

Finite Rotation Euler poles for Gondwana reassembly at 182.7 Ma (start Toarcian) Rotation model CR25AAKD

The main developments to the model in recent years have been in understanding the fit of southernmost South America to Antarctica and Africa. While the reassembly is static, studying the dynamics of the dispersion has led to valuable new insights. The definitive path for Antarctica against Africa, as revealed in the Africa-Antarctica Corridor (Mueller and Jokat, 2019), has proved seminal in refining the two plate circuits **Africa-South America-Antarctica-Africa** and **Africa-Antarctica-India-Madagascar-Africa** and understanding their interaction in Early Cretaceous times when continental dispersion gathered pace from about 138 Ma.

The animation <https://www.reeves.nl/gondwana/africa-antarctica> attempts to illustrate this succinctly. Figure 1, on the next page, shows the configuration of the fragments at 184.2 Ma (start Toarcian) in a cylindrical equidistant projection with Africa (400) retaining its present position on the globe with coordinates (unlabelled) in light grey at ten-degree intervals. The black latitude lines show the paleo-latitudes at 10 degree intervals for this time based on the fixed hotspot reference frame we have adopted. The table that follows the figure lists the finite rotations needed to move the fragments from their present day positions directly to the 184.2 Ma reassembly.

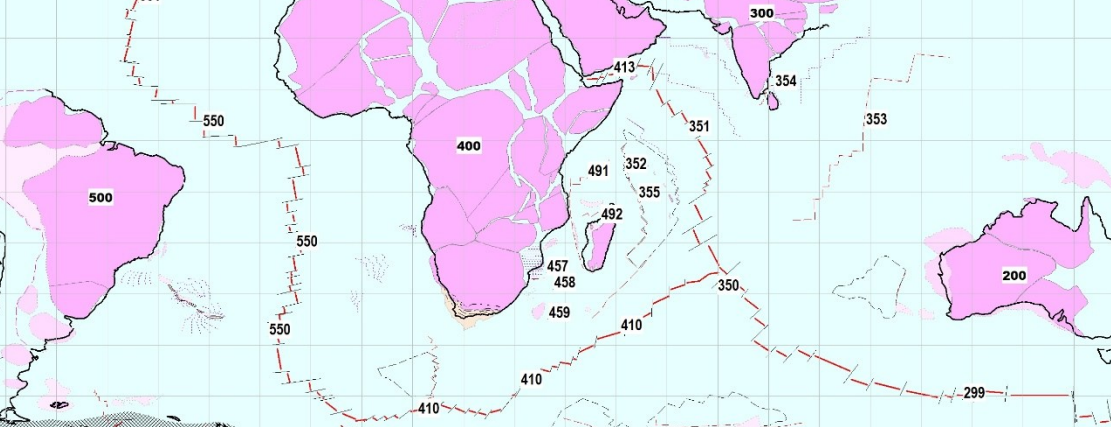
Figure 2 shows mid ocean ridges and their fragment numbers since the table of finite rotations for these features. Understanding where the mid-ocean ridge was and what it was doing is central to understanding the way in which the continents separated.

Enquiries are always welcome at reeves.earth@planet.nl.

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Figure 1. Precambrian plate codes



Region	Number of Populations
North America	500
South America	255
Central America	120
Caribbean	255
Europe	551
North Africa	550
West Africa	550
East Africa	400
South Africa	457, 458, 459
Madagascar	491, 492
Indian Ocean	410, 413, 351, 352, 355
Asia	300, 354, 353
Australia	200
Oceania	254, 256
Antarctica	100

Figure 2. Mid-ocean ridge fragment codes

Model CR25AAKD

Finite rotations 0 to 184.2 Ma

Fragment number / pole latitude / pole longitude / rotation angle / identification

