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Geology

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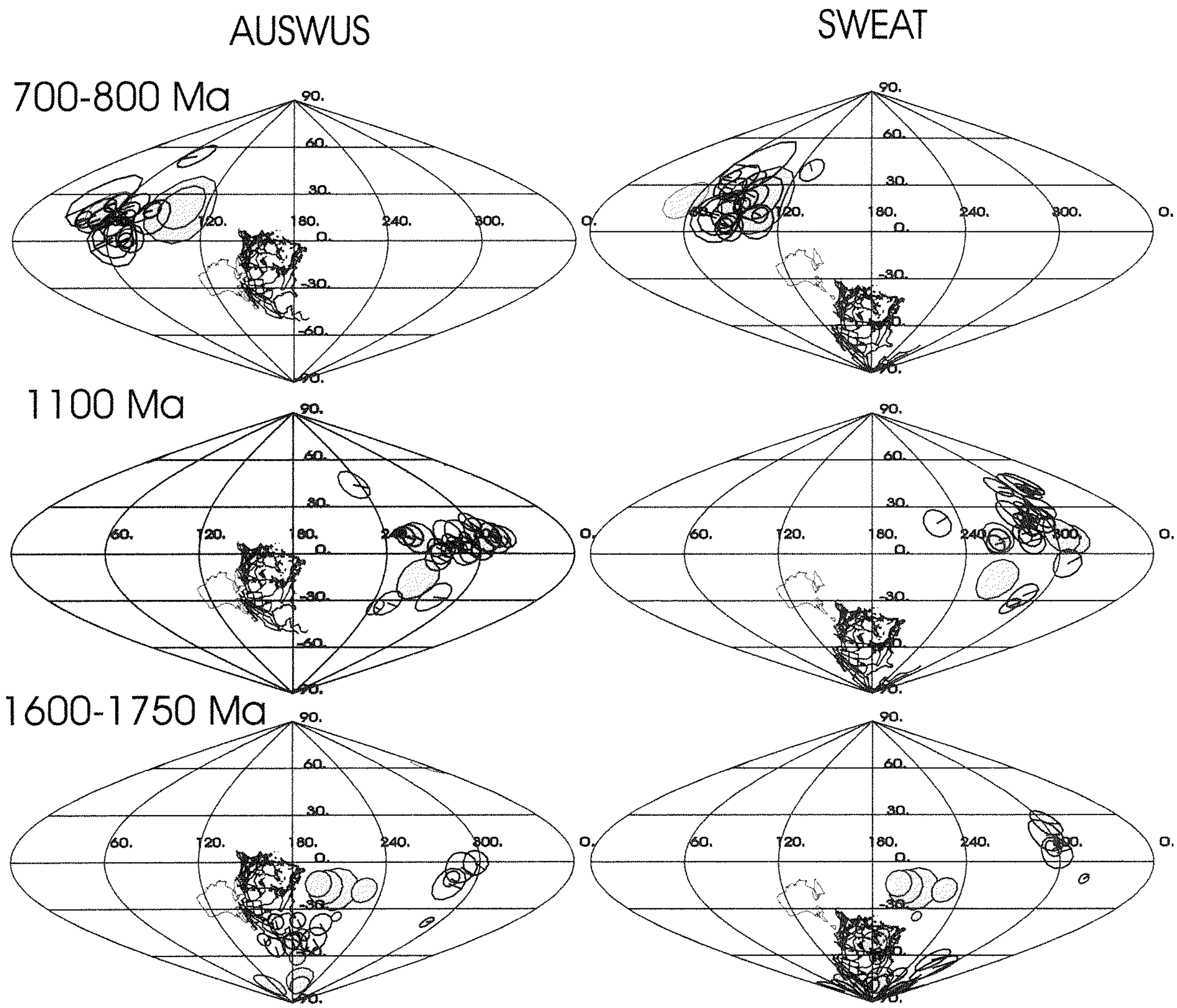
Proterozoic Australia-Western U.S. (AUSWUS) fit between Laurentia and Australia.

Paleomagnetic Analysis

In order to test the geologically based TASMO reconstruction of Laurentia and Australia we have selected paleomagnetic data for both continents from the Global Paleomagnetic Database compiled by M. McElhiiny and J.Lock and downloaded from the internet from World Data Center A in Boulder Colorado (Web site http://www.ngdc.noaa.gov). Only known primary poles dated to within 40my and with alpha95's of 16 degrees or less were selected. There are few periods in the Proterozoic where there are reliable poles in both Australia and Laurentia. Suitable times for comparison are from 1750-1600Ma, ca1100Ma, 800-700Ma and 650-550Ma. We have rotated the Laurentian paleomagnetic poles and Laurentia using the euler poles of rotation for AUSWUS and SWEAT, leaving Australia and its paleomagnetic poles in the present reference frame. As can be seen from the figures the Australian poles (shaded) overlap slightly more on the AUSWUS 1750-1600Ma reconstruction than SWEAT but there is significant non-overlap on both reconstructions. We suggest that this is possibly because Laurentia and Australia were still amalgamating up to about 1700Ma (as suggested by Condie, 1992 and Hoffman, 1998). For ca1100Ma the overlap is slightly better for AUSWUS and for 800-700Ma the overlap is about the same. Using a more selective paleomagnetic data set Karlstrom et al (1999) conclude that AUSWUS provides a greater overlap of poles. Karl Karlstrom sent us his manuscript in August 1999 and independently had come to remarkably similar conclusions as us based on geological comparisons.
As has been pointed out by numerous authors, the youngest Proterozoic paleomagnetic comparison shows that Laurentia and Australia had separated by 650Ma.

