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Study of Co-seismic Planetary Conditions for Earthquake Prediction

R. N. Ketkar
University of Roorkee, Roorkee, India

M. N. Viladkar
University of Roorkee, Roorkee, India

P. N. Agrawal
University of Roorkee, Roorkee, India

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R. N. Ketkar
Reader in Civil Engineering, University of Roorkee, Roorkee, India

M. N. Viladkar
Reader in Civil Engineering, University of Roorkee, Roorkee, India

P. N. Agrawal
Professor of Earthquake Engineering, University of Roorkee, Roorkee, India

SYNOPSIS : The periodicities in the occurrence of earthquakes, as indicated by the cosmic conditions, have been traced by analysing the planetary data at the time of occurrence of more than 1100 earthquakes of magnitude, $M \geq 7.0$, which occured during the period 1896 to 1965.

Correlation between the transits of planets in the sensitive areas and at sensitive longitudes in the zodiac and the seismicity of California and adjoining area has been shown.

Based on the analysis, a method for forecasting earthquakes is also proposed.

INTRODUCTION

The ferocity of the devastating earthquakes has been experienced by the humanity on innumerable occasions. Attempts have been made by various researchers to correlate the terrestrial and non-terrastrial phenomena with the earthquake occurrence. The entire process is extremely complex and till this date, has defied, barring a few cases, all the attempts to successfully predict the occurrence of earthquakes. The association of non-terrestrial causes with the seismicity has been recognized for a long time (Jose, 1965; Hedervary, 1967; Symson, 1967 and Tamrazyan, 1967). No reliable and rational method of predicting earthquakes has yet become available. Here, an attempt is made in this direction and the co-seismic planatery conditions for over one thousand global earthquakes have been studied and some conclusions drawn.

EXISTING CONCEPTS

Raman (1968) after studying over 200 earthquakes has suggested that –

i)   Only some selected relative positions of Moon with respect to Earth were found to be occurring on the days of these earthquakes.

ii) The earthquakes generally occurred at the time of eclipses and near the Full Moon and New Moon days.

iii) The planets namely, Saturn, Jupiter, Rahu (Ascending Node of Moon), Mars, Mercury and Moon have been found to occupy specific relative positions amongst themselves and with respect to the place of earthquake occurrence.

iv) The time of occurrence is near mid-day, mid-night or early morning   and

v)   The day of occurrence is many times indicated by the transit of Mars on the

eclipse point.

According to Kharegat (1968), the charts prepared for the time of Sun's transit at $0°-0'-1"$, $90°-0'-1"$, $180°-0'-1"$ and $270°-0"-1"$ can be successfully used for predicting the earthquakes.

Murthey (1967, 1969) has indicated certain conditions to be satisfied for the occurrence of an earthquake :

i)   The Earth, the Sun and the exploding supernova should align in one plane, so that the magnetic field of the supernova can influence the magnetic field of the Earth.

ii) The weak belts of the Earth's crust fall within the active magnetic plane.

It was also suggested that the effect of high energy of the cosmic rays upon the magnetic field of the Sun is affected by the pattern of the planets of the solar system.

A relation was also shown to exist between the resultant of the angular momentum of all planets and the earthquakes. A plot of the parameter related to the angular momentum of the planets with time is shown in Fig. 1 and the slope of the curve was found to change with associated major earthquakes.

Shanon (1981) has indicated certain conditions to be satisfied for occurrence of an earthquake

i)   Two or more planets must occupy positions in area : $31°$ to $60°$ and $211°$ to $240°$.

ii) The difference of longitudes of two or more planets must be $0°$ or $90°$ or $180°$ or $270°$.

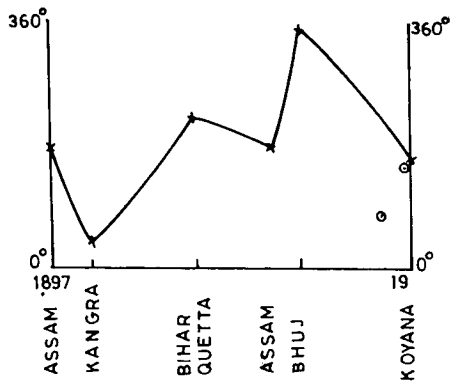iii) The planetary positions associated with the time of formation of the country have

Fig. 1   Showing the Moment of the Position of Z

been found to be related to specific planetary positions as defined in foregoing condition (ii).

iv) Presence of Mars and Venus close to each other enhances the probability of an earthquake.

Certain periods for probable occurrence, were also given (Shanon, 1981) and California earthquake of 1989 coincided with the period indicated.

Kelkar (1988) has suggested a method of forecasting earthquakes using the charts for the Solar and Lunar eclipses and the foundation charts for different countries. An earthquake is likely to occur when transiting Pluto or Uranus or Saturn or Mars or the eclipse point occupy specific positions in the foundation chart.