400	555.000	90.000	0.000	0.000	AFRICA fixed to ref frame
100	184.200	-9.723	-31.413	57.791	ANTARCTICA
410	184.200	-9.771	-30.534	28.871	MOR Antarctica-Africa
401	184.200	-5.453	-83.612	20.811	MADAGASCAR
491	184.200	-3.344	-82.905	10.393	MOR Madagascar-Africa
494	184.200	5.831	-116.522	33.844	Davie Ridge microfragment
300	184.200	-28.638	-138.670	66.458	INDIA
350	184.200	-33.036	-84.663	38.887	MOR India-Antarctica
301	184.200	-20.544	-130.798	81.476	SRI LANKA
354	184.200	-24.172	-134.277	73.729	MOR Sri Lanka-India
304	184.200	-28.638	-138.670	66.458	Tiber plateau
305	184.200	-28.638	-138.670	66.458	Kohistan
311	184.200	-27.721	-137.422	68.638	Saurashtra
312	184.200	-33.230	-145.757	52.319	Kutchch
313	184.200	-28.325	-138.018	66.015	Bombay High
314	184.200	-28.638	-138.670	66.458	Megalaya
430	142.300	-4.070	24.810	3.340	Northwest Africa
431	130.680	-12.920	40.120	2.300	Western Libya
433	142.300	-4.070	24.810	3.340	does same as 430
436	142.300	8.070	12.550	28.000	Hawal massif
411	30.000	-23.330	13.870	0.300	E. Africa (coastline only)
443	300.000	-11.329	-148.672	1.729	Tanzania Craton
450	300.000	-79.555	115.991	0.497	E of Tanzania craton
440	130.680	-7.800	32.350	0.700	Sudd block
437	142.300	-5.040	28.990	2.590	Northeast Africa
441	142.300	-5.040	28.990	2.590	Ethiopia
412	230.000	-46.677	-164.761	6.251	Arabia
413	142.300	-67.978	176.396	2.552	MOR Gulf of Aden
415	300.000	17.689	76.386	59.779	Iran and Lutt block
416	300.000	27.952	69.271	74.010	MOR Iran - Africa
442	300.000	-17.204	36.543	3.243	Somalia
454	300.000	-12.991	36.704	5.079	Bur Acaba
403	300.000	-33.753	52.553	3.895	Socotra
398	300.000	-8.876	-74.107	18.615	Madagascar (David et al)
398	555.000	-8.876	-74.107	18.615	-do-
444	290.000	-32.920	174.400	0.200	Angola
446	300.000	-17.864	30.220	2.588	East Zambia
447	300.000	-22.655	41.397	3.006	Northern Mozambique
449	300.000	32.099	67.640	0.124	Zimbabwe craton
448	300.000	3.704	27.730	0.263	Southern Kalahari
453	300.000	78.827	-112.682	0.147	Sthn K'hi NW of STASS
455	154.940	57.340	-15.340	0.500	Sthn K'hi S of Z'fontein

451	300.000	-25.086	33.092	18.050	Beira High
452	184.200	0.347	-69.299	11.360	Limpopia
452	230.000	0.347	-69.299	11.360	-do-
452	300.000	-1.316	-73.790	11.253	-do-
456	300.000	-14.708	11.085	6.508	Natal valley fragment
457	300.000	-13.305	12.431	2.240	MOR E of Natal Valley
458	300.000	-8.951	-31.845	4.723	MOR S of Limpopia
459	300.000	10.657	-59.849	3.304	MOR N of Limpopia
200	184.200	-24.400	-63.201	55.082	AUSTRALIA
299	184.200	-17.537	-46.257	53.958	MOR Australia-Antarctica
299	300.000	-18.687	-46.556	54.185	-do-
353	184.200	-32.306	-106.074	51.259	MOR Gtr India -Australia
251	184.200	-59.540	-17.464	43.756	De Gonville triangle
251	300.000	-60.308	-17.321	44.690	-do-
252	184.200	-49.927	-39.868	44.662	Naturaliste plateau
252	300.000	-50.950	-39.967	45.432	-do-
253	184.200	-41.982	-49.453	45.758	MOR de Gonville-Australia
253	300.000	-43.123	-49.663	46.389	-do-
201	184.200	-10.644	-61.308	72.897	Lord Howe Rise
202	184.200	-13.190	-57.155	69.294	not used
202	300.000	-14.076	-57.544	69.395	not used
254	184.200	-6.816	-60.427	68.441	MOR E of Australia
254	300.000	-7.715	-60.815	68.411	-do-
204	184.200	34.078	-59.460	107.894	East New Zelandia
204	200.000	34.078	-59.460	107.894	-do-
204	555.000	33.680	-59.844	107.164	-do-
255	184.200	33.156	-47.202	79.223	MOR in Pacific Ocean
255	300.000	32.527	-47.523	78.549	-do-
256	184.200	15.455	-46.839	71.651	MOR Antarctica-E New Zeal.
256	300.000	14.638	-47.182	71.265	-do-
203	184.200	9.424	-60.531	92.192	West New Zealandia
203	300.000	8.824	-60.949	91.858	-do-
214	184.200	51.085	-59.365	150.402	Tonga-Kermadec hinterland
214	300.000	50.905	-59.752	149.471	-do-
402	184.200	-3.317	-124.992	104.882	MOR Comoro-Africa
352	184.200	-12.295	-106.262	27.883	MOR Madagascar-Seychelles
352	300.000	-14.519	-106.792	27.870	-do-
352	555.000	-14.519	-106.792	27.870	-do-
404	184.200	0.202	-76.404	26.730	Madagascar Rise
404	300.000	-2.134	-76.625	26.525	-do-
358	184.200	-2.282	-79.557	23.698	MOR Mad. Rise-Madagascar
358	300.000	-4.932	-79.771	23.534	-do-
409	184.200	-8.348	18.717	32.777	Comoro Islands
409	300.000	-10.187	18.555	33.115	-do-
492	184.200	-10.948	-24.785	16.399	MOR Comoros-Madagascar
492	300.000	-14.684	-24.375	16.616	-do-
406	184.200	-3.971	-125.379	72.104	Mascarene fragment
406	300.000	-4.680	-125.971	71.927	-do-

