

ARTICLES

9/56 YEAR CYCLE: EARTHQUAKES IN THE PACIFIC RIM OF SOUTH AMERICA

“God does not play dice.” Albert Einstein

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Abstract: 54/56 year grids were established for major earthquakes in Japan, Kamchatka and Alaska. They were also applicable for world mega quakes ($M \geq 8.6$) since 1900. Given such findings, large seismic episodes in the Pacific Rim of South America were also hypothesised to fall preferentially in 54/56 year grids. This was confirmed after assessing all major quakes ($M \geq 7.8$) in Chile, Peru, Ecuador and Colombia over the past three centuries. Other grids based on 56 years and multiples of 9 years yielded significance. Why 54/56 year patterns were so crucial in seismic activity around the ‘Ring of Fire’ was unknown. Lunisolar cycles were involved but that is all that can be stated with any degree of certainty.

Keywords: 9/56 year, 54/56 year, earthquake cycles, Chile, Peru, ring of fire

Introduction

The 9/56 year grids were first established in the occurrence of financial panics in the USA and Western Europe (McMinn, 1993) and then extrapolated to seismic events (McMinn, 2011a; McMinn, 2011b). The importance of 54/56 year grids in the timing of world mega quakes was first established by McMinn (2011b). Major earthquakes in Japan, Kamchatka and Alaska were found to exhibit a similar 54/56 year effect (McMinn, 2014). Given such findings, these grids were also found to be relevant in the occurrence of large seismic events in Chile - Peru - Ecuador - Colombia over the past three centuries. Some commonalities were established in earthquake activity around the Ring of Fire, which were believed to arise from Moon Sun tidal harmonics as proposed by McMinn (2011a). The findings supported the non-random hypothesis for the timing of major earthquakes, contradicting the prevailing paradigm in seismology.

The 9/56 year cycle consists of a grid with intervals of 56 years on the vertical (called sequences) and multiples of 9 years on the horizontal (called subcycles). The 56 year sequences have been numbered in accordance with McMinn (1993), with 1817, 1873, 1929, 1985 being designated as Sequence 01; 1818, 1874, 1930, 1986 as Sequence 02 and so forth. McMinn (Appendix 2, 2002) presented the full numbering. In the accompanying tables, the dates have been expressed as YYYYMMDD and the year of best fit was taken as the year ending November 30. The database of the National Geophysical Data Center (NGDC) was accessed to compile a list of major earthquakes ($M \geq 7.8$) taking place in Chile, Peru, Ecuador and Colombia since 1700 (see Appendix 1).

9/56 Year Cycle

The major earthquakes in western South America were plotted on the complete 9/56 year grid as presented in Appendix 2. This was divided into four equal sections – Grids A, B, C and D. Major earthquakes were most likely to fall in in Grid A. Of the 58 episodes listed in Appendix 1, 29 appeared in this grid compared with an expected 14.5 (significant $p < 10^{-4}$). These earthquakes were least likely to happen in Grid D which only experienced five events (significant $p < .01$). The latter correlate could be boosted by expanding Grid D to encompass a total of 19 56 year sequences (see Table 1). The enlarged table comprised 34% of the complete 9/56 year grid, yet it only contained 13% of the 58 earthquakes in Appendix 1 (significant $p < .001$).

Table 1 9/56 YEAR CYCLE: THE MINIMUM CONCENTRATION OF QUAKES IN CHILE – PERU – ECUADOR - COLOMBIA Post 1700 $M \geq 7.8$ Year ending November 30									
Sq 31	Sq 40	Sq 49	Sq 02	Sq 11	Sq 20	Sq 29	Sq 38	Sq 47	Sq 56
			1706	1715	1724	1733	1742	1751 0525	1760
	1744	1753	1762	1771	1780	1789	1798	1807	1816
1791	1800	1809	1818	1827	1836	1845	1854	1863	1872
1847	1856	1865	1874	1883	1892	1901 0107	1910	1919 1918 1204	1928
1903	1912	1921	1930	1939 0125	1948	1957	1966 1017	1975	1984
1959	1968	1977	1986	1995 0730	2004	2013			
2015									
Sq 09	Sq 18	Sq 27	Sq 36	Sq 45	Sq 54	Sq 07	Sq 16	Sq 25	
					1702	1711	1720	1729	
		1731	1740	1749	1758	1767	1776	1785	
1769	1778	1787	1796	1805	1814	1823	1832	1841	
1825	1834	1843	1852	1861	1870	1879	1888	1897	
1881	1890	1899	1908	1917	1926	1935	1944	1953	
1937	1946 0802	1955	1964	1973	1982	1991	2000	2009	
1993	2002	2011							

