# 9/56 Year Cycle: Panics, Earthquakes, Hurricanes and Volcanoes

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David McMinn completed a BSc at the University of Melbourne in 1971 and subsequently worked as a mineral economist in ANZ Banking Group Ltd (a major Australian financial institution). Since leaving this position in 1982, he has conducted private research on cycles, with his main interests centering on Moon Sun cycles and the 9/56 year grid. These involved new innovative concepts in cycle studies. McMinn has published numerous papers and articles in the fields of technical analysis and seismology, as well as three books on market timing.

## 9/56 YEAR CYCLE: PANICS, EARTHQUAKES, HURRICANES AND VOLCANOES

**Abstract**: This paper explores cyclic commonalities evident in the timing of four phenomena – financial panics, earthquakes, volcanic eruptions and Atlantic hurricanes. Surprisingly, a 9/56 year cycle could be established for all four categories. This cycle in turn could be strongly linked to Moon Sun tidal harmonics, which were hypothesized to activate critical events within 9/56 year patterns. Several lunisolar cycles aligned very closely at 9.0 and 56.0 solar years, thus providing theoretical support for a strong lunisolar influence. How this cycle actually functioned remained a mystery, as it falls outside prevailing paradigms in finance and the sciences. Further research breakthroughs have the potential to greatly increase the forecasting accuracy in the fields of finance, seismology, meteorology and volcanology. The 9/56 year cycle may show up in the timing of other critical phenomena, although this remains to be seen.

**Key words**: 9/56 year, cycle, financial panics, earthquakes, hurricanes, volcanoes.

### Introduction

A 56 year panic cycle in US financial activity was first proposed by J M Funk (1932). McMinn (1986, 1993, 1996) expanded upon this concept and presented a 9/56 year cycle in the timing of major US and Western European financial crises since 1760. More recently, a 9/56 year effect was extrapolated to major earthquakes (McMinn, 2011a, 2011b, 2011d), Category 5 Atlantic hurricanes (McMinn, 2011c), Hawaiian volcanoes (McMinn, 2011d) and world mega eruptions (McMinn, 2012). Firm correlates could be produced with the 9/56 year grid, after assessing historic catalogs in each of the respective disciplines. These varied phenomena are believed to share a fundamental cyclic principle that influences the timing of critical events, a finding that was both remarkable and unexpected. The 9/56 year grid may be linked intimately with Moon Sun cycles, as several lunisolar cycles aligned very closely at 9.0 and 56.0 solar years. Thus, Moon Sun tidal harmonics are hypothesised to activate acute events that cluster within the 9/56 year grid.

The 9/56 year cycle consists of a grid repeating the intervals 56 years vertically (called sequences) and 9 years horizontally (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. The year of best fit has been applied in the various tables. Additionally, **Appendix 9** gives the essential background information on the various Moon Sun cycles and the terms used in this paper.

### Financial Crises

Kindleberger (Appendix B, 1996) listed some 30 major financial panics for the USA & Western Europe from 1760 to 1940 (see **Appendix 1**), of which 16 appeared in the 9/56 year grid shown in **Table 1** (significant $p < .001$). For the period 1940-1996, numerous international currency crises were given in Kindleberger's listing, only two of which

appeared within the 9/56 year configuration. Even including these currency speculations, 21 of Kindleberger's 44 crisis years (1760-1996) fell in the 9/56 year pattern, which was still significant ($p < .01$).

The layout in **Table 1** contained most of the major financial disasters in US history – 1792, 1819, 1837, 1857, 1873, 1884, 1893, 1929, 1931, 1933, 1987, 1998 and 2007. Listings of US & Western European crises by other preeminent economists also fell selectively in the 9/56 year cycle (see **Appendix 1**). Such findings offered support for a 9/56 year panic cycle in financial trends. Amazingly, this cycle has persisted for over 250 years despite the radical changes in technology, financial complexity, economic structures and so forth.

**Table 1**
**9/56 YEAR CYCLE: FINANCIAL PANICS 1760-1996**
**Year beginning March 1**

| Sq 52 | Sq 05 | Sq 14 | Sq 23 | Sq 32 | Sq 41 | Sq 50 | Sq 03 | Sq 12 | Sq 21 | Sq 30 | Sq 39 | Sq 48 | Sq 01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | 1761 |
| | | | | | | | **1763** | **1772** | 1781 | 1790 | **1799** | 1808 | 1817 |
| | 1765 | 1774 | 1783 | **1792** | 1801 | **1810** | **1819** | 1828 | **1837** | 1846 | 1855 | 1864 | **1873** |
| 1812 | 1821 | 1830 | 1839 | **1848** | **1857** | **1866** | 1875 | 1884 | **1893** | 1902 | 1911 | **1920** | **1929** |
| 1868 | 1877 | 1886 | 1895 | 1904 | 1913 | 1922 | **1931** | 1940 | 1949 | **1958** | 1967 | 1976 | **1985** |
| 1924 | **1933** | 1942 | 1951 | 1960 | 1969 | 1978 | **1987** | 1996 | 2005 | 2014 | | | |
| **1980** | **1989** | 1998 | 2007 | 2016 | | | | | | | | | |

The 56 year sequences are separated by an interval of 9 years.
Years in **bold** contained major financial panics and crises listed by Kindleberger (Appendix B, 1996).
**Source**: McMinn (1993, 1995).

**Earthquakes**
The 9/56 year grid has been correlated with an extensive range of historic seismic catalogs by country and region (McMinn, 2011a, 2011b, 2011d). A coverage of Californian events and world mega quakes has been presented from this body of work.

**California**. The US Geological Survey listed major quakes (mag ≥ 6.9) occurring in California, Nevada and Baja California for the 1800-2000 period, with post 2000 events being inserted by the author (see **Appendix 2**). This compilation gave 31 events, of which 10 took place in **Table 2** (McMinn 2011a). The table comprised five 56 year sequences or about 9% of the complete 9/56 year grid, but it contained:

* 36% of all major Californian earthquakes (mag ≥ 6.9).
* 58% of all major Californian earthquakes taking place in October to December.

**Table 2**
**9/56 YEAR CYCLE: MAJOR QUAKES IN**
**CALIFORNIA – NEVADA – BAJA CALIFORNIA 1800–2010 (mag ≥ 6.9)**

| Year beginning April 5 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sq 25** | | **Sq 34** | | **Sq 43** | | **Sq 52** | | **Sq 05** |
| | | | | 1803 | + 9 | **1812 Dec08 Dec21** | + 9 | 1821 |
| 1841 | + 9 | 1850 | + 9 | 1859 | + 9 | **1868 Oct21** | + 9 | 1877 |
| 1897 | + 9 | **1906 Apr18** | + 9 | **1915 Oct03 Nov21** | + 9 | 1924 | + 9 | 1933 |
| 1953 | + 9 | 1962 | + 9 | 1971 | + 9 | **1980 Nov08** | + 9 | **1989 Oct18** |
| **2009 Aug03 2010 Apr04** | | | | | | | | |

Years in **bold** contained quakes (mag ≥ 6.9) in the year beginning April 15.
**Source of Raw Data**: US Geological Survey.
**Source**: McMinn (2011a).