355	184.200	-2.901	-117.510	46.684	MOR Mascarene basin
355	300.000	-4.139	-118.093	46.484	-do-
407	184.200	-5.137	-119.906	55.141	Nazareth Bank
407	300.000	-6.157	-120.497	54.983	-do-
357	184.200	-5.148	-105.270	34.387	MOR sthn Mascarenes-Mad.
357	300.000	-6.923	-105.781	34.233	-do-
408	184.200	-7.081	-124.664	58.831	Saya del Malha
408	300.000	-8.016	-125.275	58.714	-do-
359	184.200	-6.987	-113.931	38.012	MOR S del M - Madagascar
359	300.000	-8.567	-114.510	37.891	-do-
356	184.200	-21.803	-132.267	82.120	Laxmi basin
356	300.000	-22.377	-132.910	82.289	-do-
105	184.200	-6.048	-55.431	49.948	fragment N of Crozet Is.
105	300.000	-7.316	-55.731	49.925	-do-
106	184.200	-8.185	-42.655	52.852	MOR N of Crozet Is.
106	300.000	-9.385	-42.940	52.922	-do-
500	142.300	46.802	-30.658	56.247	SOUTH AMERICA
575	133.780	48.090	-32.540	55.857	independent imported Sam.
550	142.300	48.092	-26.514	28.185	MOR South America-Africa
552	142.300	58.813	-177.757	74.173	fragment in Sth Atlantic
552	555.000	58.813	-177.757	74.173	-do-
584	113.200	77.377	-120.859	52.711	MOT Rio G Rise and Sam.
564	142.300	57.273	-177.952	77.248	MOR outbd of S Paulo P
565	142.300	62.051	-168.847	68.405	MOR W od S Paulo
558	142.300	44.435	172.422	100.069	San Paulo plateau
581	142.300	74.677	-148.228	59.947	MOR W of S Paulo plat.
583	142.300	75.200	-65.862	46.981	MOR E of S Paulo plat.
559	142.300	47.430	-30.999	55.603	small frag off Buzios
560	142.300	48.359	-31.521	54.683	small frag off Buzios
553	184.200	25.264	-33.947	52.090	MOR Sth Orkneys-Antarctica
553	300.000	24.159	-34.170	51.594	-do-
554	184.200	-5.292	-26.850	65.572	MOR Sam-Antarctica (old)
554	300.000	-6.251	-27.176	65.657	-do-
569	184.200	0.137	-28.258	61.749	MOR SAM-ANT (youngest)
569	300.000	-0.889	-28.569	61.727	-do-
505	142.300	42.939	-31.330	57.826	Maurice Ewing Bank
585	134.700	-1.789	-1.039	31.530	MOR E of MEB?
566	165.000	33.915	-27.847	60.680	MOR MEB - Malvinas plat.
520	142.300	46.151	-30.272	56.852	Uruguay block
515	142.300	37.327	-28.460	58.269	1st frag S of Rio d l Plata
517	142.300	33.873	-28.549	59.709	2nd frag S of Rio d l Plata
555	142.300	-6.519	0.348	23.331	MOR sthnmost Atlantic Oc.
507	165.000	22.545	-25.449	66.591	W part of Hoorn (not used)
516	165.000	22.545	-25.449	66.591	Hoorn, Falklands, Malvinas
519	184.200	7.753	-34.998	56.760	MOR Antarctica Hoorn ?
519	300.000	6.648	-35.284	56.567	-do-
571	184.200	-8.264	-28.864	62.222	MOR nearest Bouvet t jnc
571	300.000	-9.273	-29.177	62.353	-do-

