The International Seismological Summary for 1922 October, November, December.

FORMERLY THE BULLETIN OF THE BRITISH ASSOCIATION SEISMOLOGY COMMITTEE.

The present number of the Summary completes its fifth year (1918, 1919, 1920, 1921, 1922). It seems appropriate now to scrutinize the information thus gathered in order to see what probable improvements to the adopted tables will be necessary in the future. The P and S residuals have therefore been collected, and at least two sensible modifications are indicated.

(1) There is a well-marked drop in the observed curves for both P and S, with its minimum at about $\Delta=38°$, which the present tables have erroneously smoothed out. This drop has important consequences for the angle of emergence, and may solve a difficulty found by Galitzin.

(2) From $\Delta=80°$ to $\Delta=110°$ there is a separate phenomenon S_cP_cS generally recorded as S, but preceding it according to the formula

$$S-S_cP_cS=(\Delta-80°)\times 4{\cdot}6s.$$

where Δ is measured in degrees. This phenomenon has been identified by Gutenberg as a ray which travels as S until it reaches the liquid core of the earth (of which the radius is about half that of the surface), then travels as a P ray through the core, and on emergence changes back into an S ray for the journey from core to surface. The designation S_cP_cS above used is that of Gutenberg. An excellent illustration of this ray is afforded by the earthquake of October 11d. 14h. in the present number, and a detailed note on that case will be found after the observations. But a fuller discussion is rendered possible by the collection of the S residuals, and will shortly be presented. This ray has something in common with [P] which travels as P throughout, but penetrates the core; and a convenient designation for it in this bulletin would therefore be [S], which would allow of ready tabulation of the residuals in the S column. But this method of presentation requires a little consideration before it is definitely adopted, and it is mentioned now in order to invite criticism of the proposal.

The present number of the Summary deals with 72 epicentres, 23 of which are new and 49 repetitions from old epicentres. We may perhaps repeat once more the corresponding figures from the beginning of the Summary in its international form :

	New.					Old.					
	(1)	(2)	(3)	(4)	Yr.	(1)	(2)	(3)	(4)	Yr.	N/O
1918	36	44	43	35	158	44	38	67	53	202	0·78
1919	20	27	31	22	100	34	41	91	33	199	0·50
1920	24	27	31	27	109	47	48	49	42	186	0·59
1921	31	29	26	18	104	30	36	36	47	149	0·70
1922	32	38	31	23	124	36	51	58	49	194	0·64

The cases of assumed abnormal focal depth are :—

	Date.	Epicentre.	Depth below normal.
Oct.	24d. 21h.	47°·3N. 151°·5E.	+·010
Nov.	3d. 12h.	7°·6S. 128°·3E.	+·040
Dec.	6d. 13h.	36°·8N. 69°·5E.	+·020

Reference has already been made to the note on October 11. Attention may further be called to a note of a different kind on the disastrous earthquake of Nov. 11d. 4h., in Chile, which was followed by several aftershocks, the smaller of which are still under investigation at the time of going to Press, and will be noted at the end of this number of the Summary.

The earthquake of December 6 may have been a double shock ; see note appended to it. There are also special notes to December 19d. 3h. and to December 31d. 7h.

It is perhaps worthy of record that the present MS. is being delivered to our printers by special messenger during the General Strike.

H. H. TURNER.

University Observatory, Oxford.
1926 May 12.

1922 OCTOBER, NOVEMBER, & DECEMBER.

Oct. 1d. 17h. 26m. 8s. Epicentre 3°·0N. 89°·0E.

A = +·017, B = +·998, C = +·052 ; D = +1·000, E = −·017 ; G = +·001, H = +·052, K = −·999.

Very doubtful.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Colombo	9·9	294	2 28	− 1	—	—	4·2	6·4
Kodaikanal	13·6	303	5 58	?S	(5 58)	0	—	—
Batavia	20·0	117	i 4 33	− 8	8 31	+ 8	—	—
Zi-ka-wei	41·6	44	—	—	—	—	e 21·4	—

Batavia gives also i = +8m.35s.

Oct. 1d. Readings also at 7h. (near Tokyo), 13h. and 15h. (near Tacubaya), 17h. (near Tokyo).

Oct. 2d. Readings at 9h. (Colombo and Apia), 10h. (Strasbourg and Vienna), 18h. (near Tokyo), 20h. (near Lick).

Oct. 3d. Readings at 1h. (Paris), 2h. (near Tacubaya), 3h. (Marseilles), 5h. (Nagasaki, Kobe, and near Osaka), 9h. (Zi-ka-wei and Taihoku), 12h. (Manila and Eskdalemuir), 13h. (Manila (2) and De Bilt), 14h. (near Osaka), 16h. (La Paz), 17h. (Batavia), 18h. (near Tacubaya), 20h. (La Paz and near Manila), 21h. (near Manila), 22h. (Eskdalemuir).

Oct. 4d. Readings at 1h. (De Bilt, Eskdalemuir, and Oxford), 2h. (Oxford), 4h. (near Manila and near La Paz), 5h. (near Merida and Tacubaya), 9h. (Colombo), 12h. (Mizusawa), 13h. (near La Paz), 14h. (Eskdalemuir and near Algiers), 15h. (Paris), 16h. (La Paz (2)), 17h. (Paris), 20h. (La Paz).

Oct. 5d. 5h. 13m. 36s. Epicentre 2°·1N. 127°·8E. (as on 1921 Dec. 7d.).

A = −·612, B = +·790, C = +·037 ; D = +·790, E = +·613 ; G = −·022, H = +·029, K = −·999.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		14·2	332	e 3 34	+ 5	—	—	6·5	7·0
Batavia		22·5	248	e 5 45	+34	—	—	—	—
Taihoku		23·7	346	—	—	—	—	e 9·4	—
Hong Kong		24·1	328	5 22	− 7	9 34	−12	11·6	—
Zi-ka-wei		29·7	349	i 6 19	− 6	e 11 18	−11	—	19·4
Osaka		33·3	11	7 20	+21	11 44	−45	14·8	19·6
Kobe		33·3	11	e 6 22	−37	—	—	e 7·4	10·0
Tokyo		35·3	16	e 7 54	+38	e 13 26	+26	—	15·2
Mizusawa		39·0	16	7 42	− 4	13 45	− 7	—	—
Sydney		42·1	150	8 12	0	17 12	?SR_1	25·8	30·9
Melbourne		43·0	160	8 6	−12	i 14 24	−24	22·6	28·8
Honolulu	E.	74·5	69	—	—	—	—	e 34·4	—
Hamburg		104·3	327	—	—	i 24 49	−107	53·4	—
De Bilt		107·6	326	—	—	e 25 3	−123	e 54·4	56·5
Uccle		108·6	325	—	—	e 25 6	−129	e 53·4	—
Edinburgh		109·7	334	—	—	—	—	e 58·4	—
Eskdalemuir		110·1	333	—	—	e 25 12	−137	48·4	—
Oxford		111·1	329	—	—	i 28 41	+63	57·4	66·2
Bidston		111·1	330	—	—	—	—	46·4	—
Fordham		132·7	22	—	—	39 24?	?	—	—
La Paz		158·8	134	20 9 [+ 2]		26 51	?	—	—

Additional readings : Manila gives also MN = +6·6m. Batavia i = +8m.31s. and +8m.55s. Epicentre 1°·8N. 126°·4E. Osaka MN = +16·6m. Kobe MN = +9·5m. Tokyo MN = +14·7m. Melbourne iSR_1 = +17m.36s. De Bilt MN = +56·3m. Eskdalemuir e = +28m.32s.

Oct. 5d. Readings also at 11h. (Hong Kong and Manila), 12h. (La Paz), 16h. (Mizusawa, near Osaka (2), Kobe, and Tokyo (2)), 17h. (Hong Kong, Zi-ka-wei, and near Taihoku), 18h. (De Bilt), 19h. (Batavia), 23h. (near Porto Rico and Port au Prince).

Oct. 6d. 5h. 28m. 20s. Epicentre 62°·0N. 155°·0W.

$A = -\cdot426$, $B = -\cdot198$, $C = +\cdot883$; $D = -\cdot423$, $E = +\cdot906$; $G = -\cdot800$, $H = -\cdot373$, $K = -\cdot470$.

Rough. Some of the readings would be better suited with T_0 later (say 5h.29m.0s.), and an epicentre further N. and E. (say 65°N. 150°W.).

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Sitka	11·1	107	—	—	e 5 17	+20	6·5	6·8
Victoria	22·3	113	5 33	+24	—	—	i 7·8	—
Berkeley z.	31·4	127	e 6 7	−35	—	—	—	—
Chicago	43·7	87	9 50	+86	17 13	?SR_1	23·2	—
Ann Arbor	45·2	82	—	—	e 15 16	− 2	—	—
Toronto	46·1	78	—	—	—	—	24·7	26·3
Ottawa	46·4	74	8 35	− 8	15 30	− 3	e 20·7	—
Ithaca	48·4	77	—	—	e 15 52	− 7	e 23·7	—
Northfield	48·8	72	—	—	—	—	e 22·2	—
Georgetown	50·9	80	e 22 40?	?	i 26 35	?L	(i 26·6)	—
Washington	50·9	80	i 10 7	+55	i 17 33	+63	—	—
Eskdalemuir	60·6	19	e 10 44	+28	i 18 30	− 1	29·7	—
Hamburg	63·9	10	e 10 40	+ 3	i 19 12	0	—	—
De Bilt	64·9	13	—	—	e 19 23	− 1	—	—
Uccle	66·0	14	e 11 16	+25	19 35	− 2	—	—
Vienna	69·6	7	e 11 11	− 4	i 20 23	+ 2	—	—
Toledo	75·6	23	11 26	−27	21 48	+15	—	—
Rocca di Papa	75·8	9	e 11 44	−10	22 10	+35	—	—
Granada	78·2	24	11 57	−11	21 37	−25	—	—
La Paz	103·1	101	18 9	?PR_1	—	—	24·1	25·3

Additional readings: Sitka gives also eN = +4m.5s., LE = +7·4m. Ithaca L = +24·9m. Vienna iPZ = +11m.43s. Rocca di Papa iPN = +11m.46s.

Oct. 6d. Readings also at 0h. (Toronto), 8h. (near Tokyo), 9h. (Florence), 19h. (Eskdalemuir, De Bilt, and near Tokyo), 22h. (La Paz).

Oct. 7d. Readings at 0h. (Eskdalemuir, Zi-ka-wei (2), Tokyo, and La Paz), 1h. (De Bilt), 5h. (La Paz), 9h. (Merida), 11h. (Zi-ka-wei), 13h. (Nagasaki (2), Zi-ka-wei (2), and Hong Kong), 14h. (Eskdalemuir, De Bilt, and Strasbourg), 15h. (Denver), 16h. (Chicago, Ann Arbor, Toronto, Victoria, and Ottawa), 18h. (Zi-ka-wei), 19h. (Zi-ka-wei and near Berkeley), 20h. (Zi-ka-wei).

Oct. 8d. Readings at 1h. (Zi-ka-wei), 2h. (Granada (2), Rocca di Papa, and near Taihoku), 3h. (Hong Kong, Zi-ka-wei, and Granada), 16h. (Ootomari, Zi-ka-wei, and De Bilt), 17h. (Uccle, Batavia, Eskdalemuir, and near Osaka), 20h. and 21h. (near La Paz).

Oct. 9d. Readings at 5h. (near La Paz (2) and near Taihoku), 7h. (near Tokyo), 8h. (La Paz and near Batavia), 9h. (Eskdalemuir and Sydney), 19h. (near Tacubaya (2)), 20h. (near Mizusawa).

Oct. 10d. 22h. 5m. 48s. Epicentre 24°·0N. 121°·0E. (as on 1919 Aug. 28d.).

$A = -\cdot470$, $B = +\cdot783$, $C = +\cdot407$; $D = +\cdot857$, $E = +\cdot515$; $G = -\cdot210$, $H = +\cdot349$, $K = -\cdot914$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Taihoku	1·1	24	0 17	0	(0 28)	− 3	0·5	—
Hong Kong	6·5	257	1 40	+ 1	—	—	—	4·2
Zi-ka-wei	7·2	3	e 1 38	−11	—	—	—	—
De Bilt	85·6	326	—	—	—	—	e 47·2	54·8
Uccle	86·7	326	—	—	—	—	e 47·2	—
Edinburgh	87·2	332	—	—	—	—	—	56·2

De Bilt gives also MN = +55·9m.

Oct. 10d. Readings also at 0h. (Tiflis), 5h. (Marseilles and near Tacubaya (2)), 12h. (near Batavia), 13h. (La Paz), 20h. (Apia), 21h. (Helwan), 22h. (Melbourne).

Oct. 11d. 6h. 44m. 0s. Epicentre 41°·5N. 9°·0E.

A = +·740, B = +·117, C = +·663 ; D = +·156, E = −·988 ; G = +·654, H = +·104, K = −·749.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Rocca di Papa	2·8	85	i 0 48	+ 4	1 24	+ 7	(1·4)	1·5
Florence	2·8	36	0 43	− 1	—	—	—	1·3
Moncalieri	3·6	346	—	—	—	—	e 2·4	—
Pompeii	4·2	98	1 50	?S	(1 50)	− 5	—	—
Padova	4·4	28	0 58	−10	2 22	+21	3·0	3·9
Zurich	5·9	358	e 1 32	+ 1	i 2 43	+ 2	—	3·2
Strasbourg	7·1	352	—	—	e 3 51	?L	e 5·0	—
Vienna	8·5	35	e 1 49	−20	i 3 8	−42	—	3·7
Athens	11·9	102	e 4 39	?S	(e 4 39)	−38	5·0	5·2

Additional readings: Moncalieri gives also L = +5·2m. Padova SR_1 = +2m.30s. Vienna i = +2m.43s.

1922. Oct. 11d. 14h. 49m. 45s. Epicentre 15°·3S. 73°·0W.

A = +·282, B = −·922, C = −·264 ; D = −·956, E = −·292 ; G = −·077, H = +·252, K = −·965.