Crucially, four 56 year sequences in **Table 2** (Sqs 25, 34, 43 & 52) experienced many record events in south western North America.
Sq 25 - Record Baja California quake (Mexicali. mag 7.2. Apr 4, 2010).
Sq 25 – Equal 4th rank quake for Baja California (mag 6.9. Aug 3, 2010).
Sq 34 - Record northern Californian quake (San Francisco. mag 8.25. April 18, 1906).
Sq 34 - Record New Mexico quakes happened on July 16 and November 15 in 1906 (both mag 5.8).
Sq 43 - Record quake for Nevada (Pleasant Valley. mag 7.3. Oct 3, 1915).
Sq 43 - 2nd rank quake for Baja California (Volcano Lake. mag 7.1. Nov 21, 1915).
Sq 52 - Record quake for Hawaii (mag 7.9. Apr 2, 1868).
Sq 52 - Record US volcanic eruption (ex Alaska) (Mt St Helens, May 18, 1980).
Additional key records fell in another 9/56 year grid presented in **Appendix 3**.

There were notable seasonal trends in the timing of Californian earthquakes within the 9/56 year grid. Sequences 43, 52 & 05 in **Table 2** contained 7 major quakes, all of which happened in the 2.7 months to December 21. This compared with a mere 0.5 that could have been expected by chance. McMinn (2011a) presented other examples of this seasonal effect.

**World Mega Quakes.** Fujita (2011) of the Michigan State University published a catalog of the biggest world earthquakes for 1900–2010. From this was compiled a listing of mega quakes (mag ≥ 8.5) (see **Appendix 4**), with the events of March 11, 2011 (Japan mag 9.0) and April 22, 2012 (Indonesia mag 8.6) being inserted. These quakes aligned

most closely in two grids, each with 54 year intervals on the horizontal and 56 years on the vertical (denoted as 54/56 year cycles) (see **Table 3**).

**Table 3**
**54/56 YEAR CYCLES: WORLD MEGA QUAKES SINCE 1900 (mag ≥ 8.5)**

**Grid A**
**7.5 months ending March 31**

| **Sq 29** | | **Sq 27** | | **Sq 25** | | **Sq 23** | | **Sq 21** |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1949 |
| | | | | | | 1951<br>**1950**<br>**0815** | + 54 | **2005**<br>**0328**<br>**2004**<br>**1226** |
| | | | | 1953<br>**1952**<br>**1104** | + 54 | 2007 | | |
| 1901 | + 54 | 1955 | + 54 | 2009 | | | | |
| **1957**<br>**0309** | + 54 | **2011**<br>**0311** | | | | | | |
| 2013 | | | | | | | | |

**Grid B**
**10.5 months ending August 20**

| **Sq 36** | | **Sq 34** | | **Sq 32** | | **Sq 30** | | **Sq 28** | | **Sq 26** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1900 | + 54 | 1954 |
| | | | | | | 1902 | + 54 | 1956 | + 54 | **2010**<br>**0227** |
| | | | | 1904 | + 54 | 1958 | + 54 | **2012**<br>**0411** | | |
| | | **1906**<br>**0131**<br>**0820** | + 54 | **1960**<br>**0522** | + 54 | 2014 | | | | |
| 1908 | + 54 | 1962 | + 54 | 2016 | | | | | | |
| **1964**<br>**0328**<br>**1963**<br>**1013** | + 54 | 2018 | | | | | | | | |

Events in **bold** were among the top quakes (M ≥ 8.6) recorded since 1900 in the catalog by Kazuya FUJITA.
Dates expressed as YYYYMMDD.
**Source**: McMinn (2011b).

Grids A and B in **Table 3** can be combined to produce a grid repeating 9, 45, 9, 45… years on the horizontal and 56 years on the vertical (denoted as a 9-45/56 year cycle) (see **Table 4**). This accounted for 25% of the complete 9/56 year grid, yet it contained all of the top 6 world mega quakes (mag ≥ 8.8) and 11 of the top 13 mega quakes (mag ≥ 8.6). The latter was in contrast to the 3.3 that could have been expected by chance.

**Table 4**
**9-45/56 YEAR CYCLE: WORLD MEGA QUAKES SINCE 1900 mag ≥ 8.6**
**Year ending May 25**

| **Sq 29** | | **Sq 38** | | **Sq 27** | | **Sq 36** | | **Sq 25** |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 1908 | + 45 | 1953 **1952* Nov04** |
| 1901 | + 9 | 1910 | + 45 | 1955 | + 9 | **1964* Mar28** | + 45 | 2009 |
| **1957 Mar09** | + 9 | 1966 | + 45 | **2011* Mar11** | + 9 | 2020 | | |
| 2013 | | 2022 | | | | | | |
| **Continued…….** | | | | | | | | |
| | **Sq 34** | | **Sq 23** | | **Sq 32** | | **Sq 21** | |
| | | | | | 1904 | + 45 | 1949 | + 9 |
| + 9 | **1906 Jan31** | + 45 | 1951 **1950 Aug15** | + 9 | **1960* May22** | + 45 | **2005 Mar28 2004* Dec26** | + 9 |
| + 9 | 1962 | + 45 | 2007 | + 9 | 2016 | | | |
| + 9 | 2018 | | | | | | | |
| **Continued…….** | | | | | | | | |
| **Sq 30** | | **Sq 39** | | **Sq 28** | | **Sq 27** | | **Sq 28** |
| | | | | 1900 | + 45 | 1945 | + 9 | 1954 |
| 1902 | + 45 | 1947 | + 9 | 1956 | + 45 | 2001 | + 9 | **2010* Feb27** |
| 1958 | + 45 | 2003 | + 9 | **2012 Apr11** | | | | |
| 2014 | | | | | | | | |

Events *asterisked had magnitudes ≥ 8.8 in the 7 months to May 31.
**Source of Raw Data**: Kazuya FUJITA.
**Source**: McMinn (2011b).

**Atlantic Hurricanes**

The timing of Category 5 Atlantic hurricanes was sourced from UNISYS (see **Appendix**

**5**). Tropical storms of such high intensity were not recorded before 1924, a situation that may reflect long term trends in global warming. The intensity and frequency of Atlantic hurricanes has increased markedly over the past century.

The 13 56 year sequences in **Table 5** contained 17 Category 5 hurricanes, compared with a total of 32 (significant $p < .001$).

**Table 5**
**9/56 YEAR CYCLE: CATEGORY 5 ATLANTIC HURRICANES**
**1920-2010**

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1922 | 1931 | 1940 | 1949 | **1958 *** | **1967 *** |
| | 1924 * | 1933 | 1942 | **1951 *** | **1960 **** | **1969 *** | 1978 | 1987 | 1996 | **2005 ****** | 2014 | |
| **1971 *** | **1980 *** | **1989 *** | **1998 *** | **2007 **** | 2016 | | | | | | | |

* Denoted a Category 5 hurricane in a given year.
The 56 year sequences are separated by an interval of 9 years.
**Source of Raw Data:** UNISYS.
**Source:** McMinn (2011c).

**Volcanic Eruptions**

**Hawaii**. The beginning of Kilauea and Mauna Loa eruptions was well documented by the US Geological Survey (see **Appendices 6 & 7** respectively). Combining these two sets of data gave a total of 91 eruptive beginnings, of which 34 appeared in the 9/56 year grid as presented in **Table 6** (significant $p < .01$). It would have been curious to see if the maximum intensity of Hawaiian eruptions could have been linked to the 9/56 year grid. Unfortunately, such raw data was unavailable.