Dixit (1989) has shown that the eclipse point and the conjunction point for major planets are related to specific positions in the foundation chart of a country where the earthquakes occurs.

PRESENT STUDY

From foregoing review, it is clear that the planets occupying certain relative positions with respect to the place of earthquakes and among themselves have been found to be related to positions of planets in the foundation charts of the countries in which the respective earthquake areas fall.

The objective of the present study is to scientifically scrutinise the relevant data and see if some guidelines, based on such planetary positions in relation to the earthquake areas, can be identified to help the earthquake prediction. It may be worthwhile to familiarise the reader with few terms which are used in this work.

Zodiac

It is a 17° belt - 8.5° on either side of the great circle along which the Sun appears to travel in the Sky.

Sensitive Area

There are the areas in the zodiac, specified with respect to the areas of earthquakes which are repeatedly occupied by the planets at the time of major earthquakes.

Relations of Planets

The difference of apparent longitudes of two planets is generally referred to as a relation. In traditional Astrology, mainly four relations are referred. When the difference between the longitudes is 0° (zero), it is called conjunction and the longitude where the conjunction takes place is referred to as conjunction point. When the difference of longitudes is 90° or 270°, it is referred to as square relation. When the difference is 180°, it is called opposition. When the difference is 120° or 240° it is called trine.

Esclipse Point

The longitude of the Sun at the time of an eclipse is called Eclipse point.

Chart

It is the diagram in which the positions of planets are given for the date, time and place of reference. The longitude in the zodiac, rising on east horizon is called Ascendant or 1st house. The point at mid-heaven is called 10th house, the point on west horizon is called 7th house and the point opposite in mid-heaven is called 4th house.

Aspect

Certain relations are called aspects. All the planets have opposition aspect. In western astrology, all planets have square aspect. But in Indian system, Mars can aspect 90° and 210° ahead, Saturn can aspect 60° and 270° ahead, Jupiter can aspect 120° and 240° ahead. Other planets can not cause any influence on such positions.

In order to formulate well defined and reliable sets of planetary configurations for the seismicity of the earth, a detail study, of the positions or relative positions of the planets at the time of occurrence of 1160 global earthquakes of magnitude, $M \geq 7.0$, which occured during the period 1896-1965 (for which the data could be collected), was undertaken.

DATA

The seismological data i.e. the date, the time and the epicentre of the earthquake was obtained from Richter (1954, 1958), Rothe (1969) and Hedervari (1967). The astronomical data i.e. the apparent siderial longitudes (henceforth called longitudes) of the planets were calculated using condenced ephemeries by Lahiri. These data for california region pertaining to only 23 earthquakes are given in Table 1.

DATA PROCESSING AND ANALYSIS

The position of a planet is given by the geometric apparent longitude, latitude and

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TABLE I.   Coseismic Planetary Conditions for Region - 3   (California, USA)

Sl. No.	Data of Occurence	Epicentre N°	W°	Magnitude (M)	Pluto	Neptune	Uranus	Saturn	Jupiter	Rahu	Mars	Sun	Venus	Mercury	Moon
									(Degrees)						
1	18.4.1906	38	123	8.3	59	79	256	319	45	115	31	6	21	345	308
2	3.10.1915	41	118	7.75	71	100	290	84	329	292	95	166	172	191	98
3	21.11.1915	32	115	7.1	71	100	290	84	326	290	119	215	233	202	27
4	21.4.1918	34	117	6.8	70	101	303	106	48	242	141	7	20	17	133*
5	31.1.1922	41	126	7.3	76	112	316	165	177	170	208	289	287	307	327
6	22.1.1923	41	125	7.2	77	115	319	178	204	151	338	279	233	292	339
7	22.7.1923	34	117	6.25	78	114	324	171	197	140	101	95	83	98	202*
8	29.6.1925	35	120	6.2	79	117	328	195	266	103	98	74	92	85	163*
9	4.11.1927	35	122	7.3	85	127	338	224	332	58	194	199	153	211	323
10	21.12.1932	39	118	7.2	90	138	357	280	150	319	143	247	218	225	162
11	10.3.1933	34	118	6.3	88	135	358	289	145	315	134	326	318	341	340*
12	31.12.1934	32	115	7.0	93	142	5	303	204	280	167	257	267	257	199
13	25.3.1937	34	116	6.0	94	145	15	33	270	236	220	341	12	342	145*
14	15.3.1946	34	118	6.3	107	165	51	85	182	62	84	332	343	347	127*
15	10.4.1947	34	117	6.2	108	167	55	99	213	41	335	357	318	329	232*
16	21.7.1952	35	119	7.7	118	176	82	167	24	300	198	96	103	122	91
17	19.3.1954	33	116	6.2	120	183	86	194	55	268	238	335	347	321	91*
18	16.7.1954	39	118	7.1	121	181	91	190	79	262	244	91	131	77	276*
19	18.12.1954	39	118	7.1	124	185	94	204	96	254	316	241	204	236	144
20	9.2.1971	35	119	6.4	157	220	199	23	221	301	228	297	250	279	108*
21	22.11.1976				189	229	195	113	22	188	219	217	255	224	223*
22	21.6.1977				167	230	195	110	54	178	20	2	18	56	226*
23	20.10.1989			7.0	200	256	248	255	77	298	176	183	230	169	81*

* Approximate value.