See note at end on the values of S near Δ = 90°.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
La Paz		4·8	105	i 1 15	+ 1	(2 11)	0	2·2	2·4
La Quiaca	E.	9·7	136	2 39	+13	(4 3)	−18	4·0	6·8
	N.	9·7	136	2 45	+19	(4 3)	−18	4·0	5·6
Pilar	N.	18·4	155	4 9	−13	(7 3)	−46	7·0	10·0
Chacareta	E.	23·3	148	4 3	−77	(8 3)	−88	8·0	8·2
	N.	23·3	148	4 9	−71	(8 3)	−88	8·0	8·6
Cipolletti		24·0	171	1 45	?	—	—	5·4	7·4
Balboa Heights		25·1	345	5 39	0	10 27	+22	14·2	—
Rio Janeiro		29·1	110	i 6 39	+20	11 15	− 4	14·2	17·7
Port au Prince		33·9	0	e 6 56	− 8	12 1	−38	18·7	21·8
Porto Rico	E.	34·3	12	7 2	− 5	12 28	−16	—	—
	N.	34·3	12	6 56	−11	12 21	−23	17·1	21·6
Merida	E.	39·8	336	7 52	− 1	14 23	+20	17·4	20·8
	N.	39·8	336	7 51	− 2	14 21	+18	17·4	20·8
Vera Cruz		41·3	326	7 27	−38	—	—	15·0	19·0
Tacubaya	E.	43·2	322	8 17	− 3	14 59	+ 8	19·4	26·7
	N.	43·2	322	8 20	0	14 56?	+ 5	19·3	23·6
Georgetown		54·4	356	9 42	+ 7	17 26	+12	e 23·8	—
Washington		54·4	356	9 37	+ 2	17 15	+ 1	27·2	—
St. Louis		56·3	344	i 9 50	+ 2	i 17 39	+ 1	e 24·2	32·8
Ithaca		57·8	357	i 9 59	+ 1	18 3	+ 7	29·2	—
Ann Arbor		58·4	350	10 3	+ 2	18 9	+ 5	28·4	26·0
Chicago		58·6	348	10 4	+ 1	17 33	−33	26·3	36·2
Northfield		59·5	1	10 13	+ 4	18 25	+ 8	e 28·4	—
Ottawa		60·8	358	10 16	− 2	18 39	+ 6	e 29·8	—
Denver		62·6	334	9 15	−74	—	—	35·2	—
Lick		69·7	320	i 11 30	+15	i 20 33	+11	i 30·8	37·8
Berkeley		70·5	320	i 11 19	− 1	20 36	+ 4	—	—
Victoria		77·8	329	11 48	−18	(20 39)	−79	20·6	22·9
San Fernando		81·4	49	12 27	0	22 45	− 6	42·0	56·4
Coimbra	E.	81·6	45	12 19	− 9	22 32	−10	39·2	43·9
	N.	81·6	45	—	—	22 36	− 6	40·2	44·0
Rio Tinto		81·7	48	12 45	+16	—	—	—	14·8
Cape Town		83·3	124	12 23	−15	22 36	−24	—	42·8
Granada		83·6	49	i 12 31	− 9	i 22 56	− 9	37·5	43·4
Toledo		84·5	47	i 12 35	−10	i 22 55	−19	e 38·1	46·3
Tortosa		88·0	47	i 12 53	−12	i 23 17	−35	38·4	48·5
Algiers		88·4	51	12 56	−11	i 23 25	−31	38·2	43·2
Barcelona		89·4	47	e 12 27	−45	i 22 55	−72	e 38·9	49·4
Le Mans		90·6	40	e 15 15	?	23 15	−65	—	49·2
Bidston		90·8	35	12 27	−53	25 10	+48	—	50·2
Honolulu	E.	91·1	292	—	—	24 7	−18	42·8	45·2

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Oxford		91·2	37	i 13 13	− 9	i 23 34	−52	30·2	49·3
Eskdalemuir		91·5	32	13 7	−17	23 38	−51	38·2	49·0
Kew		91·6	37	13 15	−10	—	—	—	53·2
Edinburgh		91·8	32	i 13 15	−11	i 23 48	−45	40·2	49·1
Paris		92·3	40	e 14 13	+44	e 23 42	−56	38·2	48·2
Marseilles		92·3	47	e 13 15	−14	23 57	−41	40·2	41·2
Dyce	N.	92·9	30	13 22	−10	23 52	−52	39·0	52·5
Besançon		93·9	43	e 13 25	−12	23 51?	−64	47·2	—
Uccle		94·1	39	13 21	−18	23 53	−64	41·2	49·0
Monalieri		94·4	45	13 12	−28	i 23 58	−62	35·8	57·4
De Bilt		95·0	38	13 27	−16	23 58	−68	e 45·2	49·7
Strasbourg		95·5	41	i 13 30	−16	e 24 6	−65	48·2	49·6
Zurich		95·7	44	i 13 30	−17	i 24 8	−65	—	—
Wellington		95·7	225	e 13 27	−20	i 23 57	−76	43·6	48·2
Florence		96·5	47	13 20	−32	24 5	−76	—	50·2
Rocca di Papa	E.	97·0	49	i 13 35	−19	i 24 9	−77	e 47·4	52·8
Padua		97·4	45	13 38	−18	24 13	−77	—	54·8
Bergen		97·7	29	e 13 15	−43	—	—	53·0	—
Pompeii		98·1	50	13 30	−31	24 0	−97	49·2	59·2
Hamburg		98·2	37	e 13 40	−21	i 24 14	−84	48·2	53·2
Vienna		100·9	43	i 13 52	−23	i 24 28	−96	e 43·2	56·8
Belgrade	E.	103·2	47	e 18 23	?PR_1	i 24 38	−108	29·4	29·4
	N.	103·2	47	18 37	?PR_1	i 24 42	−104	29·5	—
Upsala		103·5	31	e 17 57	?PR_1	i 24 37	−112	e 45·6	55·7
Konigsberg		104·4	37	—	—	e 24 45	−112	—	57·2
Athens		104·7	55	e 17 38	?	i 24 40	−119	—	—
Helwan		109·8	65	e 14 35	−21	25 4	−142	—	63·8
Sydney		115·3	218	19 33	?PR_1	29 27	+75	52·8	59·0
Melbourne		116·1	212	—	—	—	—	—	63·2
Tiflis		120·8	50	e 21 5	?PR_1	e 27 17	−98	52·2	66·2
Adelaide		121·5	209	—	—	—	—	e 45·6	61·2
Tokyo		144·4	310	e 20 43	[+56]	—	—	—	—
Nagya		146·7	312	20 31	[+40]	—	—	—	—
Bombay		147·2	79	20 26	[+35]	—	—	—	—
Osaka		148·0	312	19 58	[+ 5]	—	—	20·6	21·8
Simla	N.	148·5	53	19 57	[+ 3]	—	—	e 82·8	—
Batavia		158·5	180	20 29	[+23]	—	—	74·5	—
Zi-ka-wei	Z.	159·4	323	e 19 59	[− 8]	e 28 15	?	—	96·2
Calcutta	N.	160·9	65	20 38	[+29]	—	—	—	—
Taihoku		163·3	308	—	—	e 32 15	?	—	—
Manila		166·5	268	e 20 36	[+23]	e 31 30	?	50·7	—
Hong Kong		170·2	317	19 49	[−26]	30 5	?	46·2	—

Additional readings and notes: Balboa Heights gives also SN = +10m.35s. Porto Rico PR_1N = +8m.6s., SR_1E = +15m.1s., SR_1N = +15m.6s., LN = +19·2m., T_0 = 14h.49m.51s. Georgetown eLN = +23·2m., LE = +28·4m., LN = +28·8m. Ithaca PR_1 = +12m.33s., eE = +24m.41s. Ann Arbor MN = +34·2m., L = +34·4m., T_0 = 14h.49m.48s. Ottawa PR_1? = +12m.59s., SR_1? = 23m.30s., SR_2 = +25m.35s., T_0 = 14h.49m.40s. Denver readings have been increased by 3h. Lick iE = +20m.39s. Berkeley SN = +20m.37s. San Fernando MN = +49·8m. Coimbra iSE = +22m.38s., iSN = +22m.42s., iE = +23m.16s., iN = +23m.44s., eLN = +34·2m., eLE = +36·2m., T_0 = 14h.49m.49s. Toledo PR_1NE = +15m.53s., PR_1NW = +16m.30s., and +18m.24s., SR_1NE = +29m.20s., and +31m.53s., MNW = +51·2m. Barcelona PR_1 = +17m.5s., i = +23m.15s., +24m.30s., and +25m.55s., SR_1? = +29m.19s., MN = +43·0m., T_0 = 14h.49m.42s. Bidston P = +13m.15s. Honolulu SR_1E = +30m.55s., SR_1N = +30m.25s., SR_2N = +36m.35s., MN = +36·9m., T_0 = 14h.50m.1s. Oxford PR_1 = +17m.12s. Eskdalemuir PR_1 = +16m.51s., PR_2 = +18m.51s., MN = +45·7m. Paris iS = +23m.48s., MN = +46·2m. Uccle PR_1 = +16m.41s., SR_1 = +31m.19s., MN = +51·9m. Moncalieri MN = +54·6m. De Bilt PR_1E = +16m.53s., MN = +51·5m., origin 16°·0S. 73°·0W., T_0 = 14h.50m.39s. Strasbourg P = +13m.33s. and +13m.37s., PR_1 = +17m.9s. MN = +50·9m., T_0 = 14h.50m.36s. Zurich eS = +14m.1s., origin 16°·0S. 73°·0W., T_0 = 14h.50m.29s. Wellington ePR_1 = +17m.21s., e = +21m.57s. i = +26m.15s., SR_1 = +31m.39s. Rocca di Papa PR_1 = +16m.36s., eSN = +24m.12s., eLN = +32·8m. and +42·4m. Bergen PR_1 = +23m.50s. Pompeii PR_1 = +17m.20s. Hamburg PR_1 = +17m.34s., SR_1 = +30m.45s., SR_2 = +36m.21s. Vienna iPR_1 = +18m.4s., PR_2 = +19m.22s., PS = +25m.36s., iE = +27m.19s., i = +28m.1s., SR_1? = +29m.37s., iN = +32m.37s. and +34m.45s. Belgrade PR_1N = +19m.47s., LE = +62·4m., MN = +63·5m. Upsala MN = +57·3m. Konigsberg PR_1? = +18m.34s., i = 24m.48s., PSN? = +26m.6s., MN = +53·2m. Athens ePR_1 = +20m.30s., iE = +25m.32s., SR_1 = +27m.48s. Helwan PR = +19m.0s. Adelaide gives many other readings. Tiflis e = +21m.25s. +26m.50s., +30m.24s., and +36m.42s., MN = +61·4m. Osaka MN = +22·5m. Batavia eLE = +50·2m., eL = +109·5m. Zi-ka-wei PR_1Z = +24m.48s., PSZ = +28m.52s. Calcutta PE = +20m.49s. Manila PR_1E = +25m.15s., PR_1N = +25m.46s.

NOTE TO 1922 OCT. 11d. 14h. 49m. 45s.

The readings for S from near $\Delta = 80°$ to about $\Delta = 110°$ probably refer to something preceding the true S. The residuals can be represented by the formula:—

$$-(\Delta - 80°) \times 4{\cdot}6\text{s.}$$

Δ	O.	C.	O−C.	Δ	O.	C.	O−C.
81°·4	− 6	− 6	0	94°·1	−64	−65	+ 1
81·6	− 8	− 7	− 1	94·4	−62	−66	+ 4
83·3	−24	−15	− 9	95·0	−68	−69	+ 1
83·6	− 9	−17	+ 8	95·5	−65	−71	+ 6
84·5	−19	−21	+ 2	95·7	−65	−72	+ 7
88·0	−35	−37	+ 2	95·7	−76	−72	− 4
88·4	−31	−39	+ 8	96·5	−76	−76	0
89·4	−72	−43	−29	97·0	−77	−78	+ 1
90·6	−65	−49	−16	97·4	−77	−80	+ 3
90·8	+48	−50	(+98)	98·1	−97	−83	−14
91·1	−18	−51	(+33)	98·2	−84	−84	0
91·2	−52	−52	0	100·9	−96	−96	0
91·5	−51	−53	+ 2	103·2	−106	−107	+ 1
91·8	−45	−54	+ 9	103·5	−112	−108	− 4
92·3	−56	−57	+ 1	104·4	−112	−112	0
92·3	−41	−57	+16	104·7	−119	−114	− 5
92·9	−52	−59	+ 7	109·8	−142	−137	− 5
93·9	−64	−64	0	115·3	+75	−162	(+237)
				120·8	−98	−188	(+90)

These results had just been tabulated when a letter was received from Dr. Harold Jeffreys calling attention, in enthusiastic terms, to Prof. Gutenberg's paper *Erdbebenwellen VIIa*, in *Gott. Nach.* 1914, and it was at once seen that the readings tabulated as S refer to Gutenberg's ray S_cP_cS, that is a ray which travels as S until it reaches the liquid core of the earth, is then transformed into P, and finally emerges as S. Since the middle part of its path is decribed with the velocity of P, which is greater than that of S, it naturally arrives before S. The figures given by Gutenberg compare with the adopted tables for S as below:—

Δ	54°	65°	70°	77°	79°·5	87°·0	94°·5	102°
	s.	s.	s.	s.	s.	s.	s.	s.
S_cP_cS	1175	1260	1295	1341	1348	1395	1442	1480
S	1029	1165	1226	1309	1338	1421	1501	1575
$S_cP_cS - S$ =	+146	+95	+69	+32	+10	−26	−59	−95
Formula =	+120	+69	+46	+14	+ 2	−32	−67	−101
Diff.	+ 26	+26	+23	+18	+ 8	+ 6	+ 8	+ 6

It will be seen that throughout the range $\Delta = 80°$ to $\Delta = 110°$ from which the formula $(80° - \Delta) \times 4{\cdot}6$s. was deduced, the difference between it and the value of $S_cP_cS - S$ assigned by Gutenberg is constant at about +7s. It changes a little for values of Δ back to 54°, but this only means that the formula for the difference from S is only approximately linear; and it is rather remarkable that the approximation should be so close. In this region S_cP_cS *follows* S, and is not very likely to be recorded.

