likelihood scores of Top 3 models based on the BIC criterion



**Supplementary Figure 6.** U-Pb Concordia plots for the U-Pb (zircon) results of the three samples dated in this study. Samples 1.04 and 1.08 were collected from the Corcal Mine locality (Fig. 1). For information on the calculation of age uncertainties, see Table 1 and the Methods section.

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<b>Sample ID</b>	<b>Weighted mean <math>^{206}\text{Pb}/^{238}\text{U}</math> date (Ma)</b>	<b><math>\pm X</math> (Myr)</b>	<b><math>\pm Y</math> (Myr)</b>	<b><math>\pm Z</math> (Myr)</b>	<b>MSWD</b>	<b><i>n</i></b>
Porto Morrinhos	555.18	0.30	0.34	0.70	1.6	8/8
1.08	542.37	0.28	0.32	0.68	0.63	4/7
1.04	541.85	0.75	0.77	0.97	3.3	5/11

X uncertainty - Analytical only

Y uncertainty - Analytical + U/Pb tracer calibration

Z uncertainty - Analytical + U/Pb tracer calibration +  $^{238}\text{U}$  decay constant

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58 **Table 3.** Summary of U-Pb zircon ID-TIMS dates for the three samples analysed in this

59 study (Fig. 2), and associated errors.

**Table 4.** U-Pb isotopic data from this study (overleaf)

U-Th-Pb isotopic data

Sample	Compositional Parameters						Radiogenic Isotope Ratios							Isotopic Ages							
	Th	<sup>206</sup> Pb*	mol %	Pb*	Pbc	<sup>206</sup> Pb	<sup>208</sup> Pb	<sup>207</sup> Pb	<sup>207</sup> Pb	<sup>206</sup> Pb	corr.	coef.	<sup>207</sup> Pb	±	<sup>207</sup> Pb	±	<sup>206</sup> Pb	±			
	U	x10-13 mol	<sup>206</sup> Pb*	Pbc	(pg)	<sup>204</sup> Pb	<sup>206</sup> Pb	<sup>206</sup> Pb	% err	<sup>235</sup> U			% err		<sup>238</sup> U		% err		<sup>206</sup> Pb	<sup>235</sup> U	<sup>238</sup> U
	(d)	(e)	(e)	(e)	(e)	(f)	(g)	(g)	(h)	(g)			(h)		(g)		(h)		(i)	(h)	(i)
(a)	(d)	(e)	(e)	(e)	(e)	(f)	(g)	(g)	(h)	(g)	(h)	(g)	(h)	(i)	(h)	(i)	(h)				
Porto Morrinhos																					
z1	0.447	0.6379	99.30%	42	0.37	2597	0.140	0.058853	0.267	0.729180	0.338	0.089860	0.135	0.673	561.3	5.8	556.1	1.4	554.79	0.72	
z2	0.439	1.2103	99.68%	93	0.32	5735	0.137	0.058643	0.113	0.727770	0.189	0.090008	0.091	0.912	553.5	2.5	555.2	0.8	555.67	0.48	
z3	0.419	1.7149	99.82%	160	0.26	9884	0.131	0.058722	0.089	0.728495	0.172	0.089975	0.087	0.975	556.5	1.9	555.7	0.7	555.47	0.47	
z4	0.636	0.6673	99.23%	40	0.43	2353	0.198	0.058674	0.157	0.727329	0.230	0.089905	0.094	0.859	554.7	3.4	555.0	1.0	555.05	0.50	
z6	0.478	0.4547	98.77%	24	0.47	1483	0.149	0.058643	0.222	0.726202	0.304	0.089813	0.133	0.756	553.5	4.8	554.3	1.3	554.52	0.71	
z7	0.656	0.5157	99.49%	62	0.22	3584	0.204	0.058636	0.122	0.726690	0.214	0.089884	0.119	0.887	553.3	2.7	554.6	0.9	554.93	0.63	
L7	0.514	0.3945	99.08%	33	0.30	1974	0.160	0.058659	0.195	0.727390	0.271	0.089936	0.116	0.778	554.1	4.3	555.0	1.2	555.24	0.62	
L9	0.557	1.4679	99.67%	92	0.41	5485	0.174	0.058706	0.112	0.727793	0.191	0.089914	0.095	0.908	555.9	2.5	555.3	0.8	555.11	0.50	
1.08																					
z1	0.388	0.7067	97.31%	11	1.63	668	0.121	0.058426	0.361	0.706782	0.431	0.087736	0.107	0.727	545.4	7.9	542.8	1.8	542.22	0.55	
z2	0.589	1.1854	99.26%	41	0.74	2442	0.184	0.058373	0.140	0.701326	0.221	0.087138	0.105	0.864	543.4	3.1	539.6	0.9	538.67	0.54	
z3	0.667	0.7022	99.53%	67	0.27	3911	0.208	0.058410	0.125	0.706673	0.201	0.087747	0.092	0.899	544.8	2.7	542.8	0.8	542.28	0.48	
z5	0.456	1.1311	98.61%	21	1.33	1295	0.143	0.058324	0.167	0.698674	0.255	0.086882	0.122	0.835	541.6	3.7	538.0	1.1	537.15	0.63	
z7	0.399	0.5957	96.39%	8	1.86	497	0.125	0.058414	0.418	0.707061	0.481	0.087788	0.127	0.593	545.0	9.1	543.0	2.0	542.53	0.66	
z10	0.724	0.6489	98.53%	21	0.81	1228	0.226	0.058354	0.218	0.703798	0.293	0.087473	0.115	0.763	542.8	4.8	541.1	1.2	540.65	0.60	
z11	0.511	0.4540	99.37%	48	0.24	2904	0.159	0.058333	0.157	0.706340	0.234	0.087821	0.112	0.817	541.9	3.4	542.6	1.0	542.72	0.58	
z12	0.397	0.6428	98.35%	17	0.90	1095	0.124	0.058600	0.207	0.721984	0.281	0.089356	0.100	0.815	551.9	4.5	551.8	1.2	551.82	0.53	
1.04																					
z1	0.347	0.4536	98.12%	15	0.72	964	0.108	0.058321	0.261	0.705755	0.333	0.087766	0.114	0.740	541.5	5.7	542.2	1.4	542.40	0.59	
z4	0.562	0.9479	99.76%	126	0.19	7492	0.176	0.058397	0.102	0.705040	0.195	0.087564	0.114	0.911	544.3	2.2	541.8	0.8	541.19	0.59	
z5	0.301	0.8468	99.71%	100	0.20	6349	0.094	0.058373	0.115	0.705044	0.203	0.087600	0.115	0.883	543.4	2.5	541.8	0.9	541.42	0.60	
z7	0.912	0.1449	97.68%	14	0.29	785	0.285	0.058433	0.420	0.711123	0.507	0.088264	0.175	0.626	545.8	9.2	545.4	2.1	545.33	0.92	
z8	0.882	0.1658	98.23%	18	0.25	1028	0.276	0.058508	0.337	0.713571	0.418	0.088455	0.160	0.652	548.5	7.4	546.9	1.8	546.46	0.84	
z9	0.891	0.1770	98.28%	19	0.26	1058	0.278	0.058492	0.306	0.711324	0.387	0.088201	0.146	0.687	547.9	6.7	545.5	1.6	544.96	0.76	
z11	0.910	0.1518	96.04%	8	0.52	459	0.285	0.058682	0.643	0.710208	0.754	0.087777	0.247	0.582	555.0	14.0	544.9	3.2	542.45	1.28	
z14	1.017	0.1943	97.26%	12	0.45	663	0.317	0.058346	0.488	0.708965	0.572	0.088127	0.168	0.612	542.5	10.7	544.1	2.4	544.52	0.88	
z15	0.910	0.2917	99.14%	39	0.21	2126	0.284	0.058376	0.353	0.707873	0.400	0.087946	0.145	0.488	543.6	7.7	543.5	1.7	543.45	0.76	
z18	0.945	0.0894	85.69%	2	1.24	126	0.297	0.058909	1.715	0.720713	1.881	0.088732	0.433	0.480	563.4	37.4	551.1	8.0	548.10	2.28	
z19	0.891	0.3141	97.85%	15	0.57	846	0.278	0.058390	0.346	0.706493	0.419	0.087755	0.127	0.676	544.1	7.6	542.7	1.8	542.32	0.66	