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declination. Here, only the apparent longitudes were used as, consideration of other parameters would have made the work unmanagable. The positions of Saturn, Jupiter, Rahu, Mars, Sun, Venus, Mercury and Moon have been used to find out favourable planatery configurations. Though the Sun, Moon and Rahu are not planets, these will be henceforth, referred to as planets.

Facts and Assumptions

Following facts and associated assumptions can help in grouping the planets :

i)   Moon being closest to the Earth, its influence on the Earth's activity may be assumed to be more prominent.

ii) The slower moving planets may have lesser influence compared to faster moving planets.

iii) Several alternate positions of the Moon and the faster moving planets with respect to different positions of the slow moving planets will have to be studied.

Thus the planets have been divided into following three groups :

Group A   -   Moon
Group B   -   The faster moving planets - Mars, Sun, Venus and Mercury
Group C   -   The major or slow moving planets - Saturn, Jupiter and Rahu.

The average periodicities of revolution of the planets considered are as follows :

Moon - 27 days; Sun, Venus and Mercury - 1 year, Mars - 18 months; Jupiter - 12 years; Rahu - 18.6 years (Rahu moves in opposite direction as compared to other planets) and Saturn - 30 years.

Thus, during the period under consideration in the present study i.e. 1896-1965, Jupiter had 5 or 6 cycles for different positions, Rahu had 3 or 4 cycles and Saturn had 2 or 3 cycles.

Analysis

A combination of one planet from each of the two or three groups has been referred to as a set. For the annual transit of Saturn $(12^{\circ}$ to $18^{\circ})$, Jupiter (30°) and Rahu (20°), the corresponding positions of Moon (Group A) and a selected planet (Group B) have been shown on a grid. Thus 224 grids of the various combinations, so arrived at, have been prepared. On each of these grids, the earthquakes which occurred during the corresponding periods of transits of the slow moving planets and grouped in three magnitude ranges (7.0 to 7.8; 7.9 to 8.5; and 8.6 to 8.9), are indicated. Each earthquake is represented by a point and the coordinates of the point give the positions of the Moon (Group A) and the planet in Group B. Richter's numbering of the zones on the earth has been used to represent the area of the earthquake. A typical plot is shown in Fig. 2. These plots have been examined to identify cluster of earthquakes in a zone of $30^{\circ} \times 30^{\circ}$ on the grid. The details of

the events in each of these clusters were then examined and following criterion used to pick up the significant planetary configurations. This is referred to as favourable planetary condition (condition at S.No. 19 in Table 2 is shown in Fig. 2.
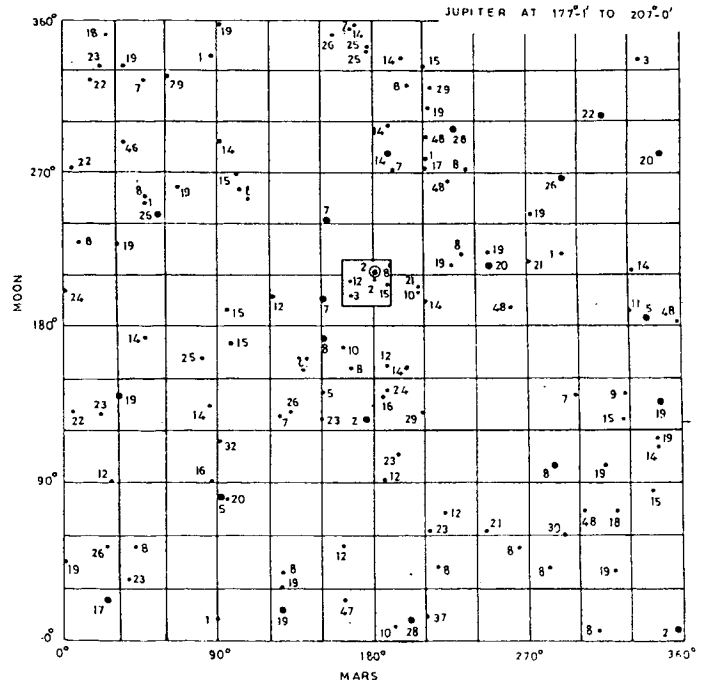
Fig. 2 Grid Showing Positions of Moon (Group-A), Mars (Group-B) Corresponding to Transit of Jupiter (Group-C) at 177°-1' to 207°-0' for Different Earthquakes

When the set involving Saturn is associated with the occurrence of an earthquake in a minimum of two cycles and the set involving Jupiter or Rahu is associated in a minimum of three cycles, the set is assumed as s favourable condition indicating a possible, occurrence of an earthquake.