But the large negative residuals from S were noticed in 1917 in discussing the observations of 1913 (*The Large Earthquakes of* 1913. *B.A. Seism. Ctee.*, 1917). On p. vii the S−P residuals are divided into five sets as follows, the figures without signs representing the numbers of observations:—

SUMMARY OF APPARENT ALTERNATIVES FOR S−P.

Δ	82°·5	87°·5	92°·5	97°·5	102°·5	107°·5	112°·5	117°·5	125°·0	140°·0
I	—	—	− 2	− 17	− 10	+ 1	− 3	−16	−22	− 27
			10	3	6	7	6	2	4	2
II	−7	−15	− 30	− 59	− 75	−100	−118?	—	−94	−100?
	126	83	40	43	32	6	1	0	14	8
III	?	?	− 66	−100	−136	−180	—	−196	−203	−170?
			14	7	2	3	—	2	11	3
IV	?	−93	−166	—	−196	−276?	−295?	−277	−288	—
		7	1	—	4	1	1	2	9	—
V	—	—	−337?	−315	−340	−375?	—	—	−344	—
			1	1	5	7	—	—	8	—

The quantity S−P was dealt with rather than S alone in order to eliminate errors of time-determination, which were in 1913 more troublesome than in these days of wireless signals. But the errors of P are comparatively small and the large residuals are chiefly due to S.

Now it is easy to identify S_cP_cS with the Set II, which absorbs the greater part of the observations. We may regard Set I as the normal S, and the records at values of Δ exceeding 110° merit further examination; for it is very rare for S to be recorded in that region. Set II or S_cP_cC dies out after 110°, but there are a number of cases under $\Delta = 125°$ and $\Delta = 140°$ which merit attention. Sets III, IV, and V need not be considered at present. There would not be much difficulty in explaining them all as mistakes of whole minutes.

Prof. Gutenberg's explanation of Set II is thus very welcome, and it is much to be regretted that it has been so long overlooked. Copies of some recent papers have been kindly sent to Oxford, but not that of 1914, and in default of the explanation therein given his notation was not understood. Moreover, attention has been chiefly concentrated on tabulating sufficient records in order to obtain corrections to the adopted tables. We now have five years of the *International Summary* (1918-1922), in addition to five years (1913-1917) not so satisfactory, and the residuals are being collected for discussion, beginning with Δ 0°–90°. They show clearly the separation of S from S_cP_cS, and an early opportunity will be taken of exhibiting this distinction for the future.

Oct. 11d. Readings also at 5h. (La Paz), 9h. (Melbourne), 11h. (near Taihoku), 12h. (Hong Kong, Calcutta, Zi-ka-wei, Taihoku, and Batavia), 13h. (De Bilt), 15h. (Melbourne), 18h. (near Tacubaya), 20h. (near Tokyo), 21h. (near Tacubaya), 22h. (La Paz).

Oct. 12d. Readings at 1h. (near La Paz), 4h. (Dehra Dun), 12h. (Taihoku and Tortosa), 13h. (Zi-ka-wei), 15h. and 16h. (Taihoku), 17h. and 18h. (La Paz), 19h. (Colombo), 20h. (near Tacubaya), 22h. (Lemberg), 23h. (La Paz and Melbourne).

Oct. 13d. Readings at 6h. (Lick), 13h. (Zi-ka-wei), 16h. (Colombo), 18h. (Vera Cruz), 19h. (near Merida and Tacubaya), 23h. (near Kobe).

Oct. 14d. 0h. 14m. 50s. Epicentre 19°·0N. 120°·5E.

A = −·480, B = +·815, C = +·326; D = +·862, E = +·507;
G = −·165, H = +·280, K = −·946.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		4·4	173	e 1 9	+ 1	(2 3)	+ 2	2·0	2·5
Hong Kong		6·7	301	1 41	− 1	—	—	3·9	4·6
Zi-ka-wei		12·2	4	e 2 56	− 6	—	—	—	—
Osaka		20·5	37	4 43	− 4	—	—	—	5·7
Colombo		41·3	260	—	—	—	—	—	10·2
De Bilt	E.	89·5	326	—	—	—	—	e 47·2	57·6
	N.	89·5	326	—	—	—	—	e 46·2	56·7
Strasbourg		89·9	323	—	—	—	—	e 57·2	—
Dyce	N.	90·1	333	—	—	—	—	i 50·3	56·2
Uccle		90·6	325	—	—	—	—	e 46·2	—
Eskdalemuir		91·8	332	—	—	e 23 41	−52	45·2	—
Kew		92·7	328	—	—	—	—	—	60·2
La Paz		171·4	74	20 8	[− 7]	—	—	—	—

Additional reading: Osaka MN = +6·4m.

1922. Oct. 14d. { **3h. 56m. 25s.** (I) / **7h. 39m. 5s.** (II) / **23h. 46m. 45s.** (III) } Epicentre **25°·0N. 121°·5E.** (as on 1922 Sept. 18d.).

A = −·472, B = +·773, C = +·423; D = +·853, E = +·522; G = −·221, H = +·360, K = −·906.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I	Taihoku	0·1	22	0 15	+13	—	—	0·5	—
II		0·1	22	0 0	− 2	—	—	0·2	—
III		0·1	22	0 20	+18	—	—	0·5	—
I	Hokoto	2·6	231	—	—	1 1	−11	1·5	—
II		2·6	231	1 8	?S	(1 8)	− 4	1·6	—
III		2·6	231	0 45	+ 4	—	—	1·2	1·9
I	Zi-ka-wei	6·2	359	e 1 37	+ 2	e 3 24	?L	(e 3·4)	4·3
II		6·2	359	e 1 35	0	e 3 17	?L	(e 3·3)	—
III		6·2	359	1 41	+ 6	e 3 16	?L	(e 3·3)	—
I	Hong Kong	7·1	249	1 49	+ 1	—	—	4·1	5·1
II		7·1	249	1 45	− 3	4 5	+52	4·7	5·1
III		7·1	249	1 45	− 3	—	—	3·4	4·8
I	Manila	10·4	183	e 2 35	− 1	—	—	6·0	8·9
II		10·4	183	e 2 35	− 1	—	—	—	—
III		10·4	183	e 2 55	+19	—	—	6·4	—
I	Nagasaki	10·7	42	2 40	0	—	—	—	—
III		10·7	42	2 40	0	(4 50)	+ 2	4·8	9·2
I	Kobe	15·3	48	—	—	—	—	—	12·0
III		15·3	48	3 56	+13	7 3	+24	10·2	10·8
I	Osaka	15·5	48	3 47	+ 1	(7 1)	+17	7·0	11·6
II		15·5	48	3 43	− 3	—	—	7·0	10·2
III		15·5	48	3 45	− 1	(7 1)	+17	7·0	11·2
III	Nagoya	16·8	49	3 59	− 3	—	—	10·6	14·8
I	Tokyo	19·0	51	e 3 38	−51	e 7 20	−42	—	—
III		19·0	51	e 3 41	−48	7 11	−51	—	15·3
III	Mizusawa E.	21·8	45	5 10	+ 7	9 4	+ 3	—	—
III	N.	21·8	45	5 5	+ 2	9 6	+ 5	—	—
III	Ootomari	27·5	33	5 40	−23	11 44	+54	16·0	17·8
I	Calcutta E.	30·3	273	14 11	?L	—	—	19·0	—
I	N.	30·3	273	14 30	?L	—	—	19·2	—
III	E.	30·3	273	6 46	+15	12 10	+31	17·8	19·8
III	N.	30·3	273	6 17	−14	11 24	−15	17·0	19·7
III	Batavia	34·3	207	i 6 42	−25	—	—	—	—
III	Dehra Dun	38·5	288	8 15	?	—	—	—	—
III	Simla E.	39·2	290	11 33	?	—	—	21·6	22·2
III	N.	39·2	290	e 13 27	?S	(e 13 27)	−27	21·4	—
III	Bombay	45·2	273	e 11 35	?PR_1	—	—	—	—
III	Tiflis	64·0	307	e 11 44	+66	e 19 20	+ 7	e 35·2	41·5
III	Sydney	65·4	153	19 21	?S	(19 21)	− 9	30·8	36·8
III	Melbourne	66·6	160	—	—	—	—	—	36·6
III	Upsala	75·1	330	11 54	+ 4	e 21 31	+ 4	e 39·8	48·5
III	Konigsberg	75·6	325	i 11 57	+ 4	21 41	+ 8	e 39·3	48·2
III	Helwan	77·9	297	12 7	+ 1	22 0	+ 1	—	50·5
III	Belgrade	79·9	315	—	—	—	—	e 44·8	—
III	Bergen	80·1	334	24 28	?S	(24 28)	+124	52·2	—
III	Vienna	80·8	320	12 23	− 1	22 37	+ 4	e 40·2	48·6
I	Hamburg	81·8	327	—	—	—	—	e 44·6	—
III		81·8	327	e 12 28	− 1	e 22 45	+ 1	e 43·2	52·2
I	De Bilt	85·0	327	—	—	—	—	e 43·6	49·6
II		85·0	327	—	—	—	—	e 43·9	—
III		85·0	327	12 41	− 7	23 8	−11	e 41·2	49·9
I	Dyce N.	85·1	334	—	—	—	—	—	44·6
III		85·1	334	e 16 0	?PR_1	23 5	−15	33·2	49·2
I	Strasbourg	85·6	323	—	—	—	—	e 60·6	—
III		85·6	323	e 12 41	−10	e 23 33	+ 7	46·2	56·6
III	Zurich	85·8	321	e 12 56	+ 4	e 23 38	+10	—	—
I	Uccle	86·1	326	—	—	—	—	e 42·6	49·6
III		86·1	326	e 12 51	− 3	e 23 15	−16	e 42·2	57·0
III	Florence	86·1	319	23 11	?S	(23 11)	−20	—	51·2
III	Rocca di Papa	86·3	315	i 12 56	+ 1	21 33	−120	e 42·2	56·4
I	Edinburgh	86·4	333	—	—	—	—	e 46·6	—
III		86·4	333	—	—	e 23 27	− 7	e 43·2	55·9
III	Eskdalemuir	86·8	333	e 13 0	+ 2	e 23 15	−24	42·2	48·1
III	Besançon	87·4	323	e 12 27	−34	23 35	−10	49·2	—

Continued on next page.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
III Moncalieri	87·6	320	13 6	+ 3	23 28	−20	34·7	56·7
III Kew	88·0	329	25 15	?	—	—	—	63·2
III Bidston	88·0	330	25 8	?	36 15	?L	(36·2)	39·2
III Paris	88·3	325	8 57	?	—	—	46·2	55·2
I Oxford	88·3	329	—	—	—	—	46·4	49·1
III	88·3	329	—	—	i 23 44	−11	46·6	54·8
III Marseilles	89·9	320	—	—	e 23 15	−58	43·2	60·2
III Barcelona	92·9	320	—	—	—	—	e 40·2	53·2
III Berkeley	93·3	45	—	—	—	—	e 55·2	—
III Tortosa	94·3	321	17 18	?PR_1	23 52	−67	e 36·2	61·9
III Algiers	95·2	316	—	—	—	—	e 54·2	63·2
I Toledo	97·6	322	—	—	—	—	e 53·6	—
III	97·6	322	—	—	—	—	e 47·2	—
III Granada	99·1	319	—	—	—	—	55·0	58·0
III Coimbra E.	99·8	325	12 27	?	25 27	−27	48·8	56·8
III N.	99·8	325	—	—	24 16	−98	50·8	59·7
III San Fernando	101·1	320	50 39?	?L	—	—	(50·6)	60·8
III Ottawa	107·9	13	e 20 33	?PR_1	e 25 15	−114	48·8	—
III Chicago	108·0	22	19 45	?PR_1	28 40	+90	e 51·2	—
III Ann Arbor	108·8	20	—	—	—	—	e 51·2	—
III Ithaca	110·5	14	—	—	—	—	53·8	—
III Georgetown	113·8	15	—	—	—	—	e 61·6	—
III Washington	113·8	15	—	—	e 26 30	−90	e 63·2	—
III Cape Town	113·9	242	—	—	—	—	—	64·2
III Cipolletti	163·9	152	75 3	?L	—	—	106·4	108·6
III La Paz	167·7	49	20 19	[+ 5]	—	—	—	—
III Andalgala	172·6	113	71 9	?L	—	—	(71·2)	—

Additional readings and notes: Zi-ka-wei I gives also MZ = +4·8m., T_e = 23h.46m.28s. Nagasaki III MN = +11·8m. Kobe I MN = +11·5m. Osaka I MN = +10·9m., II MN = +11·0m., III MN = +10·8m. Nagoya III MN = +11·6m. Ootomari III MN = +23·2m. Tiflis III e = +23m.38s., MN = +40·5m. Reading given as for 13d. Upsala III MN = +46·9m. Konigsberg III SN = +21m.47s., MN = +42·2m., T_e = 23h.46m.47s. Belgrade III L(M) = +57·9m. Vienna III eN = +25m.9s., eE = +32m.32s., e = +41m.47s., eL? = +43·6m., eE = +44m.49s. De Bilt I MN = +49·8m., MZ = +55·7m., III SR_1 = +29m.16s., MZ = +55·7m., T_e = 23h.46m.57s. Strasbourg III MN = +49·8m. Uccle III SR_1 = +29m.9s., MN = +50·7m. Rocca di Papa III eP = +13m.33s. Eskdalemuir III SR_1 = +29m.15s., SR_2 = +33m.15s., MN = +53·1m. Moncalieri III MN = +56·4m. Paris III MN = +57·2m. Coimbra III eE = +20m.18s., eN = +20m.35s.(?PR_1), T_e = 23h.45m.1s. San Fernando III MN = +67·4m. Ottawa III eE = +29m.27s., eLE = +44·2m. Chicago III L = +59·2m. Ann Arbor III L = +66·8m. Ithaca III e = +47m.15s., L = +57·2m., +62·2m., and +70·2m. Georgetown III eN = +46m.15s., LE = +62·2m., LN = +66·6m. Washington III L = +70·2m.

Oct. 14d. Readings also at 0h. (La Paz), 3h. (Taihoku), 5h. and 6h. (near Lick), 7h. (Belgrade), 9h. (Batavia), 12h. (near Rocca di Papa), 15h. (La Paz), 17h. (Mizusawa and near Port au Prince), 18h. (Colombo), 23h. (Ottawa, Chicago, and near Taihoku (3)).