There were no mega quakes $M \geq 8.6$ in this layout. Events with $M \geq 7.8$ and ≤ 8.5 were denoted in blue.
Source of Raw Data: National Geophysical Data Center.

Grid A **Appendix 2** can be reduced to give another pattern with intervals of 18 years on the horizontal (see **Table 2**). The 18/56 year arrangement represented only 13% of the complete 9/56 year grid, but it accounted for 33% of all major quakes ($M \geq 7.8$) (significant $p < 10^{-5}$) and five of the 7 mega quakes ($M \geq 8.6$).

Table 2 18/56 YEAR CYCLE: CHILE – PERU – ECUADOR = COLOMBIA EARTHQUAKES Post 1700 $M \geq 7.8$ Year ending November 30						
Sq 34	Sq 52	Sq 14	Sq 32	Sq 50	Sq 12	Sq 30
					1716 Feb06 1716 Feb11	1734
	1700	1718	1736	1754	1772	1790
1738 1737 Dec04	1756	1774	1792	1810	1828 Mar30	1846 Jun28
1794	1812	1830	1848	1866	1884	1902
1850	1868 Aug13 1868 Aug14 1868 Aug15	1886	1904 Jan20	1922 Nov11	1940 May24	1958
1906 Jan31 1906 Aug17 1906 Sep28	1924	1942 May14 1942 Aug24	1960 Jan13 1960 May22	1978	1996	2014 Apr01
1962	1980	1998	2016			
2018						

The 56 year sequences are separated by an interval of 18 years on the horizontal.
 Mega quakes $M \geq 8.6$ highlighted in red. Large events with $M \geq 7.8$ and ≤ 8.5 denoted in blue.
Source of Raw Data: National Geophysical Data Center.

54/56 Year Cycle

Major earthquakes ($M \geq 7.8$) in western South America also tended to fall in a 54/56 year grid as shown in **Table 3** (significant $p < .001$). This arrangement aligned closely with Grid B **Appendix 3** for world mega quakes, as both patterns shared Sequences 34, 32, 30, 28 and 26. Another 54/56 year layout for world mega quakes was presented as Grid A **Appendix 3**, but it did not have an equivalent for western South America.

Sq 34	Sq 32	Sq 30	Sq 28	Sq 26	Sq 24	Sq 22
						1726
					1728	1782
				1730 Jul08	1784 May14	1838
			1732	1786	1840	1894
		1734	1788	1842	1896	1950 May16 1949 Dec17 1949 Dec17
	1736	1790	1844	1898	1952	2006
1738 1737 Dec04	1792	1846 Jun28	1900 Sep18	1954	2008	
1794	1848	1902	1956	2010 Feb27		
1850	1904 Jan20	1958	2012			
1906 Jan31 1906 Aug17 1906 Sep28	1960 Jan13 1960 May22	2014 Apr01				
1962	2016					
2018						

The 56 year sequences are separated by an interval of 54 years on the horizontal.
Mega quakes $M \geq 8.6$ highlighted in **red**. Large events with $M \geq 7.8$ and ≤ 8.5 denoted in **blue**.
Source of Raw Data: National Geophysical Data Center.

Another correlate could be realised based on a grid with 108 year intervals on the horizontal (see **Appendix 4**). The 108/56 year configuration represented 14% of the complete 9/56 year grid, but it experienced 29% of all seismic events ($M \geq 7.8$) (significant $p < .01$).

Discussion and Conclusions

54/56 year seismic grids have been established in various regions around the Pacific Basin.

- * Chile - Peru - Ecuador - Colombia
- * Japan - Kamchatka (McMinn, [2014](#)).
- * Alaska (McMinn, [2014](#)).
- * World Mega quakes (McMinn, 2011b).