**Table 6**
**9/56 YEAR CYCLE: HAWAIIAN ERUPTIONS 1820–2010**
**Year ending July 31**

| Sq 52 | Sq 05 | Sq 14 | Sq 23 | Sq 32 | Sq 41 | Sq 50 | Sq 03 | Sq 12 | Sq 21 | Sq 30 | Sq 39 | Sq 48 | Sq 01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1828 | 1837 | 1846 | 1855 | **1864 #** | **1873 #** |
| | 1821 | 1830 | 1839 | 1848 | 1857 | 1866 # | 1875 | **1884 *** | **1893 #** | 1902 | 1911 | **1920 *#** | **1929 **** |
| **1868 **# ** | **1877 **# ** | 1886 | 1895 | **1904 ## ** | 1913 | **1922 *** | **1931 *** | **1940 # ** | **1949 # ** | 1958 | 1967 | **1976 *** | 1985 |
| **1924 *** ** | 1933 | **1942 # ** | 1951 | **1960 **** | **1969 ***** | **1978 *** | 1987 | 1996 | 2005 | | | | |
| **1980 *** | 1989 | 1998 | 2007 | | | | | | | | | | |

* Denoted the beginning of a Kilauea eruption.
# Denoted the beginning of a Mauna Lao eruption.
The 56 year sequences are separated by an interval of 9 years.
Years in **bold** contained the start of Hawaiian eruptions in the year ending July 31.
**Source of Raw Data**: US Geological Survey.

Much higher significance could be achieved if the 9/56 year grid was converted to one with repeating intervals 9 - 27 - 9 - 27 years ….. on the horizontal and 56 years on the vertical (denoted as a 9-27/56 year cycle). Kilauea and Mauna Loa experienced 27 eruptive beginnings within **Table 7** (significant $p < 10^{-5}$).

**Table 7**
**9-27/56 YEAR CYCLE:**
**BEGINNING OF HAWAIIAN ERUPTIONS 1820–2010**
**Year ending July 31**

| **Sq 52** | | **Sq 05** | | **Sq 32** | | **Sq 41** | |
|---|---|---|---|---|---|---|---|
| | | | | 1848 | + 9 | 1857 | + 27 |
| **1868** ****#** | + 9 | **1877** ****#** | + 27 | **1904** **##** | + 9 | 1913 | + 27 |
| **1924** ******** | + 9 | 1933 | + 27 | **1960** ****** | + 9 | **1969** ******** | + 27 |
| **1980** ***** | | 1989 | | | | | |
| **Continued…….** | | | | | | | |
| **Sq 12** | | **Sq 21** | | **Sq 48** | | **Sq 01** | |
| 1828 | + 9 | 1837 | + 27 | **1864** **#** | + 9 | **1873** **#** | |
| **1884** ***** | + 9 | **1893** **#** | + 27 | **1920** ***#** | + 9 | **1929** ****** | |
| **1940** **#** | **+ 9** | **1949** **#** | + 27 | **1976** ***#** | + 9 | 1985 | |
| 1996 | **+ 9** | 2005 | | | | | |

* Denoted the beginning of an eruption at Kilauea.
# Denotes the beginning of an eruption at Mauna Lao.
Years presented in **bold** contained eruptions in the year ending July 31.
**Source of Raw Data**: US Geological Survey.

**World Mega Eruptions**. A 9/56 year cycle could not be established for the timing of major world eruptions (VEI ≥ 5) since 1600, based on the listing by the Smithsonian Institute (see **Appendix 8**). However, a 9-27/56 year grid was found to be significant. Of the 34 mega eruptions listed by the Smithsonian Institute since 1600, 18 appeared in **Table 8** (significant $p < .001$). Five of the 6 events with VEI ≥ 6 fell in this pattern, the

anomaly being the 1991 Mt Pinatubo eruption. NB: Volcanic Explosivity Index (VEI) gives the intensity of a particular eruption.

**Table 8**
**9-27/56 YEAR CYCLE AND WORLD MEGA ERUPTIONS SINCE 1600 VEI ≥ 5**
**Based on a listing by the Smithsonian Institute**
**Year ending October 20**

| **Sq 48** | | **Sq 19** | | **Sq 28** | | **Sq 55** | | **Sq 08** | | **Sq 35** | | **Sq 44** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **1600 0219** | +27 | 1627 | +9 | 1636 | +27 |
| | | 1611 | +9 | 1620 | +27 | 1647 | +9 | 1656 | +27 | 1683 | +9 | 1692 | +27 |
| **1640 0731** | +27 | **1667 0923** | +9 | 1676 | +27 | 1703 | +9 | 1712 | +27 | **1739 0819** | +9 | 1748 | +27 |
| 1696 | +27 | 1725 | +9 | 1732 | +27 | 1759 | +9 | 1768 | +27 | 1795 | +9 | 1804 | +27 |
| 1752 | +27 | 1779 | +9 | 1788 | +27 | **1815 0517** | +9 | 1824 | +27 | 1851 | +9 | 1860 | +27 |
| 1808 | +27 | **1835 0120** | +9 | 1844 | +27 | 1871 | +9 | 1880 | +27 | **1907 0328** | +9 | 1916 | +27 |
| 1864 | +27 | 1891 | +9 | 1900 | +27 | 1927 | +9 | 1936 | +27 | **1963 0317** | +9 | 1972 | +27 |
| 1920 | +27 | 1947 | +9 | **1956 0330** | +27 | 1983 | +9 | 1992 | +27 | 2019 | +9 | 2028 | |
| 1976 | +27 | 2003 | +9 | 2012 | | | | | | | | | |

**Continued……**

| **Sq 15** | | **Sq 24** | | **Sq 51** | | **Sq 04** | | **Sq 31** | | **Sq 40** | | **Sq 11** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | 1603 | |
| | | | | | | | | 1623 | +9 | 1632 **1631 1216** | +27 | 1659 | |
| 1607 | +9 | 1616 | +27 | 1643 | +9 | 1652 | +27 | 1679 | +9 | 1688 | +27 | 1715 | |
| **1663 0813** | +9 | 1672 | +27 | 1699 | +9 | 1708 **1707 1216** | +27 | 1735 | +9 | 1744 | +27 | 1771 | |
| 1719 | +9 | 1728 | +27 | **1755 1017** | +9 | 1764 | +27 | 1791 | +9 | **1800 0115** | +27 | 1827 | |
| 1775 | +9 | 1784 | +27 | 1811 | +9 | 1820 | +27 | 1847 | +9 | 1856 | +27 | **1883 0827** | |
| 1831 | +9 | 1840 | +27 | 1867 | +9 | 1876 | +27 | 1903 **1902 1024** | +9 | **1912 0606** | +27 | 1939 | |
| 1887 | +9 | 1896 | +27 | 1923 | +9 | **1932 0510** | +27 | 1959 | +9 | 1968 | +27 | 1995 | |
| 1943 | +9 | 1952 | +27 | 1979 | +9 | 1988 | +27 | 2015 | | | | | |
| 1999 | +9 | 2008 | +27 | 2035 | | | | | | | | | |

VEI ≥ 5 eruptions presented in **Bold**.
Dates denoted as YYYYMDD.
Abbreviation: VEI - Volcanic Explosivity Index.
**Source of Raw Data**: Smithsonian Institute. Global Volcanism Program.
**Source**: McMinn (2012).

**Discussion**

The obvious question emerges as to what causes the 9/56 year effect, especially as it shows up in such varied phenomena. Excellent Moon Sun correlates can be produced with any events that cluster within the 9/56 year grid. The lunar ascending node will be sited in two segments approximately 180 degrees opposite on the ecliptic circle, WITH NO EXCEPTIONS (1st and 2nd harmonics). All events in a particular 56 year sequence have the lunar ascending node sited in a narrow sector of the ecliptic circle WITH NO EXCEPTIONS (1st harmonic). For events occurring at a similar time of year and within the 9/56 year grid, the apogee point will be found in three ecliptic segments 120 degrees apart WITH NO EXCEPTIONS (3rd harmonic). Any events happening around the same time of year and in the same 9 year subcycle will have apogee in the same sector of the ecliptic WITH NO EXCEPTIONS (1st harmonic). These properties of the 9/56 year grid arise from the very close alignments of several lunisolar cycles at 9.0 and 56.0 solar years (see **Appendix 9**). Presumably lunisolar tidal harmonics triggered critical events, as the Moon, Sun, ascending node and apogee were prime factors in terrestrial tides. The 9/56 year cycle illustrated the interconnectivity of various critical phenomena – financial panics, earthquakes, hurricanes and eruptions. By implication, the Moon and Sun may be far more influential in the timing of such events than was previously thought possible.