Oct. 15d. Readings also at 0h. (Zi-ka-wei and near Taihoku), 1h. (Zi-ka-wei, La Paz, and near Taihoku (2)), 2h. (Cipolletti), 4h. (near Tacubaya and Victoria), 7h. (La Paz), 8h. (near Taihoku), 9h. (La Paz and near Taihoku), 12h. (Taihoku), 15h. (Nagoya), 18h. (Colombo), 22h. (La Paz).

1922. Oct. 16d. 16h. 1m. 25s. Epicentre 39°·5N. 91°·5E.

A = −·020, B = +·771, C = +·636 ; D = +1·000, E = +·026 ;
G = −·017, H = +·636, K = −·772.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Simla	E.	14·3	239	e 3 5	−25	—	—	7·0	—
	N.	14·3	239	e 3 17	−13	—	—	7·4	—
Calcutta	E.	17·2	190	4 16	+ 9	7 6	−16	10·4	—
	N.	17·2	190	4 11	+ 4	7 28	+ 6	10·6	—
Zi-ka-wei		25·6	100	e 5 47	+ 3	e 10 32	+18	—	17·1
Hong Kong		25·8	125	10 28	?S	(10 28)	+10	14·4	15·1
Bombay		26·1	223	2 30	?	—	—	—	—
Colombo		34·2	203	12 5	?S	(12 5)	−38	19·2	19·9
Tiflis		35·1	289	e 7 0	−14	e 12 20	−37	16·5	18·6
Manila		35·9	128	e 7 24	+ 3	—	—	21·6	—
Ootomari		37·4	63	20 20	?	—	—	21·0	21·6
Batavia		47·8	161	e 8 52	− 1	—	—	26·7	—
Konigsberg		48·3	314	i 8 47	− 9	15 47	− 9	19·2	27·6
Upsala		48·9	321	8 55	− 4	15 57	− 8	—	29·8
Helwan		49·5	278	i 8 49	−15	15 55	−18	—	35·1
Belgrade	E.	51·2	302	e 8 58	−16	e 16 23	−11	e 28·5	35·1
	N.	51·2	302	e 9 10	− 4	e 17 16	+42	e 29·0	34·0
Vienna		52·6	308	i 9 20	− 4	16 47	− 4	28·0	34·6
Bergen		54·6	323	9 37	0	21 55	?SR_1	29·3	—
Hamburg		54·6	316	i 9 36	− 1	—	—	—	29·6
Pompeii		56·8	299	e 9 28	−23	—	—	—	—
Rocca di Papa		57·6	301	i 9 53	− 3	17 53	− 1	e 25·6	40·1
Florence		57·7	305	9 35	−22	—	—	—	32·7
Zurich		57·8	308	9 57	− 1	—	—	e 23·8	—
De Bilt		57·8	315	—	—	e 17 55	− 1	e 30·6	31·6
Strasbourg		57·8	310	9 57	− 1	17 57	+ 1	28·6	34·9
Uccle		58·8	314	e 10 4	0	e 18 11	+ 2	28·6	36·8
Dyce	N.	59·4	323	10 29	+21	18 39	+23	—	33·6
Moncalieri		59·4	307	i 10 7	− 1	21 41	?SR_1	31·6	36·7
Besançon		59·5	309	e 10 12	+ 3	—	—	31·6	—
Edinburgh		60·5	320	e 10 23	+ 7	—	—	—	41·2
Eskdalemuir		60·8	320	i 10 21	+ 3	18 37	+ 4	28·1	38·1
Paris		60·8	313	e 13 52	?PR_1	e 22 20	?SR_1	31·6	37·6
Kew		61·1	316	—	—	—	—	—	41·6
Oxford		61·5	316	10 24	+ 2	18 45	+ 3	29·9	39·2
Bidston		61·7	318	15 10	?PR_1	27 5	?L	(27·1)	40·8
Barcelona		64·7	305	—	—	—	—	e 35·2	44·0
Tortosa		66·0	306	10 55	+ 4	19 33	− 4	26·7	39·5
Toledo		69·5	307	11 16	+ 2	20 28	+ 8	e 30·0	45·4
Granada		70·7	304	i 10 38	−43	—	—	—	—
Coimbra		72·0	310	—	—	e 21 18	+28	38·2	—
San Fernando	E.	72·8	305	—	—	—	—	—	48·8
Victoria		86·8	23	—	—	—	—	—	53·7
Ottawa		94·3	352	—	—	—	—	e 50·6	—
Ann Arbor		98·1	356	—	—	—	—	e 48·6	—
Chicago		98·7	0	—	—	—	—	55·4	—
Georgetown	N.	100·9	352	—	—	—	—	e 50·3	—
La Paz		150·9	317	20 0	[+ 3]	—	—	—	—

Additional readings : Zi-ka-wei gives also MN = +15·7m. Tiflis e = +8m.6s. and +14m.37s., MN = +22·6m. Batavia i = +10m.43s. Konigsberg PE = +8m.53s., iE = +9m.53s., E = +11m.41s., SE = +16m.47s., MN = +25·6m., MZ = +28·6m. Upsala PR_1 = +10m.53s., MN = +26·2m. Helwan PR_1 = +10m.43s. Belgrade PR_1E = +11m.29s., PR_2E = +12m.56s., PR_2N = +13m.47s., LE = +31·8m., L = +43·1m. Vienna iPE = +9m.23s. (O − C = −1), iN = +9m.48s., iE = +10m.10s., PR_1 = +11m.23s., iE = +17m.14s., SR_1 = +21m.48s., e = +24m.8s., i = +28m.37s. Hamburg e = +21m.35s. and +28m.35s. Rocca di Papa PR_1N = +12m.11s., SE = +17m.47s. Strasbourg PR_1 = +12m.10s., PR_2 = +13m.21s., SR_1 = +21m.52s., MN = +31·4m. Uccle SR_1 = +22m.28s., MN = +32·6m. Moncalieri i = +10m.7s., MN = +37·2m. Eskdalemuir PR_2 = +13m.53s. Paris MN = +32·6m. Oxford PR_1 = +14m.3s. Barcelona e = +24m.13s. Toledo MNW = +44·2m. Granada LM = +10m.46s. Coimbra ePE? = +4m.55s., ePN? = +5m.55s., eS? = +13m.52s., LN = +39·4m. San Fernando MN = +47·2m. Ottawa e?E = +43m.5s., L = +55·6m. Ann Arbor L = +56·6m. Chicago e = +44m.35s. Georgetown eN? = +41m.35s., eE = +46m.35s.

Oct. 16d. Readings also at 0h. (Bidston), 2h. (De Bilt, Hamburg, and Bergen), 3h. (Bergen, Uccle, and Eskdalemuir), 4h. (Uccle, Eskdalemuir, Oxford, Hamburg, and De Bilt), 6h. (Algiers), 10h. (near Mostar), 15h. (near Tacubaya), 16h. (Batavia and Granada), 20h. (Colombo).

Oct. 17d. 6h. 37m. 54s. Epicentre 12°·0N. 95°·0E. (as on 1918 Dec. 16d.).

A = −·085, B = +·974, C = +·208; D = +·996, E = +·087; G = −·018, H = +·207, K = −·978.

The La Paz [P] suggests a high focus, say −·030, and if the epicentre be moved to 18°·0N. 97°·0E., as on 1919 Sept. 8, this would suit all the observations except those of Hong Kong and Batavia. If by chance the latter were 1 min. in error, the hypothesis might be defended.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Calcutta	N.	12·3	330	3 5	+ 2	7 25	?L	11·0	15·0
Colombo		15·8	252	—	—	—	—	—	11·1
Kodaikanal		17·3	266	9 30	?S	(9 30)	+125	11·6	14·0
Hong Kong		21·0	58	4 43	−10	8 46	+ 2	11·0	14·1
Batavia		21·6	150	4 54	− 6	—	—	i 12·0	—
Simla	N.	25·2	322	e 5 48	+ 8	—	—	—	—
Manila		25·5	83	e 5 28	−15	—	—	i 13·7	17·4
Taihoku		28·2	62	e 5 9	−61	—	—	—	—
Zi-ka-wei		31·0	48	—	—	e 11 33	−18	(e 15·8)	20·2
Nagasaki		38·0	52	21 5	?L	—	—	(21·1)	—
Kobe	E.	42·8	51	—	—	—	—	—	28·5
Osaka		43·1	51	7 0	−79	—	—	—	30·7
Tokyo		46·7	50	—	—	—	—	e 24·9	—
Melbourne		68·3	139	—	—	—	—	e 25·4	43·4
Konigsberg		71·2	325	—	—	e 20 37	− 3	—	47·1
Upsala		73·3	330	11 40	+ 2	21 0	− 6	e 40·9	46·9
Vienna		73·5	316	e 11 41	+ 2	e 21 46	+38	e 40·1	49·4
Rocca di Papa		76·3	312	e 12 54	+57	25 24	?	e 36·4	56·3
Florence		77·2	315	—	—	—	—	—	49·1
Hamburg		77·4	323	e 12 2	− 1	e 21 56	+ 3	e 47·1	53·5
Strasbourg		79·2	319	—	—	—	—	e 46·1	—
De Bilt		80·5	320	12 24	+ 2	e 22 29	0	e 42·1	55·0
Dyce	N.	83·7	328	23 25	?S	(23 25)	+19	46·3	52·9
Kew		83·8	321	50 6	?L	—	—	(50·1)	59·1
Oxford		84·4	321	—	—	22 54	−18	46·9	56·6
Edinburgh		84·6	326	—	—	e 33 6	?	48·1	56·1
Bidston		85·1	322	—	—	—	—	—	58·1
Granada		89·4	309	13 3	− 9	—	—	—	—
Coimbra		92·2	313	e 18 6	?PR$_1$	e 28 6	?SR$_1$	e 50·1	—
Victoria		110·7	27	—	—	—	—	60·6	67·1
Ottawa		122·0	351	—	—	—	—	e 59·1	—
Toronto		124·1	355	—	—	—	—	78·7	—
Ann Arbor		125·7	357	—	—	—	—	e 62·1	—
La Paz		163·1	253	20 29	[+19]	—	—	—	—

Additional readings and notes: Batavia gives also i = +13m.34s. and +16m.52s. Manila MN = +17·1m. Zi-ka-wei MN = +20·4m. Nagasaki L = +23·3m. Kobe MN = +26·6m. Osaka MN = +27·2m. Konigsberg iE = +20m.46s., MN = +42·1m. Upsala MN = +44·0m. Vienna iPZ = +11m.43s. Hamburg MN = +51·6m. De Bilt MN = +49·6m. Dyce S = +34m.30s. All readings have been diminished by 1h. Eskdalemuir (Δ = 84°·7, Az. = 323°), gives simply 7h. Coimbra e = +34m.6s., LN = +56·1m. and +65·1m. Ottawa e? = +54m.6s., LE = +72·6m.

Oct. 17d. 9h. 56m. 0s. Epicentre 12°·0N. 95°·0E. (as at 6h.).

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Calcutta	12·3	330	3 16	+13	—	—	—	—
Colombo	15·8	252	—	—	—	—	7·5	10·5
Kodaikanal	17·3	266	6 18	+129	—	—	—	—
Hong Kong	21·0	58	—	—	—	—	—	13·0
Batavia	21·6	150	e 4 50	−10	—	—	i 10·4	—
Manila	25·5	83	e 6 0	+17	—	—	14·4	15·9
Zi-ka-wei	31·0	48	—	—	e 12 50	+59	—	19·4
Melbourne	68·3	139	—	—	—	—	e 31·4	43·3

Additional readings: Batavia gives also iE = +6m.35s., i = +13m.16s., Zi-ka-wei MN = +22·1m.

Oct. 17d. **Readings** also at 3h. (near Taihoku), 5h. (near Lick), 6h. (Malaga), 8h. (near Hong Kong), 11h. (near Tacubaya), 12h. (near Port au Prince and near Oaxaca), 16h. (Dehra Dun, Port au Prince, and near Algiers), 17h. (Colombo, Manila, Hong Kong, Calcutta, Malaga, Almeria, and near Granada), 18h. (Zi-ka-wei, and Batavia), 21h. (Batavia, Manila, and Calcutta).

Oct. 18d. Readings at 2h. (near Tortosa and near La Paz), 3h. (near Taihoku), 6h. (near La Paz), 13h. (Manila), 22h. (Manila), 23h. (near Tiflis).

Oct. 19d. Readings at 0h. and 1h. (Tiflis), 3h. (near La Paz), 4h. (Tiflis), 14h. (Eskdalemuir, Hamburg, Tiflis, and near Batavia).

Oct. 20d. 20h. 22m. 48s. Epicentre 37°·0N. 10°·0W.

$A = +\cdot787$, $B = -\cdot139$, $C = +\cdot602$; $D = -\cdot174$, $E = -\cdot985$; $G = +\cdot593$, $H = -\cdot105$, $K = -\cdot799$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
San Fernando	3·1	100	0 51	+ 2	1 24	− 2	—	3·0
Coimbra	3·5	21	1 2	+ 7	1 37	0	1·8	1·8
Malaga	4·5	92	1 59	?S	(1 59)	− 5	—	—
Granada	5·1	86	i 1 21	+ 2	i 2 24	+ 4	i 2·5	3·0
Toledo	5·5	57	1 26	+ 1	2 35	+ 4	e 3·0	3·5
Almeria	6·1	89	1 33	0	—	—	—	—
Alicante	7·6	77	1 37	−18	—	—	—	—
Tortosa	9·0	62	3 19	?S	(3 19)	−44	4·1	4·3
Barcelona	10·4	61	e 5 2	?	6 12	?L	(6·2)	—
Moncalieri	15·6	53	—	—	—	—	e 8·4	—
Uccle	17·2	32	e 4 6	− 1	e 7 36	+14	e 8·7	—
Rocca di Papa	18·1	68	i 4 17	− 1	—	—	e 11·9	—
De Bilt	18·5	30	—	—	8 5	+14	e 9·4	11·3
Pompeii	19·4	71	e 9 22	?L	—	—	(e 9·4)	—
Vienna z.	22·3	51	5 1	− 8	—	—	—	—

Additional readings and notes: San Fernando gives also MN = +3·7m. Granada MN = +2·7m. Toledo MN = +4·0m., MZ = +3·7m. Barcelona i = +6m.7s. De Bilt MN = +10·9m., MZ = +12·9m. Vienna reading is given as at 21h.