Grids A and B for world mega quakes (see **Appendix 3**) overlapped with the 54/56 year patterns for western South America, Alaska and Japan - Kamchatka. The same sequences tended to show up in the various 54/56 year grids (see **Table 4**). There was an overall theme in the timing of these events, which contradicts the prevailing paradigm. Professor Shearer of UCSD believed that “*There is no plausible physical mechanism that would link a large earthquake in Chile with one in Japan, so it's most likely that these [mega quake clusters] are truly random events*” (Salleh, 2011). An alternative view is that these episodes were triggered by Moon Sun tidal harmonics (McMinn, [2011a](#)) and were thus linked by time. This hypothesis can explain the commonalities in the 54/56 year grids around the Pacific in **Table 4**, whereas the random view cannot.

Table 4
SHARED 56 YEAR SEQUENCES IN THE 54/56 YEAR SEISMIC GRIDS

	Grid A Sequence Numbers	Grid B Sequence Numbers	Source
World Mega Quakes	29, 27, 25, 23, 21	36, 34, 32, 30, 28, 26	Appendix 3 this paper McMinn (2011b)
Japan - Kamchatka	29, 27, 25, 23, 21	na	Table 1, McMinn (2014)
Alaska	29 27	36, 34, 32, 30, 28, 26	Table 2, McMinn (2014)
Wn South America	na	34, 32, 30, 28, 26	Table 3 this paper
World mega quakes had $M \geq 8.6$, whereas all the other regions had quakes with $M \geq 7.8$. Sources: World Mega Quakes. McMinn (2011b). Earthquakes in Japan – Kamchatka and Alaska. McMinn (2014).			

Sequence 12 was the most interesting series with five large Peruvian quakes ($M \geq 8.2$) happening every 112 years (see **Table 5**).

Table 5
SEQUENCE 12 & PERUVIAN EARTHQUAKES

Sq 12	M	Location
Nov 22, 1604	8.5	Peru: Arequipa Chile: Arica
+ 112		
Feb 6, 1716 Feb 11 1716	8.8 8.6	Peru: Pueblo De Torata In Tacna Peru
+ 112		
Mar 30, 1828	8.3	Peru: Lima, Callao
+ 112		
May 24, 1940	8.2	Peru
+ 112		
2052	??	

54/56 year grids could not be produced for historic large quakes in Indonesia ($M \geq 7.8$), based on a listing sourced from NGDC. The outcome was anomalous when compared with other regions around the Ring of Fire.

The 54/56 year cycle was first established for financial panics (see **Appendix 5**) and then extrapolated to earthquakes (McMinn, 2011b and 2014). Why these particular grids were so important in the occurrence of large Pacific Basin earthquakes was unknown. Lunisolar cycles hold the key to unravelling the mystery (McMinn, 2011a), but it is impossible to explain how this effect actually functioned. Much more research is essential to decipher meaningful patterns in the apparent ‘randomness’ of seismic activity.