How lunisolar cycles activated critical events remained a mystery. In finance, the Moon and Sun may be viewed as influencing mass physiological cycles of the general population, which determine the prevailing collective mood and thus financial outcomes. Hormone levels of animals and humans have been shown to fluctuate over the lunar month (Endres Schaad, 2002; Zimecki, 2006). Cajochen et al (2013) established that humans achieve 30% less deep sleep during the full Moon, which presumably would affect human behavior. Various studies have also linked hormone levels to market trading success (Chen et al, 2005; Coates & Hebert, 2008; Coates et al, 2009). Anyone who is able to crack the Moon Sun code in finance will be able to make accurate market forecasts years in advance. Such information will probably never be published given the potential profits to be made.

In seismology and volcanology, the Moon Sun tides were postulated to trigger the build-up of stress in the Earth's crust. Numerous papers have been published correlating lunisolar cycles with the timing of earthquakes and eruptions (Kokus, 2011). It is not a question of if there is a Moon Sun effect in the timing of such events, but how pervasive is this influence. Alas, the lunisolar mathematics involved with the timing of critical events remained indecipherable. The forecasting of major seismic events remains limited, until the problem can be solved.

This paper illustrates the necessity of studying cycles generally. A 9/56 year grid was first established in finance, then extrapolated to seismic events, hurricanes and eruptions. Without the input from market studies, it would be doubtful if a 9/56 year cycle would have ever been detected in patterns of earthquakes, extreme tropical storms or volcanic eruptions. Such calamitous events can be interconnected and have a massive impact in terms of loss of life and financial outcomes. Financial strains caused by the 1906 Great San Francisco quake directly contributed to the ensuing 1907 October banking panic (Odell & Weidenmar, 2011). Similarly, the 1923 great Tokyo earthquake completely devastated the city, causing over 100,000 deaths and huge economic losses. Severe financial distress was again experienced in Japan following the March 2011 mega quake. Tokyo is long overdue for another great quake and when it does occur panic will sweep through the world financial system. Additionally, exceptional hurricane activity in 2005 left New Orleans in ruins, while many oil production platforms were wrecked in the Gulf of Mexico causing severe disruption to US energy supplies. Any technique that can accurately predict the timing of critical events would lessen their impact in terms of both economic destruction and lives lost.

A 9/56 year cycle has been established for finance, earthquakes and Atlantic hurricanes and all three phenomena have been linked to sunspot cycles. (The author knows of no studies supporting a connection between sunspots and volcanic eruptions.)

Krivelyova & Robotti (2003) found that high geomagnetic storm activity induced stock market declines the following week. The outcome was statistically and economically significant. The size of the geomagnetic storm effect was similar within and across countries, ranging between -0.77% and -4.4% of average annual returns. According to the authors, substantially higher stock market returns were recorded during periods of quiet geomagnetic activity.

Choi & Maslov (2010) established that earthquake frequency for the 1973-2010 period was *"closely related to the solar* [sunspot] *cycle: the number of earthquakes increases during the declining/trough periods."* The authors also listed numerous additional references on links between sunspot and earthquake cycles.

Hodges & Elsner (2010) showed that the likelihood of three or more hurricanes hitting the US coast rises from 20% to 40% in years when sunspot activity is in the lowest 25%, compared with years in the highest 25%. During peak sunspot years, there is only a 25% chance of one or more hurricanes hitting the USA, a figure that spikes to 64% in the lowest sunspot years.

How the 9/56 year lunisolar tidal effect and the sunspot cycle interact remained unknown.

**Conclusions**

The findings from the various assessments supported a 9/56 year cycle in the timing of:

* major financial panics in US & Western European history post 1760.
* major earthquakes in south western North America since 1800.

* Category 5 Atlantic hurricanes.
* the beginning of Hawaiian volcanic eruptions post 1820.

A 9-45/56 year cycle was also determined for world mega quakes since 1900, while a 9-27/56 year cycle yielded high significance for the timing of world mega eruptions since 1600. Hawaiian tsunamis originating from Chile and Alaska may also occur preferentially in 9/56 year grids (McMinn 2011d). The author has not examined a 9/56 year tsunami effect in much detail and it remained to be explored more fully. Unfortunately, suitable raw data on major US tornadoes has only been available since 1950, which prevented an meaningful assessment of the 9/56 year effect.

The 9/56 year grids in **Table 1** (financial panics), **Table 5** (Category 5 Atlantic hurricanes) and **Table 6** (beginning of Hawaiian eruptions) were very similar, but they each produced a different series of extreme events. The layout in **Table 1** contained US financial disasters in 1792, 1819, 1837, 1857, 1873, 1884, 1893, 1920, 1929, 1931, 1933, 1980, 1987, 1998 and 2007. The timing of Category 5 Atlantic hurricanes in **Table 5** gave 1924, 1951, 1958, 1960, 1967, 1969, 1971, 1980, 1989, 1998, 2005 and 2007. The beginning of Hawaiian eruptions in **Table 6** happened in 1864, 1866, 1868, 1873, 1877, 1884, 1893, 1904, 1920, 1922, 1924, 1929, 1931, 1940, 1942, 1949, 1960, 1969, 1976, 1978 and 1980. The three series appeared to be random with no mathematical interrelationships. However, they may be linked by very similar 9/56 year grids.

The 9/56 year tidal effect is hypothesized to arise from the varying angles between the Moon, Sun, lunar ascending node, apogee and the spring equinox point. Diurnal cycles could also be relevant, but they have not been considered in this paper. Lunisolar tidal harmonics are the best options for further study. All too often researchers undertake studies testing one Moon Sun factor (in academic finance this has always been lunar phase). If no correlates were realized, then the Moon and Sun were considered to have no impact. Unfortunately, the real situation is far more complicated.

If the Moon Sun mathematics can ever be deciphered, accurate predictions could be given of windows when critical events were most likely to occur in the various disciplines - finance, seismology, climatology and volcanology. However, current understanding of the 9/56 year effect remained extremely limited. Hopefully this paper will assist in the design of much needed follow up research.

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**Appendix 1**
**THE 9/56 YEAR CYCLE AND LISTINGS OF FINANCIAL CRISES**
**Year beginning March 1**

| Source | Era | Total | Appearing in Table 1 | Probability |
|---|---|---|---|---|
| Kindleberger (1996) | 1760-1940 | 30 | 16 | p < .001 |
| | 1760-1996 | 44 | 21 | p < .01 |
| Kitchin (1933) | 1796-1933 | 38 | 16 | p < .05 |
| Adams (1936) | 1763-1933 | 31 | 15 | p < .01 |
| Encyclopedia Americana (1995) | 1672-1949 | 31 | 16 | p < .001 |