In addition to the set of three planets, the association of the position of a planet of Group C, falling in the range not exceeding 30° and the position of a planet of Group B or the difference of longitudes of the two planets falling in a range of 3° was studied. Whenever a set satisfied the foregoing criteria, it was noted as a favourable condition. The study was carried out for all possible sets of two planets. Tables have been prepared (not included in this paper) showing the details of planetary position involved in favourable conditions and also the details of the associated earthquakes.

Use of Favourable Conditions

The favourable conditions of a set of two planets or three planets indicate the probable period of occurrence of an earthquake nearest to 3 days (this is the period for transit of the Moon through 30° or the period for transit of the planet of Group B through 3° or the period for the change of the difference in the positions of two planets of Groups B and C through 3°). For a set of two planets, the period can be longer if

Sl. No.	Slow Moving Planet	Position (Range) Degrees	Difference	Range	Other Related Date	Earthquakes	
						Region	Magnitude
1.	Jupiter	1-30	Jup - Sun	289-292	25.6.1904	R19	8.3
					27.6.1904	R19	7.9
					14.7.1940	R1	7.75
					24.7.1964	R19	7.0
2.	"	57-86	"	347-351	3.7.1918	R16	7.5
					2.7.1930	R26	7.1
					8.7.1942	R8	7.0
3.	"	121-150	"	263-264	12.12.1908	R26	7.5
					16.12.1920	China	8.6
					26.11.1943	R24	7.1
					26.11.1943	R30	7.6
4.	"	181-210	"	304-309	31.12.1922	R19	7.0
					1.1.1935	R12	7.1
					3.1.1947	R19	7.0
					13.12.1957	R29	7.2
5.	"	301-330	"	161-164	7.9.1938	R21	7.0
					10.9.1950	R14	7.1
6.	Jupiter	171-200	Jup - Mars	328-333	1.1.1911	R48	7.2
					3.1.1911	R28	8.7
					13.12.1957	R29	7.2
					17.12.1957	R14	7.5
7.	Jupiter	28-57	Jup - Ven	21-23	13.6.1929	9N123E	7.2
					16.6.1929	R11	7.6
					25.6.1953	R24	7.1
8.	"	181-210	"	330-331	26.11.1910	R14	7.4
					30.11.1934	R5	7.0
9.	"	301-330	"	93	20.1.1904	R6	7.9
					30.11.1938	R19	7.0
10.	"	316-345	"	175-178	16.11.1927	R22	7.0
					24.11.1951	R21	7.3
					3.8.1962	R8	7.1
11.	Saturn	81-94	Sat - Sun	278-279	9.10.1945	R19	7.0
12.	"	81-94	"	228-229	27.11.1945	R29	8.3
13.	"	157-172	Sat - Mars	329-330	9.1.1922	R32	7.1
					26.2.1952	R8	7.0
14.	"	307-322	"	289	31.5.1964	R19	7.4
15.	"	157-172	Sat - Ven	239	4.3.1952	R19	8.6
16.	"	213-227	"	71-72	24.10.1956	R6	7.3
17.	"	251-270	"	27	27.1.1931	R26	7.6
					15.1.1960	R8	7.0

Sl. No.	Slow Moving Planet	Position (Range) Degrees	Faster Moving Planet	Position (Range) Degrees	Other Related Date	Earthquakes	
						Region	Magnitude
18.	Jupiter	52–86	Mars	244–247	29.3.1907	R23	7.2
					31.3.1907	R12	7.2
					8.11.1918	45N152E	7.9
					3.7.1954	7S106E	7.0
19.	"	1–30	Venus	101–103	24.7.1904	R19	7.5
					15.9.1916	R19	7.2
					12.9.1940	R15	7.0
20.	"	181–210	"	264–270	1.1.1911	R48	7.2
					3.1.1911	R28	8.7
					24.2.1923	56N 163E	7.4
					1.1.1935	R12	7.1
					12.1.1946	59N 147E	7.2
					17.1.1946	8S 148E	7.2
21.	"	134–163	Mercury	225–226	16.12.1920	China	8.6
					15.11.1944	R23	7.2
					16.11.1944	R14	7.3
22.	Saturn	277–297	Sun	246–247	22.12.1904	R6	8.3
23.	"	292–322	"	6–7	19.4.1935	R31	7.1
					20.4.1935	R21	7.1
					19.4.1963	R27	7.0
24.	"	64–88	Mars	119	28.6.1944	R5	7.0
25.	"	81–94	"	94–95	5.1.1946	R14	7.3
26.	"	213–227	"	194	18.10.1897	R22	8.1
27.	"	269–283	"	142–143	23.7.1961	R14	7.2
28.	"	82–103	Venus	171	21.8.1946	R12	7.0
29.	"	291–310	"	267–268	1.1.1935	R12	7.1
					15.12.1963	R24	7.1