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Appendix 1				
MAJOR EARTHQUAKES IN CHILE – PERU - ECUADOR – COLOMBIA				
Post 1700. M ≥ 7.8				
National Geophysical Data Center				
YYYY	MM	DD	Location	M
1730	7	8	CHILE: VALPARAISO	8.7
1737	12	24	CHILE: VALDIVIA, CHILOE	8.0
1751	5	25	CHILE: CONCEPCION, CHILLAN, TALCA, TUTUBEN	8.5
1819	4	3	CHILE: COPIAPO	8.0
1819	4	4	CHILE: COPIAPO	8.0
1819	4	12	CHILE: COPIAPO	8.5
1822	11	20	CHILE: VALPARAISO, QUILLOTA, CONCON	8.5
1831	10	9	CHILE: PERU: TACNA, ARICA, AREQUIPA	7.8
1835	2	20	CHILE: CONCEPCION	8.2
1837	11	7	CHILE: VALDIVIA	8.5
1868	8	13	CHILE: ARICA	8.5
1868	8	14	CHILE: ARICA	8.5
1877	5	10	CHILE: OFF NORTH COAST	8.3
1878	1	23	CHILE: TARAPACA	7.9
1906	8	17	CHILE: SOUTH CENTRAL	8.2
1918	5	20	CHILE: NORTHERN	7.9
1918	12	4	CHILE: COPIAPO	7.8
1922	11	11	CHILE: ATACAMA	8.7
1939	1	25	CHILE: CHILLAN	8.3
1943	4	6	CHILE: ILLAPEL	8.2
1946	8	2	CHILE: NORTHERN	7.9
1949	12	17	CHILE: TIERRA DEL FUEGO	7.8
1949	12	17	CHILE: TIERRA DEL FUEGO	7.8
1950	12	9	CHILE-ARGENTINA	8.0
1960	5	22	CHILE: PUERTO MONTT, VALDIVIA	9.5
1966	12	28	CHILE: TALTAL, CATALINA	7.8
1985	3	3	CHILE: CENTRAL COAST, SAN ANTONIO	8.0
1995	7	30	CHILE: ANTOFAGASTA, CALAMA, MEJILLONES	8.0
2010	2	27	CHILE: MAULE, CONCEPCION, TALCAHUANO	8.8
2014	4	1	CHILE: IQUIQUE	8.2
1716	2	6	PERU: PUEBLO DE TORATA IN TACNA	8.8
1716	2	11	PERU	8.6
1746	10	29	PERU: LIMA, CALLAO	8.0
1784	5	13	PERU: AREQUIPA, CAMANA, MOQUEGUA, TAMBO	8.0
1828	3	30	PERU: LIMA, CALLAO	8.3
1846	6	28	PERU	7.8
1906	12	26	PERU: OFF SOUTH COAST	7.9
1908	12	12	PERU: OFF COAST	8.2
1913	8	6	PERU: CARAVELI, CHUQUIBAMBA, OCONA	7.9
1940	5	24	PERU	8.2
1942	8	24	PERU: ICA, NAZCA	8.2
1950	5	16	PERU	7.9
1951	5	16	PERU	7.9
1960	1	13	PERU: AREQUIPA, CHUQUIBAMBA, CARAVELI	7.8
1966	10	17	PERU: LIMA, HUACHO, HUAURA, CHANCAY, SUPE	8.1
1970	5	31	PERU: NORTHERN, PISCO, CHICLAYO	7.9
1974	10	3	PERU: LIMA, CALLAO	8.1
2001	6	23	PERU: AREQUIPA, MOQUEGUA, TACNA	8.4
2007	8	15	PERU: ICA, PISCO, LIMA	8.0
1797	2	4	ECUADOR: RIOBAMBA, QUITO, CUZCO	8.3
1868	8	15	ECUADOR: EL ANGEL, CONCEPCION	8.0
1901	1	7	ECUADOR: ESMERALDAS	7.8

1906	1	31	ECUADOR: OFF COAST	8.6
1906	9	28	ECUADOR	7.9
1942	5	14	ECUADOR: GUAYAQUIL	7.9
1826	6	18	COLOMBIA: ENGATIVA, BOGOTA, RAMIRQUI	8.2
1900	9	18	COLOMBIA	7.9
1904	1	20	PANAMA-COLOMBIA	7.9

Mega quakes $M \geq 8.6$ highlighted in **red**.
Source: National Geophysical Data Center. Parameters: Earthquakes $M \geq 7.8$.