Years *asterisked below appeared in the 9/56 year grid presented in **Table 1**.
**Sources. Kindleberger (Appendix B 1996).** 1760-1996. 1763*, 1772*, 1793 (Jan)*, 1797, 1799*, 1811 (Jan)*, 1815-1816, 1819*, 1825, 1828, 1836-1837*, 1838, 1847-1848*, 1857*, 1864 (Jan), 1866*, 1873*, 1882 (Jan), 1890, 1893*, 1907, 1920*-1921, 1929*, 1931*-1932-1933*, 1958*, 1962, 1963, 1964, 1968, 1973, 1974-1975, 1979, 1980*, 1982, 1985*, 1987*, 1990 (Jan)* .
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**Encyclopedia Americana (1995)**. Vol 21 p 358. US & Wn European crises 1672-1932: 1672 (Jan)*, 1692 (error - 1696* correct?), 1720, 1763*, 1793* (Jan 1793), 1825, 1836-1837*, 1847, 1857*, 1866*, 1869, 1873*, 1882 (Jan), 1884*, 1889-1890, 1900, 1904*, 1907, 1914, 1920*, 1929*-1930-1931*-1932.
Vol 5, p 46-47. US crises 1837-1949: 1837*, 1873*, 1882, 1883, 1884*, 1893*, 1920*, 1929*-1930-1931*-1932-1933*, 1937, 1946, 1949*.
**Kitchin (1933)**. Major US/Wn European crises 1796-1933: 1796, 1801*, 1810*, 1818, 1825,

1836, 1847, 1857*, 1866*, 1873*, 1881 (Jan 1882), 1890, 1900, 1907, 1913*, 1920*, 1929*-1930-1931*-1932-1933*.
Minor US/Wn European crises 1799-1914**:** 1799*, 1805, 1814, 1831, 1839*, 1845, 1854, 1860-1861, 1863-1864*, 1870, 1875*, 1878, 1884*, 1893*, 1914.

**Appendix 2**
**MAJOR EARTHQUAKES IN CALIFORNIA - NEVADA - BAJA CALIFORNIA 1800–2010 (mag ≥ 6.9)**

| Year | Mth | Dy | Mag | Location |
|---|---|---|---|---|
| **1812** | **12** | **08** | **7.0** | **Wrightwood** |
| **1812** | **12** | **21** | **7.0** | **Santa Barbara Channel** |
| 1838 | 06 | ?? | 7.0 | San Francisco Peninsula |
| 1857 | 01 | 09 | 8.25 | Great Tejon earthquake |
| **1868** | **10** | **21** | **7.0** | **Hayward Fault** |
| 1872 | 03 | 26 | 7.6 | Owens Valley |
| 1892 | 02 | 24 | 7.0 | Laguna Salada, BC |
| 1899 | 04 | 16 | 7.0 | West of Eureka |
| **1906** | **04** | **18** | **8.25** | **Great San Francisco quake** |
| **1915** | **10** | **03** | **7.3** | **Pleasant Valley, Nevada** |
| **1915** | **11** | **21** | **7.1** | **Volcano Lake, BC** |
| 1918 | 04 | 21 | 6.9 | San Jacinto |
| 1922 | 01 | 31 | 7.3 | West of Eureka |
| 1923 | 01 | 22 | 7.2 | Cape Mendocino |
| 1927 | 11 | 04 | 7.3 | South West of Lompoc |
| 1932 | 12 | 21 | 7.2 | Cedar Mountain, Nevada |
| 1934 | 12 | 31 | 7.0 | Colorado River |
| 1940 | 05 | 19 | 7.1 | Imperial Valley |
| 1952 | 07 | 26 | 7.7 | Kern County |
| 1954 | 12 | 16 | 7.1 | Fairview Peak, Nevada |
| **1980** | **11** | **08** | **7.2** | **West of Eureka** |
| **1989** | **10** | **18** | **7.1** | **Loma Prieta** |
| 1991 | 08 | 17 | 7.1 | West of Crescent City |
| 1992 | 04 | 25 | 7.2 | Cape Mendocino |
| 1992 | 06 | 28 | 7.3 | Landers |
| 1994 | 09 | 01 | 6.9 | Mendocino Fracture Zone |
| 1999 | 10 | 16 | 7.2 | Hector Mine |
| 2005 | 06 | 15 | 7.2 | Offshore Northern California |
| **2009** | **08** | **03** | **6.9** | **Baja California** |
| **2010** | **04** | **04** | **7.2** | **Mexicali, Baja California** |
| 2010 | 10 | 22 | 6.9 | Baja California |

Earthquakes in **bold** occurred in **Table 2**.
**Main Source:** US Geological Survey. Californian Earthquake History: 1769 to *Present.* http://earthquake.usgs.gov/regional/sca/ca_eqs.php

**Appendix 3**

**RECORD QUAKES IN SOUTH WESTERN NORTH AMERICA**

**Table 2** in the main text contained numerous records for south western North America. Many additional events occurred in the 9/56 year grid as presented in **Table A**. These two grids comprise 29% of the complete 9/56 year grid, but they contained all the record quakes for California, Nevada, Arizona, New Mexico, Baja California, Sonora and Hawaii.
Sq 16 – Record quake for the Mexican state of Sonora (south of Arizona) (mag 7.5. May 3, 1887).
Sq 25 – 2nd rank quake for southern California (Kern County. mag 7.7. Jul 26, 1952).
Sq 34 – Equal 1st rank for Arizona (Flagstaff. mag 6.2. Jan 25, 1906).
Sq 05 – 2nd rank quake for Nevada (Cedar Mountain. mag 7.2. Dec 21, 1932).
Sq 41 – Record quake for southern California (Fort Tejon. mag 8.25. Jan 9, 1857).
Sq 41 – Equal 1st rank quake for Arizona (Lockett Tanks. mag 6.2. Aug 18, 1912).
Sq 50 – Equal 2nd rank quake for northern California (west of Eureka. mag 7.3. Jan 31, 1922).
Sq 50 – 4th rank quake for Arizona (Freedonia. mag 5.5. Jul 21. 1959).
Sq 52 – Record quake for western USA (Great Cascadia quake. mag 9.0. Jan 26, 1700).

**Table A Appendix 3**
**9/56 YEAR CYCLE: RECORD QUAKES IN SOUTH WESTERN NORTH AMERICA 1850–2010**
**9 months ending January 31**

| Sq 16 | Sq 25 | Sq 34 | Sq 43 | Sq 52 | Sq 05 | Sq 14 | Sq 23 | Sq 32 | Sq 41 | Sq 50 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | **1857 Jan09** | 1866 |
| | | 1850 | 1859 | 1868 | 1877 | 1886 | 1895 | 1904 | 1913 **1912 Aug18** | **1922 Jan31** |
| 1888 **1887 May03** | 1897 | **1906 Jan25** | 1915 | 1924 | 1933 **1932 Dec21** | 1942 | 1951 | 1960 **1959 Jul21** | 1969 | 1978 |
| 1944 | 1953 **1952 Jul26** | 1962 | 1971 | 1980 | 1989 | 1998 | 2007 | | | |
| 2000 | 2009 | | | | | | | | | |

Record quakes mentioned in this appendix have been highlighted in **bold**.