Sl. No.	Slow Moving Planet	Position Ranges (Degrees)	Faster Moving Planet	Position Range (Degrees)	Moon's Position Range (Degrees)	Other Related Date	Earthquakes	
							Region	Magnitude
30.	Jupiter	28–57	Sun	349–10	303–332	31.3.1954	R11	7.2
						30.3.1965	R1	7.5
						31.3.1965	R30	7.1
31.	"	177–207	"	236–265	189–218	1.1.1935	R12	7.1
						28.12.1945	R15	7.8
						20.12.1946	R20	8.4
						17.12.1957	R14	7.5
32.	"	57–86	Mars	241–270	248–277	25.6.1907	1N123E, R23	7.9
						8.11.1918	R19	7.0
						6.12.1918	R2	7.4
33.	"	151–180	"	139–168	161–190	7.9.1910	R15	7.2
						4.10.1910	R8	7.2
						24.9.1957	R22	7.6
34.	"	177–207	"	164–193	196–217	10.9.1899	R2	8.6
						1.1.1935	R12	7.1
						29.9.1946	R15	7.8
						30.9.1946	R8	7.0

35.	Jupiter	321–350	Mars	88–117	88–117	3.6.1927	R24	7.4
						1.5.1963	R14	7.0
36.	"	346–27	"	176–200	88–117	22.1.1905	R23	8.4
						25.8.1916	R8	7.5
						19.11.1940	R19	7.1
37.	"	57–87	"	161–190	75–104	3.12.1906	R7	7.5
						8.7.1918	R25	7.6
						26.11.1953	R19	8.3
						23.8.1965	R5	7.8
38.	"	28–57	Venus	1–30	304–315	27.6.1929	R10	8.3
						31.3.1954	12N 58E	7.2
39.	"	185–214	"	216–245·	316.345	10.12.1910	R15	7.5
						4.11.1946	R29	7.5
40.	"	357–27	"	81–110	88–117	25.8.1916	R8	7.5
						18.7.1928	R8	7.0
41.	"	57–87	"	211–240	30–60	8.11.1906	R19	7.0
						19.11.1918	R24	8.1
42.	"	177–207	"	231–262	186–215	1.1.1935	R12	7.1
						28.12.1945	R15	7.8
						17.12.1957	R14	7.5
43.	Rahu	115–95	Sun	337–6	296–319	22.3.1925	R14	7.6
						22.3.1944	R24	7.5
44.	"	115–95	Mars	31–48	308–330	22.3.1925		
						14.9.1943	R12	7.6
						14.9.1943	R14	7.5
45.	"	65–45	"	181–210	306–329	28.12.1908	R31	7.5
						13.8.1965	R14	7.1
46.	"	318–300	Venus	85–108	88–109	25.6.1914	R24	7.6
						24.6.1933	R24	7.5
47.	"	275–255	"	121–150	251–280	31.7.1917	R46	7.5
						9.9.1935	R17	7.0
48.	"	163–140	"	218–247	334–357	5.1.1941	R23	7.0
						1.11.1960	R9	7.2
49.	"	130–107	"	341–10	281–310	4.3.1924	R6	7.0
						16.4.1925	R21	7.1
						1.4.1943	R24	7.0
50.	"	318–300	Mercury	95–121	85–100	26.6.1914	R24	7.6
						24.6.1933	R14	7.5
51.	"	261–239	"	228–251	118–147	24.11.1899	R20	7.8
						15.12.1935	R15	7.6
52.	"	115–95	"	343–354	301–312	22.3.1925	R14	7.6
						22.3.1944	R24	7.5
53.	"	300–281	"	156–185	90–120	21.9.1897	R22	8.7
						18.10.1897	R22	8.1
						7.9.1915	R6	7.9
						1.11.1915	R19	7.7
54.	Saturn	157–172	Sun	286–315	317–340	26.2.1952	R8	7.0
55.	"	172–187	"	250–279	331–360	24.12.1952	R15	7.0
56.	"	307–322	"	341–10	296–325	30.3.1962	R1	7.5