Appendix 2 COMPLETE 9/56 YEAR SEISMIC CYCLE: CHILE – PERU – ECUADOR - COLOMBIA Post 1700 $M \geq 7.8$ Year ending November 30													
Grid A													
Sq 34	Sq 43	Sq 52	Sq 05	Sq 14	Sq 23	Sq 32	Sq 41	Sq 50	Sq 03	Sq 12	Sq 21	Sq 30	Sq 39
									1707	1716 0206 1716 0211	1725	1734	1743
		1700	1709	1718	1727	1736	1745	1754	1763	1772	1781	1790	1799
1738 1737 1204	1747	1756	1765	1774	1783	1792	1801	1810	1819 0403 1819 0403 1819 0411	1828 0330	1837 1107	1846 0628	1855
1794	1803	1812	1821	1830	1839	1848	1857	1866	1875	1884	1893	1902	1911
1850	1859	1868 0813 1868 0814 1868 0815	1877 0510	1886	1895	1904 0120	1913 0806	1922 1111	1931	1940 0524	1949	1958	1967 1966 1228
1906 0131 1906 0817 1906 0928	1915	1924	1933	1942 0514 1942 0824	1951 0516 1950 1209	1960 0113 1960 0522	1969	1978	1987	1996	2005	2014 0401	
1962	1971	1980	1989	1998	2007 0815	2016							
2018													
Grid B													
Sq 48	Sq 01	Sq 10	Sq 19	Sq 28	Sq 37	Sq 46	Sq 55	Sq 08	Sq 17	Sq 26	Sq 35	Sq 44	Sq 53
													1701
							1703	1722	1721	1730 0708	1739	1748	1757
	1705	1714	1723	1732	1741	1750	1759	1768	1777	1786	1795	1804	1813
1752	1761	1770	1779	1788	1797 0204	1806	1815	1824	1833	1842	1851	1860	1869
1808	1817	1826 0618	1835 0220	1844	1853	1862	1871	1880	1889	1898	1907 1906 1226	1916	1925
1864	1873	1882	1891	1900 0918	1909 1908 1212	1918 0520	1927	1936	1945	1954	1963	1972	1981
1920	1929	1938	1947	1956	1965	1974 05	1983	1992	2001 0623	2010 0227			
1976	1985 0303	1994	2003	2012									
Grid C													
Sq 06	Sq 15	Sq 24	Sq 33	Sq 42	Sq 51	Sq 04	Sq 13	Sq 22	Sq 31	Sq 40	Sq 49	Sq 02	Sq 11
													1706
						1708	1717	1726	1735	1744	1753	1762	1771

1710	1719	1728	1737	1746 1029	1755	1764	1773	1782	1791	1800	1809	1818	1827	
1766	1775	1784 0514	1793	1802	1811	1820	1829	1838	1847	1856	1865	1874	1883	
1822 1120	1831 1009	1840	1849	1858	1867	1876	1885	1894	1903	1912	1921	1930	1939 0125	
1878 0123	1887	1896	1905	1914	1923	1932	1941	1950 0516 1949 1217 1949 1217	1959	1968	1977	1986	1995 0730	
1934	1943 0406	1952	1961	1970 0531	1979	1988	1997	2006	2015					
1990	1999	2008	2017											
Grid D														
Sq 20	Sq 29	Sq 38	Sq 47	Sq 56	Sq 09	Sq 18	Sq 27	Sq 36	Sq 45	Sq 54	Sq 07	Sq 16	Sq 25	
							1731	1740	1749	1758	1702	1711	1720	1729
1724	1733	1742	1751 0525	1760	1769	1778	1787	1796	1805	1814	1823	1832	1841	1850
1780	1789	1798	1807	1816	1825	1834	1843	1852	1861	1870	1879	1888	1897	1906
1836	1845	1854	1863	1872	1881	1890	1899	1908	1917	1926	1935	1944	1953	1962
1892	1901 0107	1910	1919 1918 1204	1928	1937	1946 0802	1955	1964	1973	1982	1991	2000	2009	2018
1948	1957	1966 1017	1975	1984	1993	2002	2011	2020						
2004	2013	2022												
The 56 year sequences are separated by an interval of 9 years on the horizontal. Mega quakes $M \geq 8.6$ highlighted in red . Events with $M \geq 7.8$ and ≤ 8.5 denoted in blue . Source of Raw Data: National Geophysical Data Center.														

Appendix 3					
54/56 YEAR CYCLE: WORLD MEGA QUAKES Post 1870 $M \geq 8.6$					
National Geophysical Data Center					
Grid A					
7.5 months ending March 31					
Sq 29	Sq 27	Sq 25	Sq 23	Sq 21	
				1893	
			1895	1949	
		1897	1951 1950 Aug15	2005 Mar28 2004 Dec26	
	1899	1953 1952 Nov04	2007		
1901	1955	2009			
1957 Mar09	2011 Mar11				
2013					
Grid B					
9 months ending June 10					
Sq 36	Sq 34	Sq 32	Sq 30	Sq 28	Sq 26
					1898 Jun05 1897 Sep20 1897 Sep21
				1900	1954
			1902	1956	2010 Feb27