**Appendix 4**
**MAGNITUDES OF THE LARGEST SEISMIC EVENTS: 1900 – 2012**
**Kazuya Fujita (revised March 1, 2010)**

| Rank | Date | Location | Mw |
|---|---|---|---|
| **1a** | **1960.05.22** | **Chile Mainshock (a)** | **9.6** |
| **1b** | **1960.05.22** | **Chile "Precursor" (a)** | **9.5** |
| **1c** | **1960.05.22** | **Chile "Afterslip"(a)** | **9.0** |
| **2** | **1964.03.28** | **Prince William Sound, Alaska** | **9.2** |

| | | | |
|---|---|---|---|
| **3** | **2004.12.26** | **Offshore Northern Sumatra** | **9.0** |
| **4** | **1952.11.04** | **Kamchatka (Russia)** | **9.0** |
| | **2011.03.11** | **Offshore Honshu Japan** | **9.0** |
| | **2010.02.27** | **Bio Bio, Chile** | **8.8** |
| 5 | 1965.02.04 | Aleutian Islands, Alaska | 8.7 |
| **6** | **1950.08.15** | **Assam, India** | **8.7** |
| 7 | 1933.03.02 | Sanriku, Japan | 8.6 |
| **8** | **1957.03.09** | **Aleutian Islands Alaska** | **8.6** |
| **9** | **1906.01.31** | **Ecuador-Colombia** | **8.6** |
| | **2005.03.28** | **Offshore Northern Sumatra** | **8.6** |
| | **2012.04.11** | **Offshore Indonesia** | **8.6** |
| **10** | **1963.10.13** | **Etorofu, Kurile Islands** | **8.5** |
| 11 | 1938.02.01 | Banda Sea, Indonesia | 8.5 |
| 12 | 1906.08.17 | Valparaiso, Chile | 8.5 |
| 13 | 1923.02.03 | Kamchatka | 8.5 |
| | 2007.09.12 | Offshore southern Sumatra | 8.5 |

(a) There were three mega earthquakes on May 22, 1960 (mag ≥ 9.0), but they have been treated as one event.
Episodes (mag ≥ 8.5) post 2004 were sourced from the US Geological Survey and inserted by the author.
Years in **bold** contained major quakes that took place within the 9/56 year grid as presented in **Table 4**.
**Sources: Fujita, K.,** Magnitudes of the Largest Events of the 20th Century.
www.msu.edu/~fujita/earthquake/bigquake.html
**US Geological Survey**., Historic World Earthquakes.
http://earthquake.usgs.gov/earthquakes/world/historical.php

**Appendix 5**
**CATEGORY 5 ATLANTIC HURRICANES 1851–2009**

| Year | Active | Rank (a) | Cat | Year | Active | Rank (a) | Cat |
|---|---|---|---|---|---|---|---|
| **1924** | **Oct 14 – Oct 23** | **10** | **5** | **1971** | **Sep 05 – Sep 18** | **6** | **5** |
| 1928 | Sep 06 – Sep 20 | 4 | 5 | 1977 | Aug 29 – Sep 03 | 1 | 5 |
| 1932 | Aug 30 – Sep 13 | 4 | 5 | 1979 | Aug 25 – Sep 08 | 4 | 5 |
| 1935 | Aug 29 – Sep 10 | 2 | 5 | **1980** | **Jul 31 – Aug 11** | **1** | **5** |
| 1938 | Sep 10 – Sep 22 | 4 | 5 | 1988 | Sep 08 – Sep 20 | 8 | 5 |
| 1947 | Sep 04 – Sep 21 | 4 | 5 | **1989** | **Sep 10 – Sep 25** | **8** | **5** |
| 1950 | Aug 30 – Sep 17 | 4 | 5 | 1992 | Aug 16 – Aug 28 | 2 | 5 |
| **1951** | **Sep 02 – Sep 13** | **5** | **5** | **1998** | **Oct 22 – Nov 09** | **13** | **5** |
| 1955 | Sep 21 – Sep 30 | 10 | 5 | 2003 | Sep 06 - Sep 20 | 9 | 5 |
| **1958** | **Aug 11 – Aug 22** | **3** | **5** | 2004 | Sep 02 – Sep 24 | 9 | 5 |
| **1960** | **Aug 29 - Sep 14**<br>**Sep 14 – Sep 17** | **5**<br>**6** | **5**<br>**5** | **2005** | **Jul 11 – Jul 21**<br>**Aug 23 – Aug 31**<br>**Sep 18 – Sep 26** | **5**<br>**11**<br>**17** | **5**<br>**5**<br>**5** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | **Oct 15 – Oct 26** | **22** | **5** |
| 1961 | Sep 03 – Sep 16<br>Oct 27 – Nov 01 | 3<br>9 | 5<br>5 | **2007** | **Aug 13 – Aug 23**<br>**Aug 31 – Sep 06** | **4**<br>**6** | **5**<br>**5** |
| **1967** | **Sep 05 – Sep 22** | **2** | **5** | | | | |
| **1969** | **Aug 14 – Aug 22** | **3** | **5** | | | | |

(a) In a given year, the first hurricane of the season is numbered 1, the second 2, the third 3 and so forth.
Category 5 hurricanes in **bold** appear in **Table 5.**
**Source of Raw Data:** UNISYS. Atlantic Tropical Storm Tracking By Year.
http://weather.unisys.com/hurricane/atlantic/index.html

**Appendix 6**
**BEGINNING OF KILAUEA ERUPTIONS SINCE 1820**

| **Year** | **Start** | **Vol (km3)** | **Year** | **Start** | **Vol (km3)** |
|---|---|---|---|---|---|
| 1983 | Jan 03 | 1.9 | 1955 | Feb 28 | 0.0876 |
| 1982 | Sep 25 | 0.003 | 1954 | May 31 | 0.0062 |
| 1982 | Apr 30 | 0.0005 | 1952 | Jun 27 | 0.0467 |
| **1979** | **Nov 16** | **0.00058** | 1934 | Sep 06 | 0.0069 |
| **1977** | **Sep 13** | **0.0329** | 1931 | Dec 23 | 0.007 |
| **1975** | **Nov 29** | **0.00022** | **1930** | **Nov 19** | **0.0062** |
| 1974 | Dec 31 | 0.0143 | **1929** | **Jul 25** | **0.0026** |
| 1974 | Sep 19 | 0.0102 | **1929** | **Feb 20** | **0.0014** |
| 1974 | Jul 19 | 0.0066 | 1927 | Jul 07 | 0.0023 |
| 1973 | Nov 10 | 0.0027 | **1924** | **Jul 19** | **0.000234** |
| 1973 | May 05 | 0.0012 | **1924** | **May 10** | **No lava** |
| 1972 | Feb 03 | 0.162 | **1923** | **Aug 25 ?** | **0.000073** |
| 1971 | Sep 24 | 0.0077 | **1922** | **May 28** | **?** |
| 1971 | Aug 14 | 0.0091 | 1921 | Mar 18 | 0.0064 |
| **1969** | **May 24** | **0.185** | **1919** | **Dec 21** | **0.0453** |
| **1969** | **Feb 22** | **0.0161** | 1919 | Feb 07 | 0.0252 ? |
| **1968** | **Oct 07** | **0.0066** | 1918 | Feb 23 | 0.000183 |
| **1968** | **Aug 22** | **0.00013** | 1894 | Jul 07 | ? |
| 1967 | Nov 05 | 0.0803 | 1894 | Mar 21 | ? |
| 1965 | Dec 24 | 0.00085 | 1885 | Mar | ? |
| 1965 | Mar 05 | 0.0168 | **1884** | **Jan 22** | **?** |
| 1963 | Oct 05 | 0.0066 | **1877** | **May 21 ?** | **?** |
| 1963 | Aug 21 | 0.0008 | **1877** | **May 04** | **?** |
| 1962 | Dec 07 | 0.00031 | **1868** | **Apr 02 ?** | **0.000183** |
| 1961 | Sep 22 | 0.0022 | **1868** | **Apr 02** | **?** |
| 1961 | Jul 10 | 0.0126 | 1840 | May 30 | 0.205 |
| 1961 | Mar 03 | 0.00026 | 1832 | Jan 14 | ? |
| 1961 | Feb 24 | 0.000022 | 1823 | Feb Jul | 0.0110 |
| **1960** | **Jan 13** | **0.1132** | | | |
| **1959** | **Nov 14** | **0.0372** | | | |

Eruptions in **bold** appeared in 9/56 year cycle in **Table 6**.
**Source**: US Geological Survey. *Summary of Historical Eruptions, 1750 – Present.*
http://hvo.wr.usgs.gov/kilauea/history/historytable.html