57.	Saturn	81–94	Mars	85–114	89–118	1.11.1915	R19	7.7
						17.1.1946	R16	7.2
						11.4.1946	R32	7.2
						8.5.1946	R24	7.1
58.	"	82–97	"	91–120	358–27	11.1.1946	R19	7.2
						12.1.1946	R1	7.2
59.	"	157–172	"	182–211	86–115	18.12.1921	R8	7.9
						17.8.1952	R26	7.5
60.	"	157–172	"	182–214	326–355	6.1.1922	R8	7.0
						26.2.1952	R8	7.0
61.	"	217–232	"	176–199	306–329	23.11.1955	R19	7.1
62.	"	73–87	Venus	156–186	71–100	11.9.1944	R23	7.2
63.	"	157–172	"	271–300	315–338	26.2.1952	R8	7.0
64.	"	292–312	"	249–278	181–210	1.1.1935	R12	7.1
						24.1.1965	R23	7.7
65.	"	241–260	"	218–247	75–110	23.11.1899	R19	7.9
						17.12.1929	R1	7.6
						13.1.1960	R8	8.0
66.	"	157–172	Mercury	299–328	321–344	28.3.1922	R8	7.2
						26.2.1952	R8	7.0
67.	"	202–217	"	214–243	133–162	10.11.1925	R23	7.4
						13.11.1925	R22	7.3
68.	"	292–307	"	251–280	194–217	1.1.1935	R12	7.1
						6.2.1964	R1	7.1
69.	"	307–322	"	338–7	289–318	28.3.1965	R8	7.4
						30.3.1965	R1	7.5

planet of Group B is in apparent retrograde motion and it can be smaller when the motion of the planet is accelerated.

*   On many occasions, two or more favourable conditions occur simultaneously. The period of concurrence may be one day to a week. Whenever such concurrence is noted, an earthquake with magnitude, $M \geq 7.0$ is most likely to occur somewhere on the earth. The larger the number of favourable conditions superimposed in a small period, the larger will be the confidence level of prediction.

*   When the planets occupy sensitive areas or sensitive longitudes related with the seismicity of a region, that region can expect an earthquake of magnitude, $M \geq 7.0$, in the period indicated. These sensitive areas or the sensitive longitudes can be determined by studying sufficiently larger seismic data of that area. The favourable conditions associated with the earthquakes of that area give a better idea.

Method of Predicting Earthquakes

i.   Using the data of past earthquakes of a region, the sensitive areas or sensitive longitudes are to be determined.

ii. The period of occurrence of an earthquake is to be fixed using the global favourable conditions.

iii. The correlation between the sensitive areas and sensitive longitudes for the area and the positions of planets involved in favourable conditions may help predicting an earthquake in the area, during the period indicated.

SEISMICITY OF CALIFORNIA REGION

The seismicity of California and region around, bounded by $32^{\circ}N$ to $41^{\circ}N$ and $115^{\circ}W$ to $126^{\circ}W$, which is designated as Region 3 by Richter (1954) is discussed here, in the light of the suggested method for the prediction of the earthquakes.

Using the data in the Table 1, the sensitive areas in the zodiac where the transits of the slow moving planets namely, Saturn, Jupiter, and Rahu display a marked association with the seismicity of this region, are presented in Table 3.

Using the favourable cosmic conditions related to seismicity of Region 3 (Table 2), the sensitive longitudes related to Region 3 are determined and are shown in Table 4. These longitudes have been found to have the traditional conjunction, square and opposition relations with the positions of planets in the foundation chart of U.S.A. prepared for 4 July, 1776. For the transits of extremely slow moving planets namely, Pluto, Neptune and Uranus, a tolerance of $\pm 1^{\circ}$ is to be allowed and for the slow moving planets namely, Saturn, Rahu and Jupiter the tolerance is to be $\pm 2^{\circ}$. For the earthquakes of Region 3, Saturn or Jupiter or Rahu was found to be transiting sensitive area (except in one case) and a

minimum of two slow or extremely slow moving planets were at sensitive longitudes (except on three occasions).

The sensitive areas and the sensitive longitudes for the transit of the particular planets of Groups B and A alongwith additional transits of the planets of Groups C and B which enhance the probability of occurrence are presented in Table 5.

DISCUSSION OF PAST EARTHQUAKES AND LIMITATION OF WORK

The probability of occurrence of an earthquake, when a favourable condition is present, can be determined by the number of occasions the favourable condition occurs in a certain period and the number of occasions it is found to be associated with the occurrence of an earthquake. When two or more conditions superimpose in a small period, the combined probability can also be evaluated. In the absence of the knowledge of the probability coefficients for all favourable conditions traced, it is assumed that the probability coefficient is not less than 0.5 (as per the criterion laid down in the analysis) for all cases. In order to have a confidence level of 90 percent for any event, presence of at least FOUR favourable conditions becomes necessary. An earthquake may be predicted even when the number of superimposing favourable conditions is less than four, but it will have a lesser probability. To find out the minimum favourable conditions which can indicate the occurrence of an earthquake, those conditions present at the time of occurrence of all earthquakes of magnitude, $M \geq 7.0$ of Region 3 were determined (not being presented here). It was found that four or more conditions were present in all cases except for the earthquake of 16.12.1954. The two conditions present in this case had a probability coefficient of 0.6 and 0.67, thus giving an acceptable compounded probability. In case of earthquakes of smaller magnitudes, all the requirements indicated were not satisfied.