Figure

Paleomagnetic comparison of AUSWUS and SWEAT hypotheses. Australia in present-day position and Laurentia and Laurentian poles rotated about euler poles to obtain TASMO and SWEAT reconstructions. Poles are shown with alpha 95's and with Australian poles shaded.


AUSWUS
SWEAT
700-800 Ma
1100 Ma
1600-1750 Ma
90.
60.
30.
0.
-30.
-60.
-90.
60.
120.
180.
240.
300.
0.

MOJAVE	**BROKEN HILL - OLARY**	**MT ISA WEST**	**MT ISA EAST**
(Nd $T_{DM\,2.6-2Ga}$)	(Nd $T_{DM\,2.2-2\,Ga}$)		(Nd $T_{DM\,2.27-2.2Ga}$)
Widespread dolerite 1200 – 1100 Ma	Widespread Poolamacca Group basalts 1076 ± 34	Lakeview Dolerite 1116 ± 12	Dolerite
	"Grenvillian" event at ≈ 1280		
'anorogenic' granites 1.5 – 1.3 Ga	anorogenic Mundi Mundi Granite 1490 ± 20 (plus Tietz Dam, Calico Ck Well granites?)		Naraku Batholith 1505 ± 5 Wimberu Granite 1508 ± 4 Yellow Waterhole Granite 1493 ± 8
	≈ 1580 deformation high grade metamorphism	ISAN Orogeny 1500 – 1530 greenschist to amphibolite facies metamorphism	1584 ± 17 high grade metamorphism
≈ 1640 ductile deformation in SE Mojave	1650 ± 10 deformation, high grade thermal event upper amphibolite - granulite		
post orogenic granitoids 1635 ± 5 augen gneiss 1642 ± 12 foliated granitoid 1659 ± 4 1672 ± 5 1674 ± 5 1675 ± 8 Fenner Gneiss (intrusion) 1680 ± 7 1683 ± 5 1686 ± 12 1688 ± 9 1695 ± 10	Rasp Ridge Gneiss 1688 ± 18 Purnamoota Gneiss (intrusion) 1651 ± 12 Parnell 'Fm' (intrusion) 1693 ± 5 Cues Fm metaggabbro(intrusion) 1683 ± 5 Hores Gneiss (intrusion) 1689 ± 5 Alma Gneiss (intrusion) 1691 ± 12, 1693 ± 10 Gneiss in Himalaya 'Fm' 1675 ± 10	Sybella Batholith 1655 ± 5 Carters Bore Rhyolite 1678 1654 ± 2 Mt Isa Mine tuff 1652 1654 ± 7 Weberra Granite 1698 1654 ± 28	Tommy Ck Bimodal volcanism ≈ 1625 Soldiers Cap Gp Rhyolite 1654 ± 4 Cannington Paragneiss ≈ 1650 Gandry Dam gneiss 1676 ± 5
IVANPAH OROGENY (youngest small zircon 1696) high grade metamorphism pre-orogenic – synorogenic plutonics 1713 ± 16 augen gneiss 1710 ± 10 augen gneiss 1710 ± 9 augen gneiss 1708 ± 10 augen gneiss 1710 ± 40 granite gneiss	OLARIAN OROGENY ≈ 1690 Major thermal event (post orogenic mafic intrusion ≈ 1690 ± 11) 1717 ± 14 metagranitoid 1703 ± 6 metagranitoid 1699 ± 10 felsic igneous 1705 ± 5 granitoids & rhyolite 1717 ± 14 felsic		

	metaigneous 1710 felsic metavolcanics		
pre-orogenic plutonics 1726 ± 8 granite gneiss 1734 ± 11 granite augen gneiss 1760 ± 20 gneiss/tonalite/dolerite	inherited zircons dominated by 1740 – 1730 populations	Rhyolite 1737 ± 15 Wonga Batholith 1736 ± 5 Burstall Granite 1726 – 1745	Jessie Granite 1746 ± 6 Gin Ck Granite 1741 ± 7 Double x intrusion 1740 ± 6 Naraku Microgranite 1754 ± 25
		BARRAMUNDI OROGENY ± 1875	
earliest Proterozoic supracrustals 2300 – 2100, 1975 – 1700, 1920 – 1800, 1885 - 1765	detrital zircons 3050, 2700, 2400 clusters at 1900 – 1780 1860 – 1740		
Major fold axes/N-S foliations strike	Major fold axes/foliations strike NE - SW	Major fold axes/foliations strike NW - SE	

TABLE

Comparison of major features of Mojavia and terranes in Australia. Compiled from numerous sources.