(a) z1, z2 etc. are labels for fractions composed of single zircon grains or fragments; all fractions annealed and chemically abraded after Mattinson (2005). Fraction ID in **bold** indicates fraction used in weighted mean cacluation.

(b) Nominal fraction weights estimated from photomicrographic grain dimensions, adjusted for partial dissolution during chemical abrasion.

(d) Model Th/U ratio calculated from radiogenic <sup>208</sup>Pb/<sup>206</sup>Pb ratio and <sup>207</sup>Pb/<sup>235</sup>U age.

(e) Pb\* and Pbc represent radiogenic and common Pb, respectively; mol % <sup>206</sup>Pb\* with respect to radiogenic, blank and initial common Pb.

(f) Measured ratio corrected for spike and fractionation only. SEM analyses, based on analysis of NBS-981.

(g) Corrected for fractionation, spike, and common Pb; up to 1 pg of common Pb was assumed to be procedural blank: <sup>206</sup>Pb/<sup>204</sup>Pb = 18.60 ± 0.80%; <sup>207</sup>Pb/<sup>204</sup>Pb = 15.69 ± 0.32%; <sup>208</sup>Pb/<sup>204</sup>Pb = 38.51 ± 0.74% (all uncertainties 1-sigma). Excess over blank was assigned to initial common Pb.

(h) Errors are 2-sigma, propagated using the algorithms of Schmitz and Schoene (2007) and Crowley et al. (2007).

(i) Calculations are based on the decay constants of Jaffey et al. (1971). <sup>206</sup>Pb/<sup>238</sup>U and <sup>207</sup>Pb/<sup>206</sup>Pb ages corrected for initial disequilibrium in <sup>230</sup>Th/<sup>238</sup>U using Th/U [magma] = 3.

(j) Corrected for fractionation, spike, and blank Pb only.