Table 6 shows different overlaping favourable conditions present at time of three past earthquakes of Region 3 (the data of these earthquakes were used for fixing the favourable conditions). The data for the recent earthquake of 20.10.1989 were not used in the earlier analysis and is included in Table 6, to show that minimum requirement is found to be satisfied in this case also . Table 6 also shows the correlation between the transits of the planets in the sensitive areas and sensitive longitudes in the zodiac, which are associated with the seismicity of the region.

The magnitudes of the earthquakes associated with the favourable conditions present can give a broad idea of magnitude of the probable earthquake. Magnitudes thus expected are also shown in Table 6. The difference in the observed and expected magnitudes may be reduced by using an analysis in which the effect of positions of the extremely slow moving planets and their mutual relative placements are included in determining the favourable conditions. This could not be done due to

TABLE 3. Sensitive Areas for the Transits of Slow Moving Planets Associated with Region 3

Sl. No.	Transit of Planet	Position Range	Number of Cycles	Period of the Cycles
1	Saturn	84 – 113	3	1915; 1946-47; 1976-77
		165 – 195	2	1922-25; 1952-54
2	Jupiter	24 – 55	4	1906; 1918; 1952; 1977
		195 – 224	4	1923; 1934; 1947; 1971
3	Rahu	319 – 290	5	1915; 1932-33; 1952; 1971; 1989
		268 – 236	3	1918; 1937; 1954

TABLE 4. Sensitive Longitudes for the Transit of Slow Moving Planets and Their Relations with Positions of Planets in the Foundation Chart of U.S.A.

Sl. No.	Position of Planet in Foundation Chart of USA		Sensitive Longitude	Nature of Relation
	Planet	Position		
1	Uranus	46°	317°	Square
2	Jupiter	77°	77°	Conjunction
			168°	Square
			256°	Opposition
3	Rahu	108°	106°	Conjunction
			196°	Square
			290°	Opposition
4	Nepture	150°	58°	Square
			149°	Conjunction
			328°	Opposition
5	Saturn	176°	85°	Square
			176°	Conjunction
6	Moon	299°	117°	Opposition
			205°	Square
			302°	Conjunction

TABLE 5. Sensitive Areas for the Transits of Fact Moving Planets Associated with Region 3

Sl. No.	Transiting Fast Moving Plant	Position/Area (degrees)	Additional Transits of Planets, which enhance the probability of occurrence	
			Planet	Position/Area (degrees)
1	Sun	91 – 100	Saturn	165 – 195
		165	–	–
		211 – 240	Saturn	84 – 113
				199 – 210
		257	–	–
		279 – 292	–	–
		341 – 10	Saturn	96 – 115
2	Mars	81 – 102	Saturn	79 – 89
			Jupiter	177 – 206
		117	–	–
		134 – 145	–	–
		167	–	–
		196 – 205	–	–
		216 – 245	Rahu	268 – 236
3	Venus	12 – 21	Saturn	101 – 115
			Jupiter	36 – 65
		85	–	–
		205	–	–
		211 – 240	Rahu	319 – 290
		255	–	–
		317	–	–
4	Mercury	58	–	–
		77	–	–
		85	–	–
		205	–	–
		211 – 240	–	–
		321 – 350	Jupiter	36 – 65
			Rahu	268 – 236
5	Moon	77	–	–
		81 – 110	Jupiter	51 – 80
			Rahu	306 – 287
			Sun	161 – 190
			Mars	171 – 200
			Mercury	166 – 195
		121 – 150	Saturn	81 – 110
			Rahu	260 – 231
			Sun	331 – 10
			Venus	1 – 30
			Mercury	348 – 17
		305 – 340	Mercury	331 – 360

TABLE 6. Coseismic Planatery Conditions for Selected Earthquakes for Region 3 (California and Nearer Area)