Oct. 20d. Readings also at 1h. (Tiflis (2) and near Manila), 4h. (La Paz), 7h. (near Mizusawa and Tokyo), 8h. (Mizusawa, Tokyo, and La Paz), 9h. (La Paz), 13h. (near Manila), 22h. (Florence).

Oct. 21d. Readings at 0h. (near Barcelona and Tortosa), 8h. (Lick), 14h. and 15h. (near Tiflis), 18h. (Moncalieri), 20h. (Manila and Strasbourg), 22h. (Manila and La Paz).

Oct. 22d. Readings at 1h. (Moncalieri), 6h. (La Paz, Tortosa, Almeria, Toledo, and near Granada), 8h. (Colombo, Zi-ka-wei, and Tiflis), 17h. (Manila and near Nagasaki).

Oct. 23d. Readings at 1h. (Batavia), 2h. (La Paz), 3h. (near Manila), 6h. (Ootomari, Tokyo, and near Mizusawa), 17h. (Zi-ka-wei and near Tacubaya (4)), 18h. (Hong Kong and De Bilt), 20h. (near La Paz), 22h. (Tortosa).

1922 Oct. 24d. 21h. 21m. 0s. Epicentre 47°·3N. 151°·5E.

(as on 1922 May 6d.).

A = −·596, B = +·324, C = +·735; D = +·477, E = +·879; G = −·646, H = +·351, K = −·678.

A depth of focus 0·010 is assumed (see Note at end).

		Corr. for Focus	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	°	m. s.	s.	m. s.	s.	m.	m.
Ookmari		0·0	6·0	267	1 40	+ 8	—	—	3·0	3·8
Mimasawa	E.	−0·1	11·1	226	2 43	− 1	4 37	−17	—	—
Tokyo		−0·2	14·5	221	3 20	−10	6 15	0	e 9·2	—
Nagoya		−0·3	16·3	227	3 42	−10	(6 54)	− 1	6·9	7·0
Osaka		−0·3	17·4	230	4 11	+ 5	(7 29)	+ 9	7·5	9·8
Kobe		−0·3	17·6	230	4 6	− 3	(7 23)	− 2	7·4	7·8
Nagasaki		−0·4	21·9	236	5 1	+ 2	(8 59)	+ 4	9·0	9·2
Zi-ka-wei		−0·6	28·0	246	i 5 58	− 4	e 10 36	−12	—	16·2
Taihoku		−0·7	32·5	237	6 20	−25	12 14	+ 9	16·7	—
Hong Kong		−0·8	38·9	242	7 26	−13	(13 17)	−22	13·3	22·0
Manila		−0·8	41·4	229	e 7 43	−17	—	—	—	—
Sitka	E.	−0·9	43·6	50	8 5	−11	14 34	−10	20·9	23·9
Honolulu	N.	−1·0	48·0	104	i 8 37	−10	i 15 30	−11	22·0	22·1
Victoria		−1·1	54·1	55	(9 41)	+15	—	—	9·7	30·8
Calcutta	E.	−1·1	55·6	269	9 40	+ 4	17 40	+25	26·3	—
	N.	−1·1	55·6	269	9 50	+14	17 28	+13	—	—
Simla	E.	−1·2	57·5	282	9 30	−18	19 42	+124	e 32·6	—
	N.	−1·2	57·5	282	9 48	0	17 36	− 2	e 34·9	—
Berkeley	E.N.	−1·2	60·9	65	e 10 13	+ 3	18 25	+ 6	e 29·4	35·9
Lick	N.	−1·2	61·7	65	e 10 14	− 2	i 18 35	+ 5	i 28·5	34·2
Batavia		−1·2	66·4	230	i 10 48	+ 2	i 19 28	+ 1	e 33·0	—
Upsala		−1·2	66·5	337	i 10 51	+ 4	—	—	e 32·3	40·2
Bombay		−1·3	68·7	276	12 6	+66	21 9	+74	36·7	42·9
Bergen		−1·3	68·8	345	i 11 11	+10	(20 10)	+14	20·2	—
Konigsberg	E.	−1·3	69·8	332	11 13	+ 5	20 15	+ 7	—	43·0
	N.	−1·3	69·8	332	11 11	+ 3	20 10	+ 2	—	—
Tiflis		−1·3	69·9	310	e 12 13	+65	i 22 15	+66	37·0	44·2
Kodaikanal		−1·3	71·7	268	12 36	+77	(21 18)	+47	21·3	21·6
Colombo		−1·3	72·5	263	11 30	+ 6	(21 12)	+32	21·2	22·5
Dyce	N.	−1·3	73·2	347	11 33	+ 4	20 56	+ 7	—	36·5
Hamburg		−1·3	74·0	338	i 11 37	+ 3	i 21 3	+ 5	e 37·0	43·0
Edinburgh		−1·3	74·7	347	e 11 44	+ 6	i 21 9	+ 2	36·0	47·8
Kakioka		−1·3	75·2	347	i 11 45	+ 4	21 16	+ 3	36·5	—
De Bilt		−1·3	76·5	340	i 11 54	+ 4	i 21 34	+ 6	e 36·0	44·2
Chicago		−1·3	76·7	41	i 13 27	+96	i 22 39	+69	36·8	—
Vienna		−1·3	76·8	332	i 11 55	+ 3	21 34	+ 2	e 35·5	51·0
Hobson		−1·3	77·0	345	12 58	+65	22 35	+61	—	23·3
West Bromwich		−1·3	77·6	345	21 40	?S	(21 40)	− 1	—	—
Uccle		−1·3	77·9	340	i 12 1	+ 2	21 47	+ 3	36·0	44·6
St. Louis		−1·3	78·0	46	i 12 30	+31	i 21 48	+ 3	e 36·4	—
Ann Arbor		−1·3	78·2	38	12 24	+24	21 42	− 6	47·2	—
Oxford		−1·3	78·3	345	i 12 2	+ 1	i 21 49	0	—	—
Kew		−1·3	78·3	345	22 0	?S	(22 0)	+11	—	50·0
Belgrade		−1·3	78·4	327	i 12 5	+ 3	i 21 49	− 1	e 40·5	55·2
Ottawa		−1·3	78·5	31	12 26	+24	21 49	− 2	40·0	—
Toronto		−1·3	78·6	35	13 18	+75	22 36	+44	e 41·8	59·8
Strasbourg		−1·3	79·1	337	i 12 7	+ 1	i 22 3	+ 5	38·0	47·0
Innsbruck		−1·3	79·2	335	i 12 8	+ 2	e 22 2	+ 3	e 38·0	—
Zurich		−1·3	80·0	336	i 12 12	+ 1	i 22 9	+ 1	—	—
Paris		−1·3	80·2	341	i 12 14	+ 2	i 22 12	+ 1	43·0	46·0
Mostar		−1·3	80·5	327	i 12 17	+ 3	e 21 8	−66	e 41·0	—
Northfield		−1·3	80·6	30	12 45	+30	22 20	+ 5	e 38·0	—
Besançon		−1·3	80·8	338	e 12 25	+ 9	22 21	+ 3	29·0	—
Ithaca		−1·3	80·8	34	e 12 30	+14	22 10	− 8	35·0	—
Sydney		−1·3	81·1	180	13 30	+72	22 24	+ 3	31·2	38·2
Le Mans		−1·3	81·5	342	—	—	24 0	+95	—	48·0
Moncalieri		−1·3	82·4	336	12 22	− 4	22 30	− 9	37·4	50·0
Florence		−1·3	82·4	333	12 19	− 7	22 23	−16	—	41·5
Fordham		−1·4	82·8	34	e 12 28	+ 1	e 22 36	− 3	35·0	—
Athens		−1·4	82·9	321	12 26	− 2	i 22 36	− 5	e 45·0	47·4
Puy de Dôme		−1·4	82·9	340	12 30	+ 2	22 40	− 1	47·0	—
Adelaide		−1·4	83·1	191	e 11 0	−89	(e 22 30)	−13	i 22·5	22·8
Georgetown	E.	−1·4	83·5	37	e 12 38	+ 7	i 22 44	− 3	e 37·8	—
	N.	−1·4	83·5	37	e 12 36	+ 5	22 44	− 3	48·4	—

Continued on next page.

		Corr. for Focus	△	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	°	m. s.	s.	m. s.	s.	m.	m.
Washington		−1·4	83·5	37	13 43	+72	23 47	+60	40·3	—
Rocca di Papa		−1·4	83·8	330	i 12 31	− 1	e 22 42	− 8	34·3	58·9
Pompeii		−1·4	84·0	329	12 15	−19	22 35	−18	32·0	46·0
Marseilles		−1·4	84·6	337	e 12 45	+ 8	23 0	+ 1	42·0	54·0
Melbourne		−1·4	85·3	185	13 6	+25	i 23 6	− 2	39·0	41·4
Perth		−1·4	85·5	210	13 6	+23	(23 8)	− 1	23·1	—
Helwan		−1·4	86·0	312	i 12 42	− 4	22 58	−17	—	57·1
Barcelona		−1·4	87·2	338	12 50	− 2	i 23 24	− 4	41·7	50·8
Tacubaya		−1·4	88·1	64	12 6	−51	22 11	−87	—	—
Tortosa		−1·4	88·2	339	12 49	− 9	23 13	−26	40·0	51·2
Toledo		−1·4	90·2	343	12 59	−10	23 25	−36	e 38·2	56·7
Coimbra	E.	−1·4	90·8	346	12 55	−17	23 26	−41	e 39·3	53·5
	N.	−1·4	90·8	346	—	—	—	—	44·0	55·7
Wellington		−1·4	91·0	164	e 13 42	+28	23 18	−52	42·0	44·0
Algiers		−1·4	91·3	335	13 6	− 9	23 21	−52	37·0	57·5
Granada		−1·4	92·6	341	i 13 20	− 2	24 16	−10	33·0	38·8
Rio Tinto		−1·4	92·7	344	25 0	? S	(25 0)	+33	—	58·0
San Fernando		−1·4	93·9	343	13 12	−18	23 48	−52	46·0	58·2
La Paz		—	135·2	60	i 19 28	[− 2]	33 6	?	65·0	67·2
La Quiaca	E.	—	140·9	63	22 48	? PR_1	—	—	28·9	30·2
Cape Town		—	142·5	274	19 30	[−14]	—	—	70·0	89·5
Andalgala	N.	—	144·6	70	20 30	[+42]	—	—	—	70·2
Pilar	E.	—	149·0	73	20 54	[+60]	—	—	78·3	86·0
	N.	—	149·0	73	21 0	[+66]	—	—	81·3	84·4
Cipolletti		—	150·3	88	22 42	? PR_1	—	—	45·5	46·3

Additional readings and notes: Ootomari gives also MN = +3·4m. Mizusawa SN = +4m.38s. Nagoya MN = +7·4m. Osaka MN = +7·5m. Kobe MN = +7·7m. Nagasaki MN = +9·4m. Readings all given as at 19h. Zi-ka-wei MN = +17·2m., T_0 = 21h.21m.3s. Sitka SR_1N = +17m.59s., MN = +18·6m., T_0 = 21h.20m.54s. Honolulu iPR_1N = +10m.29s., T_0 = 21h.20m.56s. Berkeley iPZ = +10m.12s. Lick ePZ = +10m.12s., ePE = +10m.20s., iZ = +10m.39s. Batavia i = +13m.48s. and +40m.24s. Upsala iN = +21m.25s., MN = +41·2m. Bergen S = +15m.29s. (?PR_1). Tiflis e = +13m.16s. and +18m.10s., eN = +31m.50s., MN = +65·7m. All readings given as on 25d. Konigsberg PZ = +11m.12s., PR_2 = +16m.10s., PS = +20m.58s., SR_1 = +29m.20s. Colombo S = +17m.42s. Hamburg PS = +21m.48s., SR_1 = +26m.48s., SR_3 = +30m.48s., T_0 = 21h.21m.10s. Edinburgh i = +21m.56s., SR_1 = +26m.44s. Eskdalemuir PR_1 = +15m.10s. De Bilt MN = +43·0m., MZ = +53·8m. Chicago PR_1 = +16m.30s., PR_2 = +18m.30s., SR_1 = +27m.47s. Vienna iN = +12m.26s., PR_1 = +15m.24s., iE = +19m.4s., iN = +21m.0s., i = +22m.6s., PS = +22m.24s., iE = +25m.56s., SR_1N = +26m.57s., iN = +27m.38s. Bidston readings are given as at 20h. Uccle SR_1 = +27m.48s., MN = +45·1m. Oxford PR_1 = +15m.37s. Belgrade PR_1 = +12m.10s., PR_2 = +13m.22s., SR_1E = +22m.1s., SR_1N = +22m.15s., SR_2E = +22m.33s., SR_2N = +22m.38s. Ottawa PR_1 = +15m.36s., T_0 = 21h.22m.3s. Toronto e = +27m.24s., L = +34·4m. Strasbourg iP = +12m.8s. and +12m.9s., MN = +54·8m., T_0 = 21h.21m.9s. Innsbruck PS = +23m.0s. Paris +23m.0s., MN = +45m.0s. Ithaca PR_1 = +15m.43s., L = +46·0m. and +53·0m. Moncalieri MN = +52·2m. Fordham eE = +22m.8s. Athens PR_1 = +15m.58s., iSE = +22m.41s., iN = +23m.24s. and +25m.36s., iE = +25m.41s., MN = +51·9m. Adelaide e = +21m.0s. Rocca di Papa iSN = +22m.46s. Melbourne SR_1 = +28m.36s., SR_2 = +32m.13s. Perth SR_1 = +20m.26s. Barcelona PR_1? = +17m.0s., PS = +24m.4s., MN = +51·5m. Coimbra iE = +23m.51s., and +24m.39s., T_0 = 21h.21m.21s. Origin at 52°·5N. 159°·0W. Wellington ePR_1 = +16m.42s., e = +21m.0s., SR_1 = +29m.30s. Granada PR_1 = +23m.38s., PS = +24m.42s., T_0 = 21h.21m.20s. San Fernando MN = +65·5m. La Paz PR_1 = +22m.33s., i = +23m.32s., T_0 = 21h.22m.25s.