**Appendix 7**
**BEGINNINGS OF MAUNA LOA ERUPTIONS SINCE 1840**

| Year | Start | Vol ($km^3$) | Year | Start | Vol ($km^3$) |
|---|---|---|---|---|---|
| 1984 | Mar 26 | 0.220 | **1892** | **Nov 30** | **0.012** |
| 1975 | Jul 5 | 0.030 | 1887 | Jan 16 | 0.128 |
| 1950 | Jun 1 | 0.376 | 1880 | Nov 5 | 0.130 |
| **1949** | **Jan 6** | **0.116** | 1880 | May 1 | 0.130 |
| **1942** | **Apr 26** | **0.176** | 1879 | Mar 9 | 0.001 |
| **1940** | **Apr 17** | **0.110** | **1877** | **Feb 14** | **0.008** |
| 1935 | Nov 21 | 0.087 | **1872** | **Aug 9** | **0.630** |
| 1933 | Dec 2 | 0.100 | 1871 | Aug 10 | 0.020 |
| 1926 | Apr 10 | 0.121 | **1868** | **Mar 27** | **0.123** |
| **1919** | **Sep 26** | **0.183** | **1865** | **Dec 30** | **0.050** |
| 1916 | May 19 | 0.031 | 1859 | Jan 23 | 0.383 |
| 1914 | Nov 25 | 0.055 | 1855 | Aug 8 | 0.280 |
| 1907 | Jan 9 | 0.121 | 1852 | Feb 17 | 0.182 |
| **1903** | **Oct 6** | **0.070** | 1851 | Aug 8 | 0.035 |
| **1903** | **Sep 1** | **0.003** | 1849 | May ? | 0.025 |
| 1899 | Jul 1 | 0.081 | 1843 | Jan 10 | 0.202 |
| 1896 | Apr 21 | 0.025 | | | |

Eruptions in **bold** commenced in the 9/56 year grid as given in **Table 6**.
**Source**: US Geological Survey. *Summary of Historical Eruptions, 1843 – Present.*
http://hvo.wr.usgs.gov/maunaloa/history/historytable.html

**Appendix 8**
**WORLD VOLCANIC MEGA ERUPTIONS SINCE 1600 VEI ≥ 5**
**Listing by the Smithsonian Institute**

| VEI | DATE | VOLCANO | COUNTRY |
|---|---|---|---|
| **6** | **1600 Feb 19** | **Huaynaputina** | **Peru** |
| 5 | 1625 Sep 02 | Katla | Iceland |
| 5? | 1630 Sep 03 | Furnas | Azores |
| **5** | **1631 Dec 16** | **Vesuvius** | **Italy** |
| **5** | **1640 Aug 31** | **Komaga-Take** | **Japan** |
| 5? | 1641 Jan 04 | Parker | Philippines |
| 5 | 1650 ± 10 yrs* | Shiveluch | Kamchatka Russia |
| 6 | 1660 ± 20 yrs* | Long Island | Papua New Guinea |
| **5** | **1663 Aug 16** | **Usu** | **Japan** |
| **5** | **1667 Sep 23** | **Shikotsu** | **Japan** |
| 5? | 1673 May 20 | Gamkokora | Indonesia |

| | | | |
|---|---|---|---|
| 5? | 1680 ?? ?? | Tongkko | Indonesia |
| **5** | **1707 Dec 16** | **Fuji** | **Japan** |
| 5? | 1721 May 11 | Katla | Iceland |
| **5** | **1739 Aug 19** | **Shikotsu** | **Japan** |
| **5?** | **1755 Oct 17** | **Katla** | **Iceland** |
| **5** | **1800 Jan 15 ± 120 days** | **Mt St Helens** | **Washington USA** |
| **7** | **1815 May 10** | **Tombora** | **Indonesia** |
| 5 | 1822 Oct 08 | Galunggung | Indonesia |
| **5** | **1835 Jan 20** | **Cosiguina** | **Nicaragua** |
| 5 | 1854 Feb 18 | Shiveluch | Kamchatka |
| 5 | 1875 Mar 25 | Askja | Iceland |
| **6** | **1883 Aug 27** | **Krakatau** | **Indonesia** |
| 5 | 1886 Jan 11 | Okataina | New Zealand |
| **6** | **1902 Oct 24** | **Santa Maria** | **Guatemala** |
| **5** | **1907 Mar 28** | **Ksudach** | **Kamchatka Russia** |
| **6** | **1912 Jun 06** | **Novarupta** | **Alaska USA** |
| 5 | 1913 Jan 20 | Colima | Mexico |
| **5** | **1932 Apr 10** | **Azul Cerro** | **Chile** |
| 5 | 1933 Jan 08 | Kharimkotan | Kuriles Russia |
| **5** | **1956 Mar 30** | **Bezymianny** | **Kamchatka Russia** |
| **5** | **1963 Mar 17** | **Agung** | **Lesser Sunda Is** |
| 5 | 1980 May 18 | Mt St Helens | Washington USA |
| 6 | 1991 Jun 15 | Mt Pinatubo | Philippines |
| 5 | 1991 Aug 12 | Cerro Hudson | Chile |

* Imprecise date could not be used in the calculations.
Events in **bold** fell within the 9-27/56 year cycle as shown in **Table 8**.
**Abbreviation**: VEI - Volcanic Explosivity Index
**Source:** Smithsonian Institute. Global Volcanism Program. Large Holocene Eruptions.

**Appendix 9**

**MOON SUN BACKGROUND INFORMATION**

**Apogee**
Apogee is the point in the lunar orbit, where the Moon is the greatest distance from Earth, while perigee is the least distance. In the lunar apse cycle, the apogee – perigee axis (apsides) rotates counter clockwise around the ecliptic circle, with apogee completing one cycle from spring equinox to spring equinox every 8.8474 tropical years. The apsides is very important in oceanic tides on Earth. When the full/new Moon is at apogee, the amplitude of tides in New York Harbor is 50% lower than when the full/new Moon is at perigee. Apogee could be expected to play a key role in any Moon Sun tidal effect.

9.0 divided by the 8.8474 year apse cycle yielded 1.02, while 56.0 divided by the apse cycle gave 6.33 (6 plus one third). Thus, every 9.0 years apogee will be sited about 6 degrees further anticlockwise on the ecliptic circle. Every 56.0 years, apogee will be located 120 degrees further

anticlockwise on the ecliptic circle. For events occurring around the same time of year in the 9/56 year grid, apogee is always located in three segments approximately 120 degrees apart on the ecliptic circle. For example, **Table A** gives the apogee position as on July 1 of those years in a 9/56 year grid. Apogee was always located in three segments 120 degrees apart 335 – 015 $E^o$; 095 – 135 $E^o$ and 215 – 250 $E^o$ ($3^{rd}$ harmonic).

| **Table A Appendix 9<br>9/56 YEAR CYCLE & THE POSITION OF APOGEE<br>Ecliptic Degree of Apogee on July 1** | | | | | |
|---|---|---|---|---|---|
| **Sq 32** | **Sq 41** | **Sq 50** | **Sq 03** | **Sq 12** | **Sq 21** |
| | | | 1763<br>000 | 1772<br>007 | 1781<br>013 |
| 1792<br>100 | 1801<br>106 | 1810<br>113 | 1819<br>119 | 1828<br>126 | 1837<br>131 |
| 1848<br>219 | 1857<br>225 | 1866<br>231 | 1875<br>237 | 1884<br>244 | 1893<br>250 |
| 1904<br>337 | 1913<br>344 | 1922<br>350 | 1931<br>356 | 1940<br>002 | 1949<br>008 |
| 1960<br>096 | 1969<br>102 | 1978<br>108 | 1987<br>115 | 1996<br>121 | 2005<br>127 |
| The 56 year sequences are separated by an interval of 9 years. | | | | | |

**Equinoxes**
These points are sited where the plane of the Earth's equator projected out onto the sky (celestial equator) cuts the plane of the Earth's orbit around the Sun (ecliptic). The vernal or spring equinox (000 E°) occurs around March 20 and is sited where the Sun crosses the celestial equator from south to north. The autumnal equinox (180 E°) happens around September 22 and is located where the Sun crosses the celestial equator from north to south.