Sl. No.	Date of Occurrence	Recorded Magnitude (M)	Transiting Planet	Sensitive Position/ Area Transited (degree)	Additional-Transit Enhancing the Probability Position/Area	S.No. and Favourable Condition Causing Global Seismicity (Table - 3)	Period of Occurrence	Common Period of Occurrence	Probable Maximum Magnitude Indicated by Favourable Conditions
1	18.4.1906	8.3	Pluto	59		7, JU & JU-VE	18-22 April		
			Nepture	76		14, SA & SA.MA	18 April		
			Uranus	256		23, SA & SU	17-18 April		
			Saturn	319		30, JU, SU, MO	18-20 April		
			Rahu	115		38, JU, VE, MO	18-19 April	18 April	7.6
			Jupiter	24-25		43 RA, SU, MO	18-29 April		
			Venus	12-21	Jupiter 36-65	44 RA, MA, MO	18-20 April		
			Mercury	321-350	Jupiter 36-65	49 RA, VE, MO	17-18 April		
			Moon	305-340	Mercury 331-360	52 RA, ME, MO	17-18 April		
						56 SA, SU, MO	17-19 April		
						69 SA, ME, MO	17-19 April		
2	3.10.1915	7.75	Uranus	290		5 JU & JU-SU	3-10 Oct.		
			Saturn	84		11 SA & SA-SU	2-3 Oct.		
			Rahu	292		25 SA & MA	2-3 Oct.		
			Jupiter	329		28 SA & VE	2-3 Oct.	3 Oct.	7.5
			Mars	95	Saturn 79-89	35 JU, MA, MO	2-3 Oct.		
			Sun	166		62 SA, VE, MO	1-3 Oct.		
			Moon	98	Rahu 306-287	57 SA, MA, MO	2-3 Oct.		
					Sun 161-190				
					Mercury 166-195				
3	21.7.1952	7.7	Pluto	118		13 SA & SA-MA	19-22 July		
			Neputer	176		1 JU & JU-SU	19-23 July		
			Saturn	167		19 JU & VE	19-24 July		
			Rahu	300		38 JU, MA, MO	21-23 July	21-22 July	7.9
			Sun	91-100		40 JU-VE, MO			
			Mars	196-205		46 RA, VE, MO	21-23 July		
			Moon	81-110	Rahu 306-287	50 RA, ME, MO	21-23 July		
					Mars 171-200	59 SA, MA, MO	21-23 July		
4	20.10.1989	7.0	Neputer	256		17 SA & SA-VE	19-20 Oct.		
			Saturn	255		37 JU, MA, MO	20-21 Oct.		
			Jupiter	77		41 JU, VE, MO	17-19 Oct.	19-20 Oct.	7.9
			Rahu	299		53 RA, ME, MO	21-23 Oct.		
			Venus	211-240	Rahu 319-290	65 SA, VE, MO	20-22 Oct.		
			Moon	81° (Appr.)	Jupiter 51-80				
					Rahu 306-287				
					Sun 161-190				
					Mars 171-200				
					Mercury 166-195				

TABLE 7. Probable Dates of Occurrence of Earthquakes in 1991, and Corresponding Favourable Condition of Planets

Date	Favourable Conditions				Position of Moon Range in Degrees	Related recorded earthquakes		
	Slow Moving Planet	Position Range (Degrees)	Fast Moving Planet or Difference	Range in Degrees		Date	Region	Mag. M
Jan. 1, 1991	Sat.	262–277	Venus	271–300	86–109	14.1.1903 2.3.1931 8.3.1960	R5 R14 R14	8.3 7.1 7.2
Jan. 7, 1991	Sat.	262–277	Sat-Ven	355–356		Ist Cycle 2nd Cycle 3rd Cycle	R15 R14 R28	8.3 7.9 7.9
Jan. 10, 1991	Sat.	267–288	Sat–Sun	6		14.1.1903 21.1.1933	R5 R3	8.3 7.0
	Sat.	262–267	Venus	282		14.1.1903 9.3.1931 13.12.1960	R5 R19 R11	8.3 7.6 7.2
Jan. 14, 1991	Sat.	261–270	Sun	270–271		14.1.1903 15.1.1931 13.1.1960	R5 R5 R8	8.3 7.9 8.0
	Jup.	88–117	Mars	21 – 50	262–271	26.3.1908 18.6.1932 10.9.1943 14.4.1955 15.4.1955	R5 R5 R20 R26 R48	7.9 7.9 7.4 7.4 7.0
Sept. 20, 21, 1991	Rahu	276–257	Sun	126–155	301–324	31.8.1898 11.9.1916 11.9.1935	– R24 R19	7.9 7.2 7.6
	Rahu	276–257	Mer	143–172	305–321	Same 3 dates as above		
	Sat.	264–277	Mars	168	–	14.1.1903 18.8.1931 1.9.1961	R5 R28 R10	8.3 7.2 7.5

the limited time spread of the data.

FUTURE PROBABILITY

In the months of January and May of 1991,. the conditions for large earthquakes will be met . However, all the requirements for the earthquake of occur in California or nearer area are not present, as only the slow (Jupiter) and extremely slow (Uranus) moving planets are transiting the sensitive areas, an earthquake of magnitude M < 7.0 may occur in these months.

On January 1, 1991; January 10, 1991 and January 14, 1991, the favourable condition for very large earthquakes of magnitude $M \geq 7.9$ will be present and for all these favourable conditions, earthquakes were registered in Mexico (R-5). Therefore this area should expect an earthquake of magnitude M 7.5 during this period. On Sept. 20-21, 1991 the conditions for occurrence of earthquakes of large magnitude ($M \geq 7.5$) would be met, but the region is not clearly indicated. The details of the planetary positions for the possible occurrence of earthquakes during 1991 are presented in Table 7.

CONCLUSION

On the basis of the foregoing study, it looks possible that, if reliable earthquake data spread over sufficiently large period say atleast 500 years is analysed, it may be possible to develop dependable earthquake prediction programmes.

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