Note on the assumption of focal depth +·010: There are four good groups of stations in mean azimuths 61°, 230°, 263°, and 341°. Without the assumption the mean errors in △ would be all negative, viz., −1°·4, −0°·7, −0°·8, −0°·9 respectively. With the assumption these become −0°·3, −0°·2, +0°·3, +0°·4. They suggest a slight displacement of the epicentre, say to 47°·0N. 151°·8E.

Oct. 24d. Readings also at 3h. (La Paz), 8h. (La Paz and Zi-ka-wei), 11h. (Innsbruck, La Paz, Port au Prince, and near Balboa Heights), 19h. (Moncalieri), 22h. (Manila).

Oct. 25d. Readings at 0h. (near Balboa Heights), 3h. and 4h. (Moncalieri), 9h. and 17h. (La Paz), 22h. (Denver).

Oct. 26d. Readings at 14h. (near Oaxaca, Tacubaya, and Vera Cruz), 16h. (near La Paz), 17h. (Fordham).

Oct. 27d. 14h. 22m. 40s. Epicentre 23°·3N. 122°·0E. (as on 1922 July 2d.).

A = −·487, B = +·779, C = +·396; D = +·848, E = +·530; G = −·209, H = +·335, K = −·918.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Taihoku	1·8	345	0 39	+11	—	—	0·9	1·1
Hokoto	2·3	276	—	—	1 3	0	1·5	2·3
Hong Kong	7·3	264	1 50	− 1	—	—	3·7	6·8
Zi-ka-wei	7·9	356	i 1 52	− 8	e 3 39	+ 5	—	5·2
Manila	8·8	186	e 2 20	+ 7	—	—	i 5·2	6·4
Kobe	16·1	42	e 4 34	+41	—	—	e 11·4	16·9
Osaka	16·3	43	4 16	+20	(7 29)	+27	7·5	9·9
Tokyo	19·7	47	e 5 8	+31	e 8 59	?L	(e 9·0)	15·6
Calcutta E.	31·0	275	7 15	+37	12 15	+24	18·5	—
Batavia	33·0	210	6 45	−11	i 12 9	−15	23·3	—
Simla N.	40·4	291	—	—	—	—	e 21·0	—
Colombo	43·7	256	9 56	+92	(14 8)	−50	14·1	34·8
Kodaikanal	44·4	261	27 50	?L	—	—	(27·8)	—
Sydney	63·5	153	27 44	?	—	—	37·8	38·8
Melbourne	64·8	160	—	—	19 32	+ 9	29·4	45·6
Tiflis	65·5	308	—	—	—	—	e 40·3	43·2
Honolulu	72·9	74	—	—	e 21 20	+19	e 34·3	—
Konigsberg	77·4	325	i 12 12	+ 9	—	—	e 41·3	48·3
Bergen	82·0	335	37 35	?	47 35	?	52·1	—
Vienna	82·5	321	e 12 20	−13	e 22 56	+ 4	e 46·3	55·3
Hamburg	83·5	326	e 12 41	+ 2	—	—	e 42·3	54·4
Innsbruck	86·0	321	e 12 50	− 3	—	—	e 46·3	—
De Bilt	86·7	326	12 43	−14	23 11	−27	e 40·3	55·2
Strasbourg	87·4	322	e 12 50	−11	e 23 9	−36	48·3	57·4
Victoria	87·7	37	—	—	—	—	49·3	57·2
Uccle	87·8	325	e 12 56	− 8	e 23 20	−30	e 40·3	55·3
Edinburgh	88·3	331	—	—	e 23 20	−35	48·3	56·8
Eskdalemuir	88·6	331	e 14 20	?	e 23 20	−39	43·3	49·3
Moncalieri	89·3	320	e 12 19	−53	24 9	+ 3	47·1	62·0
Kew	89·8	329	—	—	—	—	—	59·3
Bidston	89·8	331	—	—	42 45?	?L	(42·8?)	59·8
Paris	90·0	324	—	—	—	—	e 48·3	57·3
Oxford	90·1	329	—	—	—	—	30·3	57·3
Barcelona	94·7	319	—	—	—	—	e 53·1	61·1
Tortosa N.	95·9	320	—	—	—	—	e 47·3	62·3
Algiers	96·8	315	—	—	—	—	e 61·3	64·8
Toledo	99·2	321	—	—	—	—	e 52·3	64·3
Coimbra	101·4	324	—	—	—	—	e 53·3	—
Rio Tinto	102·2	321	58 20	?L	—	—	(58·3)	69·3
San Fernando	102·8	320	21 20	?PR_1	—	—	—	69·0
Ottawa	109·4	12	—	—	—	—	e 52·3	—
Toronto	110·2	15	—	—	—	—	e 69·5	76·1
Ann Arbor	110·2	19	—	—	—	—	e 57·3	—
Ithaca	112·0	14	—	—	—	—	68·3	—
Cape Town	113·5	242	—	—	—	—	—	70·8
La Paz	168·3	57	19 57	[−17]	—	—	84·3	107·4

Additional readings and notes: Zi-ka-wei gives also MN = +4·4m. Manila MN = +7·2m. Kobe MN = +18·5m. Readings given as at 16h. Osaka MN = +10·9m. Tokyo MN = +13·6m. Calcutta PN = +7m.10s. Bergen e = +42m.35s. and +44m.5s. Hamburg MZ = +52·8m., MN = +54·1m. De Bilt ePR_1Z = +16m.10s., MNZ = +56·5m. Strasbourg MN = +64·8m. Uccle SR_1 = +29m.20s. Eskdalemuir SR_1? = +33m.50s., MN = +57·3m. Moncalieri MN = +67·1m. Paris MN = +63·3m. Toledo MNW = +65·3m. San Fernando MN = +64·5m. Ottawa LE = +58·3m.

Oct. 27d. Readings also at 0h. (Lick), 1h. (near Tokyo and Mizusawa), 10h. (near Lick and Berkeley), 13h. (near Tacubaya and near Nagasaki), 14h. (Taihoku and Zi-ka-wei), 15h. (near Oaxaca), 16h. (near La Paz).

Oct. 28d. Readings also at 5h. (near Mizusawa), 7h. (Pilar and Andalgala), 8h. (Cipolletti and La Paz), 11h. (Batavia), 17h. (De Bilt), 18h. (near Mostar), 19h. (Batavia), 22h. (La Paz and Nagasaki).

Oct. 29d. Readings at 0h. (La Paz (2), near Osaka, and Kobe, and near Balboa Heights), 1h. (Nagasaki), 11h. (near Lick), 13h. (near Manila), 18h. (Apia), 20h. (near Manila).

Oct. 30d. 13h. 5m. 30s. Epicentre 13°·5N. 143°·0E. (as on 1917 Nov. 24d.).

$A = -\cdot777$, $B = +\cdot585$, $C = +\cdot233$; $D = +\cdot602$, $E = +\cdot799$; $G = -\cdot186$, $H = +\cdot140$, $K = -\cdot972$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	21·4	276	e 5 2	+ 4	(9 4)	+11	9·1	9·2
Osaka	22·3	343	5 3	− 6	—	—	—	10·7
Tokyo	22·4	353	6 8	+58	11 28	?L	(11·5)	—
Zi-ka-wei	26·6	315	e 5 46	− 8	e 9 43	−50	—	16·8
Adelaide	48·6	185	—	—	—	—	e 19·0	25·5
Melbourne	51·3	178	—	—	e 19 18	?SR_1	—	28·1
Victoria	82·4	41	—	—	—	—	39·5	45·9
Uccle	106·3	334	—	—	—	—	e 50·5	—
Strasbourg	106·4	330	—	—	—	—	e 57·5	—
Toronto	111·0	31	e 7 12	?	—	—	32·9	—
La Paz	149·8	100	19 56	[0]	—	—	—	—

Additional readings: Manila gives also MN = +9·3m. Osaka MN = +12·4m. Adelaide eSR_2? = +15m.0s., e = +22m.42s. Toronto L = +15·7m.

Oct. 30d. Readings also at 1h. (Victoria and Toronto), 2h. (Ithaca, Georgetown, Ottawa, Chicago (2), Victoria, and Toronto), 3h. (Ottawa), 4h. (Florence), 6h. (Calcutta), 13h. and 22h. (Granada).

Oct. 31d. Readings at 1h. (near Nagasaki), 4h. (La Paz), 5h. (Zi-ka-wei, near Taihoku, and near Mizusawa), 13h. (Tiflis and near Mizusawa), 20h. (near Tokyo and Mizusawa) 21h. (near Osaka and Kobe), 22h. (near Mizusawa).

Nov. 1d. Readings at 0h. (De Bilt, Uccle, and Hong Kong), 5h. and 8h. (La Paz), 9h. (near Tokyo and Mizusawa), 17h. (near Mizusawa), 19h. (near Athens), 22h. (La Paz).

Nov. 2d. Readings at 1h. (near Tokyo), 4h. (Chicago), 16h. (Tokyo and near Mizusawa), 17h. (near Mizusawa), 18h. (La Paz).

Nov. 3d. 12h. 50m. 10s. Epicentre 7°·6S. 128°·3E. (as on 1921 Mar. 30d.).

$A = -\cdot614$, $B = +\cdot778$, $C = -\cdot132$; $D = +\cdot785$, $E = +\cdot620$; $G = +\cdot082$, $H = -\cdot104$, $K = -\cdot991$.

The depth of focus 0·040 as assumed for 1921 March 30d., is retained. See note at end.

		Corr. for Focus	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia	N.	−1·7	21·3	272	i 4 57	+21	—	—	—	—
Manila		−1·9	23·3	342	e 4 56	− 2	e 8 0	−53	i 8·8	9·0
Hong Kong		−2·8	32·9	336	7 59	?	—	—	—	—
Sydney		−2·9	33·7	143	11 50	?S	(11 50)	+ 2	18·0	19·3
Melbourne		−2·9	33·8	154	—	—	11 50	0	15·8	20·0
De Bilt		—	115·9	325	—	—	—	—	e 59·8	—
La Paz		—	150·9	146	19 50	[− 7]	—	—	(61·9)	—

Additional readings and notes: Manila gives also eS = +8m.0s. Melbourne SR_1 = +13m.8s. La Paz L is given as the P of another shock.

The evidence for this solution may not seem sufficient to warrant it, if the shock stood alone. But direct comparison with the shock of 1921 March 30 gives for the excess of the present readings

of P, Batavia +22s. Manila − 2s. La Paz [+10s.].
of S, Manila − 9s. Sydney −12s. Melbourne +12s.

It is difficult to treat these as other than accidental, and accordingly we may give this solution the benefit of the former copious evidence.

Nov. 3d. Readings also at 0h. (Zi-ka-wei), 2h. (near Lick), 15h. (near Taihoku and near Mizusawa), 16h. (Zi-ka-wei), 18h. (Cape Town and near Kobe), 19h. (De Bilt and Eskdalemuir), 22h. (near Mizusawa and Ootomari), 23h. (De Bilt).

Nov. 4d. 3h. 19m. 36s. Epicentre 40°·5N. 122°·0W. (as on 1920 Mar. 20d.).

A = −·403, B = −·645, C = +·649 ; D = −·848, E = +·530 ;
G = −·344, H = −·551, K = −·760.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Berkeley		2·6	186	e 0 39	− 2	e 1 3	− 9	i 1·7	2·9
Lick		3·1	174	i 1 31	?S	(i 1 31)	+ 5	i 2·0	5·5
Victoria		8·0	354	(2 12)	+11	—	—	2·2	3·7
Chicago		25·8	76	—	—	10 24	+ 6	14·2	—
Ann Arbor		28·5	74	—	—	—	—	e 14·5	—
Toronto		31·4	70	—	—	—	—	i 20·4	—
Ottawa		33·5	65	—	—	e 12 24	− 8	e 20·4	—
Georgetown	N.	34·2	79	e 9 50	?PR_1	—	—	22·9	—
Washington		34·2	79	—	—	—	—	19·9	—
Honolulu		36·0	250	—	—	e 14 19	?	15·4	16·5
Eskdalemuir		71·0	31	—	—	—	—	38·4	—
Stonyhurst		72·4	33	e 38 12	?L	—	—	(e 38·2)	—
De Bilt		76·7	30	—	—	—	—	e 37·4	—

Additional readings: Berkeley gives also eLN = +1·6m., iLZ = +1·7m., MN = +1·9m. Lick iPE = +1m.34s., MN = +2·7m. Victoria E (Milne-Shaw), P = +1m.10s., L = +1·6m., M = +3·6m. Ottawa L = +21·7m. Georgetown eLN = +20·2m. Honolulu LN = +15·5m.

Nov. 4d. 4h. 20m. 12s. Epicentre 37°·0N. 20°·5E. (as on 1922 July 2d.).