		1904	1958	2012 Apr11	
	1906 Jan31	1960 May22	2014		
1908	1962	2016			
1964 Mar28	2018				
2020					
WORLD MEGA QUAKES: 1870–2013 M ≥ 8.6 National Geophysical Data Center					
Date	Country				Mag
1897 Sep 20	Philippines: North west Mindanao, Dapitan				8.6
1897 Sep 21	Philippines: Mindanao, Zamboanga, Sulu				8.7
1898 Jun 05	Japan: Offshore east coast Honshu				8.7
1906 Jan 31	Ecuador: Offshore				8.6
1922 Nov 11	Chile: Atacama				8.7
1946 Apr 01	Alaska: Unimak Island				8.6
1950 Aug 15	India-China				8.6
1952 Nov 04	Russia: Kamchatka				9.0
1957 Mar 09	Alaska				8.6
1960 May 22	Chile: Puerto Montt, Valdiva				9.5
1964 Mar 28	Alaska				9.2
1965 Feb 04	Alaska: Aleutian Islands, Rat Islands				8.7
2004 Dec 26	Indonesia: Offshore west coast Sumatra				9.1
2005 Mar 28	Indonesia: Offshore south west Sumatra				8.6
2010 Feb 27	Chile: Maule, Concepcion, Talcahuano				8.8
2011 Mar 11	Japan: Honshu				9.0
2012 Apr 11	Indonesia: Offshore north west coast Sumatra				8.6
<p>In Grids A & B, the 56 year sequences are separated by intervals of 54 years on the horizontal. World mega quakes M ≥ 8.6 falling in Grids A and B are highlighted in red. The NGDC listed some 17 world mega quakes (M ≥ 8.6) since 1870, of which 14 showed up in Grids A & B compared with an expected 3.3. Source of Raw Data: National Geophysical Data Center. Source: McMin, 2011b.</p>					

Appendix 4 108/56 YEAR CYCLE: WESTERN SOUTH AMERICA Post 1700 ≥ M 7.8 Year ending November 30							
Sq 50	Sq 46	Sq 42	Sq 38	Sq 34	Sq 30	Sq 26	Sq 22
							1726
							1782
						1730 0708	1838
						1786	1894
					1734	1842	1950 0516 1949 1217 1949 1217
					1790	1898	2006
				1738 1737 1204	1846 0628	1954	
				1794	1902	2010 0227	
			1742	1850	1958		
			1798	1906 0131 1906 0817 1906 0928	2014 0401		
		1746 1029	1854	1962			
		1802	1910	2018			

	1750	1858	1966 1017				
	1806	1914	2022				
1754	1862	1970 0531					
1810	1918 0520						
1866	1974 1003						
1922 1111							
1978							

The 56 year sequences are separated by an interval of 108 years on the horizontal.
 Mega quakes $M \geq 8.6$ highlighted in **red**. Events with $M \geq 7.8$ and ≤ 8.5 denoted in **blue**.
Source of Raw Data: National Geophysical Data Center.

Appendix 5 54/56 YEAR CYCLE: MAJOR US & WESTERN EUROPEAN FINANCIAL CRISES Post 1810 Year beginning March 1						
Grid A						
Sq 11	Sq 09	Sq 07	Sq 05	Sq 03	Sq 01	Sq 55
						1815
					1817	1871
				1819	1873	1927
			1821	1875	1929	1983
		1823	1877	1931	1985	
	1825	1879	1933	1987		
1827	1881	1935	1989			
1883	1937	1991				
1939	1993					
1995						
Grid B						
Sq 04	Sq 02	Sq 56	Sq 54	Sq 52	Sq 50	Sq 48
						1808
					1810	1864
				1812	1866	1920
			1814	1868	1922	1976
		1816	1870	1924	1978	
	1818	1872	1926	1980		
1820	1874	1928	1982			
1876	1930	1984				
1932	1986					
1988						

The 56 year columns are separated by intervals of 54 years on the horizontal.
 Years in **bold** experienced major financial crises as listed by Kindleberger (Appendix B, 1996).
 Of the 25 major financial crises listed by Kindleberger (1996) for the 1810-1940 era, 14 appeared in
 the two 54/56 year grids (significant $p < .01$).
Source: McMinn, 1993.