**Lunar Ascending Node**
The lunar nodes are sited, where the plane of the Earth's orbit around the Sun (the ecliptic) is cut by the plane of the Moon's orbit around the Earth. The ascending (north) node is where the Moon crosses the ecliptic from south to north, whereas the descending (south) node is where the Moon crosses from north to south. In the lunar nutation cycle, it takes 18.62 years for the ascending node to complete one cycle from spring equinox to spring equinox.

The ecliptic position of the lunar ascending node in a 9/56 year grid is presented in **Table B**. On July 1, this point is always found in two segments approximately 180 degrees apart in the ecliptic circle ($1^{st}$ and $2^{nd}$ harmonics). In any particular 56 year sequence, the lunar node is always found in a narrow sector of the ecliptic circle ($1^{st}$ harmonic).

| **Table B Appendix 9<br>9/56 YEAR CYCLE &<br>THE POSITION OF THE ASCENDING NODE<br>Ecliptic Degree of Ascending Node on July 1** | | | | | |
|---|---|---|---|---|---|
| **Sq 32** | **Sq 41** | **Sq 50** | **Sq 03** | **Sq 12** | **Sq 21** |

| | | | | | |
|---|---|---|---|---|---|
| | | | 1763<br>019 | 1772<br>205 | 1781<br>031 |
| 1792<br>178 | 1801<br>004 | 1810<br>190 | 1819<br>016 | 1828<br>202 | 1837<br>028 |
| 1848<br>175 | 1857<br>001 | 1866<br>187 | 1875<br>013 | 1884<br>199 | 1893<br>025 |
| 1904<br>172 | 1913<br>358 | 1922<br>184 | 1931<br>010 | 1940<br>196 | 1949<br>022 |
| 1960<br>169 | 1969<br>355 | 1978<br>181 | 1987<br>007 | 1996<br>193 | 2005<br>019 |
| The 56 year sequences are separated by an interval of 9 years. | | | | | |

**Moon Sun Cycles**.
The 9/56 year effect arises due to a very close alignment of several lunisolar cycles at 9.0 and 56.0 solar years (see **Table C**). NB: The synodic month (or lunar month) is the time taken for the Moon and Sun to complete one cycle new Moon to new Moon and is the basic time unit in the cycles discussed in this appendix.

Relative angles between the Moon, Sun, ascending node and apogee repeat very closely every 223 synodic months (or one 18.0 year Saros). These angles will also recur in similar ecliptic positions - plus about 11 degrees anticlockwise on the ecliptic circle every 223 synodic months.

223 synodic months divided by two gives the Half Saros of 111.5 synodic months. Every 9.0 tropical years, the Moon repeats the same angle to the ascending node, with the Sun 180 degrees on the opposite side of the angular circle. The apogee - Sun angle is similar, while the Moon - apogee angle changes in multiples of 60 degrees.

On the same date every 56 years, the lunar ascending node is located a further 3 E° clockwise on the ecliptic circle (eg: as on July 1: 1761 at 48 E°; 1817 - 45 E°; 1873 - 42 E°; 1929 - 39 E°; 1985 - 36 E°). This reflects a close alignment between the 18.6 year lunar nutation cycle and the solar year. Every 692.5 synodic months (or one 56.0 year cycle), the Sun forms the same angle to the ascending node with the Moon 180 degrees on the opposite side of the angular circle. The relative angles of apogee to the Moon, Sun and ascending node change in multiples of 60 degrees.

| **Table C Appendix 9<br>9 & 56 YEAR LUNISOLAR CYCLES** | | |
|---|---|---|
| **18.0 Year Saros** | | |
| **Days** | **Years** | **Lunisolar cycles** |
| 6,574.36 | 18.00 | 18.0 Tropical Years |
| 6,585.78 | 18.03 | 19.0 Nodical Years |
| 6,585.32 | 18.03 | 223.0 Synodic Months (Saros cycle) |
| 6,584.51 | 18.03 | 241.0 Tropical Months |
| 6,585.35 | 18.03 | 242.0 Nodical Months |
| 6,585.55 | 18.03 | 239.0 Apogee Months |
| **9.0 Year Half Saros** | | |
| **Days** | **Years** | **Lunisolar Cycles** |
| 3,287.18 | 9.00 | 9.0 Tropical Years |

| | | |
|---|---|---|
| 3,292.89 | 9.02 | 9.5 Nodical Years |
| 3,292.66 | 9.02 | 111.5 Synodic Months (Half Saros cycle) |
| 3,292.26 | 9.01 | 120.5 Tropical Months |
| 3,292.68 | 9.02 | 121.0 Nodical Months |
| 3,292.77 | 9.02 | 119.5 Apogee Months |
| **56.0 Year Cycle** | | |
| 20,453.44 | 56.00 | 56.0 Tropical Years |
| 20,450.58 | 55.99 | 59.0 Nodical Years |
| 20,449.94 | 55.99 | 692.5 Synodic Months (56 Year Cycle) |
| 20,450.23 | 55.99 | 748.5 Tropical Months |
| 20,449.97 | 55.99 | 751.5 Nodical Months |
| 20,450.06 | 55.99 | 742.17 Apogee Months |

**Synodic Month** (or Lunar Month) is the interval between successive new Moons and is equal to 29.5306 days.
**Tropical Year** (or Solar Year) is the time taken for the Sun to complete one cycle of the ecliptic from spring equinox to spring equinox and is equal to 365.2422 days.
**Tropical Month** is the time taken for the Moon to complete one cycle of the ecliptic from spring
equinox to spring equinox and is equal to 27.3216 days.
**Nodical Month** (or Draconic Month) is the time taken for the Moon to complete one cycle from ascending node to ascending node and is equal to 27.2122 days.
**Nodical Year** (or Eclipse Year) is the time taken for the Sun to complete one cycle from
ascending node to ascending node and is equal to 346.6201 days.
**Apogee Month** (or Anomalistic Month) is the time taken for the Moon to complete one cycle from apogee to apogee and is equal to 27.5546 days.
**Source:** McMinn, 1996.

These cycles of 111.5 and 692.5 synodic months repeat the angles of 0 and 180 degrees between the Moon, Sun and ascending node very closely. Angles involving apogee repeat in multiples of about 60 degrees. Thus, any events clustering in a 9/56 year grid will have the lunar ascending node in two sectors of the ecliptic approximately 180 degrees apart WITH NO EXCEPTIONS ($1^{st}$ and $2^{nd}$ harmonics). Any events in a particular 56 year sequence will have the lunar ascending node in a narrow sector of the ecliptic WITH NO EXCEPTIONS ($1^{st}$ harmonic). If the events occur around the same time of year and in the 9/56 year grid, then apogee will be in three ecliptic sectors 120 degrees apart WITH NO EXCEPTIONS ($3^{rd}$ harmonic). If events occurred around the same time of year and in a particular 9 year subcycle, they will have apogee in one sector of the ecliptic circle WITH NO EXCEPTIONS ($1^{st}$ harmonic).