A = +·748, B = +·280, C = +·602 ; D = +·350, E = −·937 ;
G = +·564, H = +·211, K = −·799.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Athens		2·8	69	0 53	+ 9	—	—	i 1·8	2·3
Pompeii		5·9	311	1 48	+17	2 18	−23	—	5·3
Mostar		6·6	343	i 1 46	+ 5	i 3 13	+13	—	3·3
Rocca di Papa		7·6	311	i 2 0	+ 5	4 30	?L	(4·5)	4·6
Belgrade		7·8	0	i 1 31	−27	i 3 4	−27	—	3·8
Florence		9·8	317	2 34	+ 7	5 17	?L	(5·3)	7·3
Vienna		11·6	346	5 47	?L	8 42	?	i 9·5	11·2
		11·6	346	5 55	?L	8 52	?	i 9·4	11·8
Helwan		11·6	125	e 2 54	+ 1	(4 56)	−13	—	18·3
Moncalieri		12·4	314	3 2	− 3	5 23	− 6	7·2	11·6
Lemberg		13·1	10	e 3 19	+ 5	—	—	e 6·4	9·1
Marseilles		13·2	304	3 20	+ 4	6 2	+13	6·8	8·8
Zurich		13·6	324	e 3 17	− 4	i 5 47	−11	—	—
Algiers		13·9	275	i 3 23	− 2	6 16	+10	9·8	15·5
Besançon		14·8	318	e 3 34	− 2	—	—	7·8	—
Strasbourg		14·9	326	3 31	− 7	6 30	0	7·3	11·7
Barcelona		14·9	293	e 3 34	− 4	e 6 34	+ 4	6·8	10·6
Tortosa	N.	16·0	290	3 47	− 5	6 45	−10	8·1	15·4

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Paris		17·6	318	e 4 36	+24	—	—	9·8	10·8
Konigsberg	E.Z.	17·8	0	i 4 10	− 5	7 27	− 9	e 8·8	11·8
	N.	17·8	0	i 4 16	+ 1	7 29	− 7	e 10·8	11·8
Uccle		18·0	325	e 4 16	− 1	e 7 31	− 9	9·6	11·6
Hamburg		18·1	340	i 4 16	− 2	i 7 40	− 2	e 10·2	12·8
De Bilt		18·5	330	4 24	+ 1	7 52	+ 1	9·8	13·8
Granada		19·2	278	i 4 32	+ 1	i 8 6	0	12·8	17·9
Tiflis		19·3	68	5 13	+40	8 37	+29	12·3	13·6
Toledo		19·4	286	4 35	+ 1	8 5	− 5	e 12·4	15·5
Kew		20·6	321	7 48	?S	(7 48)	−48	—	16·8
Oxford		21·3	321	4 55	− 2	8 38	−12	—	—
San Fernando		21·4	277	4 54	− 4	8 54	+ 1	—	20·1
Coimbra	E.	22·8	287	4 56	−19	8 54	−27	14·3	15·6
	N.	22·8	287	—	—	i 9 1	−20	e 11·3	16·2
Upsala		22·9	357	i 5 6	−10	i 9 9	−14	e 11·6	16·8
Stonyhurst		23·1	324	—	—	—	—	9·8?	14·1
Bidston		23·2	323	6 11	+52	10 10	+41	—	18·4
Eskdalemuir		24·4	326	i 4 54	−38	i 9 2	−50	12·4	14·0
Edinburgh		24·7	328	5 28	− 7	i 9 44	−13	13·8	20·3
Dyce	N.	25·2	331	5 35	− 5	9 40	−27	—	14·0
Bergen		25·3	343	—	—	e 9 48	−21	14·8	—

Additional readings: Athens gives also PE = +1m.6s., iP = +1m.9s., MN = +2·0m., T_o = 4h.19m.57s. Mostar iPN = +48s. Rocca di Papa SN = +4m.24s., eL = +11·3m. Belgrade iPN = +58s. Vienna gives two sets of readings, the first being partly E and partly Z, the other N, also we have iN = +6m.38s., +7m.26s., and +7m.57s., MZ = +10·6m. Helwan S is given as PR_1, also S = +9m.48s. Moncalieri MN = +9·3m. Strasbourg PV = +3m.33s., PN = +3m.36s., and PE = +3m.37s., MN = +10·0m. Barcelona MN = +11·2m. Konigsberg PZ, MZ, SE, LE are entered in the line EZ. Uccle P = +4m.20s. De Bilt MN = +13·9m., MZ = +14·2m. Granada MN = +15·9m. Tiflis e = +11m.6s., MN = +12·9m. Toledo MNW = +17·2m. San Fernando MN = +13·3m. Upsala MN = +15·8m. Eskdalemuir MN = +13·8m.

Nov. 4d. Readings also at 4h. (near Mizusawa and Tokyo), 5h. (La Paz, Chicago (2), Porto Rico and near Port au Prince), 10h. (near Marseilles and near Mizusawa), 18h. (Hong Kong, Manila, and Zi-ka-wei), 19h. (De Bilt), 21h. (near Mazatlan).

Nov. 5d. 23h. 26m. 20s. Epicentre 39°·0S. 17°·0W. (as on 1921 Feb. 13d.).

A = +·743, B = −·227, C = −·629; D = −·292, E = −·956; G = −·602, H = +·184, K = −·777.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Pilar	E.	38·5	270	7 34	− 8	—	—	20·5	26·6
	N.	38·5	270	7 40	− 2	—	—	21·2	24·3
Cipolletti		39·2	256	15 16	?S	(15 16)	+82	19·8	22·4
Mendoza		41·5	265	14 28	?S	(14 28)	0	24·9	26·7
La Paz		49·7	282	9 3	− 2	i 16 22	+ 7	24·7	29·4
Uccle		91·8	13	—	—	—	—	—	55·7
De Bilt		93·1	16	—	—	—	—	58·7	—
Zi-ka-wei	Z.	145·4	90	e 20 14	[+25]	—	—	—	—

No additional readings.

Nov. 5d. Readings also at 1h. (Port au Prince), 2h. (Kobe), 3h. (Florence), 5h. (near Mizusawa), 9h. (Zi-ka-wei), 15h. (Sinj), 17h. (La Paz), 18h. (2) and 19h. (Lick).

Nov. 6d. Readings at 17h. (Tiflis), 23h. (Granada and Edinburgh).

1922. Nov. 7d. 23h. 0m. 12s. Epicentre **27°·5S. 72°·8W.**

A = +·262, B = −·847, C = −·462 ; D = −·955, E = −·296 ;
G = −·137, H = +·441, K = −·887.

This solution was made before any observations had been received from S. American stations other than La Paz and Rio de Janeiro. The negative residuals shown by all the additional stations except Cipolletti are striking, and suggest an epicentre further east, but the testimony of Rio de Janeiro against this change is strong.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	N.	5·8	93	0 0	−90	—	—	0·6	2·5
Mendoza		6·6	146	0 0	−101	—	—	1·1	2·9
La Quiaca	E.	8·4	52	1 12	−55	—	—	2·6	5·3
	N.	8·4	52	1 6	−61	—	—	2·5	3·9
Pilar	E.	8·8	121	1 42	−31	—	—	2·2	6·5
	N.	8·8	121	1 54	−19	—	—	2·5	6·9
La Paz		11·8	22	2 59	+ 3	i 5 19	+ 5	6·6	7·5
Cipolletti		12·1	162	3 24	+24	—	—	5·9	11·1
Chacarita	E.	14·2	123	3 0	−29	—	—	6·9	—
	N.	14·2	123	3 12	−17	—	—	6·8	—
Rio de Janeiro		27·2	87	6 0	0	10 42	− 3	14·3	15·7
Vera Cruz		51·9	332	9 0	−19	16 46	+ 3	24·4	29·4
Tacubaya	E.	53·4	329	9 34	+ 5	17 14	+13	25·2	30·4
Georgetown	E.	66·5	357	i 10 55	0	e 19 45	+ 1	e 30·8	—
Washington		66·5	357	10 50	− 5	19 41	− 3	34·0	—
Ithaca		70·1	358	e 11 48	+30	20 30	+ 3	34·8	—
Chicago		70·6	350	11 16	− 5	20 23	−10	34·0	—
Ann Arbor		70·6	353	11 18	− 3	20 24	− 9	34·0	—
Toronto		71·4	355	10 6	−80	21 42	+59	i 31·0	52·4
Northfield		71·7	1	11 28	0	20 49	+ 3	e 44·8	—
Ottawa		73·0	358	11 35	− 1	20 58	− 4	e 30·8	—
Cape Town		76·0	122	21 28	?S	(21 28)	− 9	—	41·5
Lick	E.	79·4	323	e 12 28	+13	i 22 22	+ 6	i 39·3	44·7
Berkeley		80·2	323	e 12 33	+13	—	—	i 40·6	—
Johannesburg		86·9	118	—	—	—	—	43·8	—
Wellington		87·0	225	e 12 48	−11	i 23 48	+ 7	40·6	44·8
Victoria		88·3	330	12 43	−24	23 17	−38	39·6	50·6
	E.	88·3	330	13 8	+ 1	23 33	−22	39·8	50·4
San Fernando		89·5	48	12 56	−17	23 30	−39	—	61·0
Rio Tinto		90·0	47	15 48	+152	—	—	—	62·8
Coimbra		90·3	44	e 12 38	−40	22 48	−89	e 40·8	52·2
Granada		91·6	49	i 13 11	−14	23 58	−33	41·7	47·0
Toledo		92·9	46	13 13	−19	23 46	−58	e 41·2	48·8
Honolulu	E.	95·7	291	24 15	?S	(24 15)	−58	44·7	46·8
Algiers		95·9	51	e 13 26	−22	24 3	−72	41·8	54·8
Tortosa		96·3	47	e 12 48	−63	24 8	−71	38·2	59·0
Barcelona		97·7	48	—	—	—	—	e 42·8	55·8
Le Mans		99·8	41	—	—	—	—	57·8	—
Marseilles		100·6	47	—	—	e 25 8	−53	e 39·8	56·8
Oxford		100·9	38	—	—	i 24 29	−95	44·0	62·2
Kew		101·3	38	—	—	—	—	—	65·8
Stonyhurst		101·4	36	e 14 24	+ 7	24 48	−81	—	58·3
Paris		101·5	41	—	—	—	—	49·8	53·8
Eskdalemuir		101·8	34	e 18 13	?PR_1	24 32	−101	43·8	46·8
Besançon		102·8	44	—	—	e 27 49?	+87	47·8	—
Moncalieri		102·9	46	24 5	?S	(24 5)	−138	48·2	62·9
Dyce	N.	103·3	32	—	—	i 24 43	−104	43·6	58·1
Uccle		103·5	40	—	—	e 24 43	−106	e 43·8	60·0
De Bilt		104·5	40	e 14 10	−22	e 24 48	−110	44·8	59·0
Strasbourg		104·5	43	—	—	e 27 48	+70	e 44·8	68·3
Florence		104·7	48	18 42	?PR_1	—	—	33·3	60·3
Rocca di Papa		104·8	50	e 18 12	?PR_1	24 48	−112	e 52·8	64·6
Melbourne		105·7	210	—	—	—	—	—	58·5
Sydney		105·8	217	—	—	—	—	52·7	57·0
Innsbruck		106·2	45	—	—	—	—	e 50·8	—
Hamburg		107·8	39	e 18 48	?PR_1	—	—	e 51·8	60·8
Vienna		109·7	45	19 0	?PR_1	28 30	+65	e 49·8	65·8
Konigsberg		114·1	40	—	—	29 18	+75	e 53·5	59·5
Helwan		114·7	70	19 34	?PR_1	29 24	+76	—	72·7
Tiflis		127·9	57	e 31 16	?	—	—	e 52·8	73·6

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia		146·3	178	i 19 45	[− 5]	—	—	—	—
Kodaikanal		147·1	117	19 42	[− 9]	—	—	77·7	88·3
Bombay		147·4	98	e 71 21	?L	—	—	(e 71·4)	—
Mizusawa	E.	149·6	300	20 0	[+ 5]	20 23	?	—	—
Tokyo		151·3	295	e 20 35	[+37]	—	—	—	—
Simla		153·7	75	—	—	—	—	e 82·5	—
Manila		161·8	228	20 5	[− 4]	—	—	—	—
Zi-ka-wei		167·1	290	e 15 0	?	—	—	—	—

Additional readings and notes: Tacubaya LN = +25·4m., MN = +30·5m. Georgetown iSN = +19m.46s., LE = +40·8m., LN = +39·8m. Ithaca L = +38·8m. and +41·8m. Chicago L = +39·5m. Ann Arbor L = +37·8m. Toronto L = +51·2m., eL = +56·5m., +75·8m., and +87·0m. Ottawa eLN = +33·8m., L = +42·8m., T_0 = 23h.0m.23s. Lick i = +34m.18s. Berkeley iPE = +12m.53s., iSR_1EN = +28m.48s., iSR_2E = +32m.6s. Wellington ePR_1 = +16m.6s., e = +22m.30s., and +26m.48s., SR_1 = +29m.48s., SR_2 = +33m.24s., e = +35m.36s. San Fernando MN = +54·6m., T_0 = 23h.0m.31s. Coimbra iE = +23m.44s., iN = +23m.52s., eLN = +37·8m., T_0 = 23h.0m.37s. Toledo MNW = +46·1m. Honolulu PR_1E = +26m.21s., PR_1N = +26m.53s., eN = +37m.13s., LN = +44·6m., MN = +46·4m. Algiers MN = +50·3m. Paris e = +32m.48s. and +40m.48s. Moncalieri S = +35m.30s., MN = +59·3m. Dyce iN = +33m.48s. Uccle MN = +59·4m. De Bilt ePR_1Z = +18m.23s., MN = +58·4m., MZ = +59·3m. Strasbourg e = +18m.18s., MN = +66·7m. Rocca di Papa PN = +18m.48s., eS = +24m.54s. Hamburg MNZ = +61·9m. Konigsberg MN = +63·8m. Tiflis MN = +63·4m. Simla ePN = +75m.36s. (?eLN).

Nov. 7d. Readings also at 4h. (Nagasaki and near Marseilles), 5h. (Nagasaki (2) and near Batavia), 7h. (Stonyhurst), 9h. (Batavia), 17h. (Batavia), 20h. (Sinj), 22h. (near Batavia). But see also Appendix.

Nov. 8d. 10h. 28m. 28s. Epicentre 46°·0N. 12°·0E.

A = +·679, B = +·144, C = +·719.

	Δ	P.	O−C.	S.	O−C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Innsbruck	1·3	i 0 18	− 2	e 0 35	− 1	—	—
Chur	1·9	0 30	+ 1	0 53	0	—	—
Zurich	2·7	e 0 45	+ 3	i 1 20	+ 6	—	—
Vienna	3·7	i 1 10	+12	—	—	i 1·9	2·2

Zurich gives also iP = +46s., iV = +57s.

Nov. 8d. 20h. 16m. 20s. Epicentre 36°·0N. 141°·0E. (as on 1922 June 25d.).

A = −·629, B = +·509, C = +·588; D = +·629, E = +·777;
G = −·457, H = +·370, K = −·809.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Tokyo		1·1	253	i 0 14	− 3	0 26	− 5	—	0·5
Mizusawa	N.	3·1	1	0 49	0	1 47	+21	—	—
Nagoya		3·4	256	0 51	− 2	1 31	− 3	—	—
Osaka		4·7	256	1 18	+ 5	(2 18)	+ 9	2·3	2·6
Kobe		5·0	256	1 22	+ 5	(2 12)	− 5	2·2	2·6

Additional readings: Mizusawa gives also ME = +50s. Osaka MN = +2·8m., all readings given as on 7d. Kobe S = +1m.55s. (O−C = −22s.), MN = +2·4m.