573	184.200	24.568	-37.310	56.551	MOR not used
573	300.000	23.556	-37.563	56.052	-do-
572	184.200	28.281	-45.239	53.401	MOR not used
572	300.000	27.263	-45.466	52.811	-do-
556	142.300	40.085	-28.978	51.863	Scotia Arc
562	184.200	8.831	-34.367	53.313	MOR Scotia Arc
562	300.000	7.654	-34.632	53.104	-do-
561	184.200	16.735	-36.689	58.358	Western Scotia Arc
561	300.000	15.702	-36.970	57.995	-do-
557	184.200	74.227	-90.053	73.576	Sth Orkney microfragment
557	300.000	74.141	-89.897	72.482	-do-
522	142.300	44.512	-36.207	53.025	South Georgia
590	142.300	44.138	-33.742	55.709	MOR W of Sth Georgia
591	130.680	7.870	-22.180	9.600	MOR E of Sth Georgia
563	142.300	54.756	-37.555	54.886	MOR E of MEB
523	165.000	15.986	-24.275	67.495	Frgs W of Sth Georgia
524	165.000	-0.562	-22.524	76.911	Sth of Magellan fault
068	184.200	-11.167	-22.103	56.009	MOR Nazca - Antarctica
063	184.200	-7.312	-34.543	59.912	Pacific Plate
063	300.000	-8.365	-34.852	60.000	-do-
120	184.200	11.698	-29.477	53.628	MOR in Weddell Sea
120	300.000	10.534	-29.738	53.388	-do-
121	184.200	10.557	-45.629	50.578	MOR nr Bouvet tj
121	300.000	9.338	-45.888	50.288	-do-
115	184.200	10.870	-67.246	51.435	Kerguelen
115	300.000	9.716	-67.561	51.058	-do-
900	190.000	64.334	-11.985	76.434	NORTH AMERICA
900	300.000	38.968	4.825	72.800	-do-
551	170.000	62.194	-9.205	36.994	MOR North America-NW Africa
551	190.000	62.294	-8.565	38.736	-do-
800	190.000	61.316	3.883	66.077	GREENLAND
800	300.000	32.300	15.971	68.046	-do-
700	190.000	49.136	0.959	58.772	BALTICA
700	300.000	19.262	14.926	64.858	-do-
727	190.000	50.961	1.509	59.111	Porcupine Bank (approx.)
727	300.000	20.939	15.388	64.747	-do-
711	190.000	47.535	0.425	25.575	Iberia (approx.)
060	190.000	44.883	-94.521	91.707	Pacific Ocean (not used)
060	200.000	45.347	-102.192	87.501	Pacific Ocean (not used)
060	220.000	45.239	-103.227	86.751	Pacific Ocean (not used)
064	190.000	-19.275	-43.914	115.674	Pacific Ocean (not used)
064	220.000	-19.845	-50.039	113.695	Pacific Ocean (not used)
065	190.000	34.813	-68.381	112.059	Pacific Ocean (not used)
065	220.000	36.148	-73.880	105.612	Pacific Ocean (not used)
066	190.000	86.168	-68.901	139.948	Pacific Ocean (not used)
066	220.000	89.618	-60.118	132.320	Pacific Ocean (not used)
067	190.000	42.874	-74.789	100.682	Pacific Ocean (not used)
067	220.000	44.151	-81.502	94.191	Pacific Ocean (not used)

062	190.000	7.508	-45.662	49.158	Pacific Ocean (not used)
062	220.000	1.533	-54.730	44.038	Pacific Ocean (not used)
101	184.200	-9.723	-31.413	57.791	Frag of W W Antarctica
101	300.000	-10.812	-31.707	57.938	-do-
102	184.200	-9.723	-31.413	57.791	Frag of W W Antarctica
102	300.000	-10.812	-31.707	57.938	-do-
103	184.200	-9.723	-31.413	57.791	Frag of W W Antarctica
103	300.000	-10.812	-31.707	57.938	-do-
104	184.200	-9.723	-31.413	57.791	Frag of W W Antarctica
104	300.000	-10.812	-31.707	57.938	-do-
111	184.200	-9.723	-31.413	57.791	Frag of W W Antarctica
111	300.000	-10.812	-31.707	57.938	-do-
112	184.200	-9.723	-31.413	57.791	Frag of W W Antarctica
112	300.000	-10.812	-31.707	57.938	-do-
113	184.200	-9.723	-31.413	57.791	Frag of W W Antarctica
113	300.000	-10.812	-31.707	57.938	-do-
600	190.000	49.136	0.959	58.772	SIBERIA
600	300.000	19.262	14.926	64.858	-do-

Subject to change and improvement.

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2025 September 29