Nov. 8d. 23h. 33m. 40s. Epicentre 6°·7S. 12°·0W.

$A = +·971$, $B = -·206$, $C = -·117$; $D = -·208$, $E = -·978$; $G = -·114$, $H = +·024$, $K = -·993$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
San Fernando	43·5	8	14 32	?S	(14 32)	−23	(18·0)	23·8
Granada	44·6	10	i 8 24	− 6	16 57	+107	—	29·3
Algiers	45·7	19	e 8 29	− 9	15 13	−11	23·3	24·5
Coimbra E.	47·0	4	10 14	?PR_1	18 18	?SR_1	21·8	—
N.	47·0	4	e 10 34	?PR_1	—	—	e 22·8	—
Toledo	47·1	9	8 23	−25	18 44	+182	—	—
Tortosa E.	48·9	13	—	—	—	—	e 23·3	25·7
Barcelona	49·9	15	—	—	18 51	+153	e 24·6	—
Rocca di Papa	53·5	24	i 9 26	− 4	17 8	+ 5	e 28·3	29·8
Moncalieri	54·6	17	9 48	+11	18 18	+62	27·1	—
La Paz	55·7	258	9 47	+ 3	17 20	−10	26·3	31·9
Strasbourg	57·9	16	—	—	—	—	e 30·0	—
Kew	59·0	9	—	—	—	—	—	38·3
Uccle	59·2	12	—	—	e 18 14	+ 1	e 28·3	—
Belgrade	59·2	28	e 9 10	−56	e 18 6	− 7	e 28·0	—
Vienna Z.	60·3	22	e 10 15	+ 1	—	—	—	—
De Bilt	60·6	13	10 18	+ 2	18 37	+ 6	e 30·3	—
Eskdalemuir	62·4	7	—	—	e 18 51	− 2	e 25·3	—
Edinburgh	63·0	7	—	—	—	—	e 26·3	—
Ottawa	77·0	321	—	—	—	—	e 35·3	—
Toronto	78·7	319	—	—	—	—	59·5	—
Victoria	109·1	320	—	—	—	—	68·3	72·9

Additional readings: San Fernando gives also MN = +23·7m. Rocca di Papa iPE = +9m.32s. Paris (Δ = 57°·0) gives 23h.48m.

Nov. 8d. Readings also at 0h. (Colombo), 1h. (Athens), 6h. (near Granada), 7h. (Athens), 9h. (La Paz), 11h. (Melbourne), 12h. (Strasbourg), 14h. and 20h. (near Tokyo), 22h. (near Zurich and Chur), 23h. (Paris and La Paz).

Nov. 9d. Readings at 0h. (Kodaikanal), 1h. (De Bilt and Uccle), 2h. (Manila), 9h. (near Zurich), 11h. (near Merida), 12h. (near Victoria), 21h. (Batavia).

Nov. 10d. 12h. 24m. 12s. Epicentre 13°·5N. 143°·0E. (as on 1922 Oct. 30d.).

$A = -·777$, $B = +·585$, $C = +·233$; $D = +·602$, $E = +·799$; $G = -·186$, $H = +·140$, $K = -·972$.

The evidence is so slight that the old epicentre has been retained, but a position at 12°·5N. 139°·0E. would suit the observations better, with T_0 = 12h.24m.50s.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	21·4	276	e 6 3	+65	—	—	7·0	10·1
Zi-ka-wei	26·6	315	e 6 7	+13	e 10 25	− 8	—	—
Hong Kong	28·8	292	6 23	+ 7	—	—	8·9	10·3
Batavia	41·0	244	—	—	e 14 16	− 5	—	—
De Bilt	105·0	335	—	—	—	—	e 52·8	62·3
Uccle	106·3	334	—	—	—	—	e 49·8	—

Additional readings: Manila gives also MN = +7·4m. De Bilt MN = +62·0m., MZ = +62·2m.

Nov. 10d. Readings also at 9h. (Nagasaki), 11h. and 12h. (near Tokyo and Mizusawa), 14h. (near Balboa Heights), 18h. (Rio Tinto), 20h. (near Tokyo and Mizusawa), 21h. (La Paz).

1922. Nov. 11d. 4h. 32m. 30s. Epicentre 29°·0S. 71°·0W.

A = +·285, B = −·827, C = −·485 ; D = −·946, E = −·326 ;
G = −·158, H = +·458, K = −·875.

The epicentre appears to be definitely different from that on November 7 (See note at end of these observations). But there are several severe aftershocks.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Pilar		6·7	115	—	—	—	—	2·3	5·4
La Quiaca	N.	8·4	36	(1 6)	−61	—	—	1·1	5·3
Cipolletti		10·3	167	—	—	—	—	6·3	—
Chacarita	E.	12·0	121	2 42	−17	—	—	3·9	—
	N.	12·0	121	2 48	−11	—	—	4·2	—
La Paz		12·8	13	3 10	0	—	—	—	—
Rio de Janeiro		25·7	83	i 5 30	−15	10 6	−10	13·5	—
Balboa Hts.	E.	38·9	348	7 56	+11	13 44	− 7	16·9	17·3
	N.	38·9	348	7 30	−15	13 38	−13	17·0	21·1
	E.	38·9	348	7 40	− 5	13 10	−41	17·1	17·5
	N.	38·9	348	7 34	−11	13 30	−21	16·7	17·3
Porto Rico	E.	47·5	7	e 8 41	−10	e 15 42	− 6	24·0	29·8
	N.	47·5	7	e 8 35	−16	15 20	−28	e 25·8	31·5
Port au Prince	N.E.	47·6	359	e 8 36	−15	15 30	−19	25·1	28·6
	N.W.	47·6	359	i 8 45	− 6	—	—	—	32·6
Oaxaca		52·4	330	8 34	−48	(15 58)	−51	16·0	31·0
Merida		53·1	340	8 36	−51	15 57	−60	19·3	22·3
	Z.	53·1	340	8 34	−53	15 55	−62	19·2	22·3
Vera Cruz		54·0	331	9 32	− 1	17 12	+ 3	21·6	28·3
	Z.	54·0	331	9 32	− 1	17 9	0	21·6	28·2
Puebla		54·8	330	11 36	+118	19 21	+122	27·6	30·6
Tacubaya	E.	55·5	328	9 46	+ 3	14 24	−184	21·0	29·5
	N.	55·5	328	9 44	+ 1	17 25	− 3	23·5	26·8
	Z.	55·5	328	9 47	+ 4	17 26	− 2	24·5	26·9
Colima	E.	56·8	322	23 0	?	31 30	?L	37·5	41·0
	N.	56·8	322	—	—	—	—	37·6	41·2
Mobile		61·9	345	—	—	18 22	−25	30·8	—
Mazatlan	E.	62·4	324	9 12	−76	18 16	−37	25·7	30·5
	N.	62·4	324	9 18	−70	18 20	−33	25·6	30·6
Cheltenham	E.	68·0	356	e 11 17	+13	19 46	−16	e 34·3	37·8
	N.	68·0	356	11 1	− 3	19 46	−16	e 35·1	42·0
Georgetown	E.	68·2	355	e 11 11	+ 6	20 2	− 2	e 28·2	37·9
	N.	68·2	355	i 11 7	+ 2	20 2	− 2	e 29·0	39·7
Washington		68·2	355	11 2	− 3	20 0	− 4	33·8	—
Ithaca		71·7	356	11 22	− 6	20 37	− 9	32·0	—
Tucson	E.	72·0	325	e 11 35	+ 5	20 56	+ 6	e 34·5	39·0
	N.	72·0	325	e 11 30	0	20 56	+ 6	e 34·8	38·8
Ann Arbor		72·3	351	11 36	+ 4	20 48	− 6	34·8	33·1
Chicago		72·5	348	i 11 30	− 3	20 37	−19	—	34·5
Toronto		73·0	354	11 24	−12	20 48	−14	i 36·0	57·2
Northfield		73·2	359	11 36	− 1	21 3	− 1	36·5	—
Cape Town		73·9	120	11 49	+ 8	21 16	+ 3	34·8	48·0
Halifax		74·0	5	e 12 3	+21	21 30	+16	e 36·0	—
Ottawa		74·5	357	i 11 40	− 6	21 12	− 8	e 35·9	40·0
Denver		75·6	333	11 30?	−23	20 30?	−63	30·5?	46·5?
Lick	E.	81·6	321	e 12 27	− 1	e 22 28	− 4	i 34·6	38·5
	N.	81·6	321	i 12 33	+ 5	22 38	− 4	i 34·4	40·6
Berkeley	E.	82·7	321	e 12 27	− 7	22 51	− 3	e 34·2	39·7
	N.	82·7	321	e 12 24	−10	26 39	?	34·7	39·2
	Z.	82·7	321	e 12 42	+ 8	—	—	—	39·9
Johannesburg		84·8	117	12 48	+ 1	23 6	−11	35·5	49·5
Christchurch		87·0	220	12 42	−17	23 24	−17	41·9	43·6
Wellington		87·1	225	12 54	− 6	i 23 0	−42	39·6	46·5
San Fernando		89·3	46	13 12	0	24 24	+18	41·7	57·2
Rio Tinto		89·9	45	15 30	+135	—	—	—	71·5
Coimbra	E.	90·4	42	12 44	−34	23 38	−40	38·2	45·9
	N.	90·4	42	—	—	23 30	−48	38·7	43·1
Victoria		90·5	329	13 27	+ 8	24 21	+ 2	45·7	49·6
	E.	90·5	329	13 10	− 9	23 42	−37	38·7	49·4
	Z.	90·5	329	13 10	− 9	24 5	−14	42·7	47·4
Granada		91·4	47	i 13 16	− 7	24 5	−23	i 29·4	47·5
Apia		92·5	254	13 29	− 1	24 33	− 7	43·0	44·5
Toledo		92·8	45	13 19	−12	24 11	−32	e 41·1	51·1
Algiers		95·6	50	13 34	−13	24 21	−51	43·5	50·5
Tortosa		96·2	46	13 28	−22	24 30	−48	40·9	59·4

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Barcelona		97·5	46	e 13 27	−30	24 31	−60	41·2	53·6
Honolulu	E.	97·8	290	13 55	− 4	i 24 55	−39	41·2	45·5
	N.	97·8	290	e 14 0	+ 1	—	—	41·0	47·4
Le Mans		99·6	40	e 17 30	?PR_1	i 24 55	−57	—	65·4
Puy de Dôme		100·2	43	14 8	− 4	25 20	−38	46·7	—
Marseilles		100·5	46	e 14 0	−13	25 0	−61	42·8	55·8
West Bromwich		101·2	36	13 52	−24	25 6	−61	—	—
Bidston		101·2	35	15 10	+54	25 48	−19	—	75·5
Oxford		101·4	37	13 56	−21	24 50	−79	42·5	63·5
Kew		101·5	37	14 30	+12	—	—	—	62·5
Sitka	E.	101·6	330	—	—	25 15	−56	e 47·8	54·4
	N.	101·6	330	—	—	e 26 8	− 3	49·8	47·2
Paris		101·6	40	e 14 4	−14	e 25 13	−58	45·5	56·5
Stonyhurst		101·7	35	14 6	−13	25 6	−66	46·7	55·7
Edinburgh		102·5	32	e 14 2	−21	i 24 58	−82	42·5	52·8
Moncalieri		102·8	45	13 51	−33	24 55	−87	35·0	59·5
Besançon		102·8	42	14 4	−20	25 18	−64	62·5	—
Uccle		103·6	39	14 5	−23	i 25 22	−67	43·5	59·6
Dyce	N.	103·7	30	14 5	−24	25 2	−88	—	46·3
Zurich		104·4	44	e 14 23	− 9	e 25 24	−73	—	—
Florence		104·5	47	14 8	−24	25 20	−78	44·0	67·5
Rocca di Papa	E.	104·5	50	e 14 23	− 9	e 25 18	−80	43·5	63·5
	Z.	104·5	50	e 14 13	−19	e 27 30	+52	e 52·5	—
Strasbourg		104·5	42	14 8	−24	25 35	−63	44·5	57·5
De Bilt		104·7	39	14 12	−21	e 25 26	−73	e 43·5	66·3
Melbourne		105·2	209	14 18	−17	25 0	−104	47·0	58·7
Pompeii		105·3	51	e 13 51	−45	25 30	−75	34·5	71·5
Sydney		105·5	215	13 36	−61	24 48	−119	50·0	56·5
Riverview		105·5	215	e 12 42	−115	e 24 42	−125	e 45·0	57·0
Innsbruck		106·1	43	e 14 31	− 9	e 25 34	−79	e 42·2	62·2
Hamburg		108·0	38	e 14 26	−22	e 28 30	+80	e 50·5	58·9
Bergen		108·6	30	14 36	−15	28 34	+79	e 50·8	58·6
Mostar		108·7	49	—	—	—	—	54·4	—
Vienna		109·6	44	e 14 40	−15	27 26	+ 2	e 44·8	61·5
Adelaide		110·2	206	e 5 30	?	i 27 30	0	e 45·5	56·0
Athens		110·7	58	e 18 41	?PR_1	29 5	+91	e 49·5	72·0
Belgrade		110·9	49	e 14 56	− 6	i 26 36	−60	38·2	66·5
Helwan		113·8	69	14 56	−19	—	—	—	69·5
Upsala		114·1	33	e 16 0	+44	i 29 19	+76	e 47·0	59·8
Konigsberg		114·2	39	e 16 27	+70	—	—	e 47·3	55·0
Lemberg		114·8	45	e 19 0	[+23]	e 30 0	+112	e 47·2	69·7
Perth		118·7	187	20 36?	?PR_1	35 9	?	62·4	81·6
Tiflis		127·1	57	e 19 56	[+45]	—	—	e 43·6	66·2
Malabar		143·7	177	i 19 44	[− 2]	—	—	73·6	—
Batavia		144·7	174	i 19 44	[− 4]	—	—	73·4	75·3
Colombo		144·7	122	(20 0)	[+12]	20 0	?P	76·0	82·5
Kodaikanal		145·0	117	—	—	—	—	78·9	92·3
Bombay		145·6	97	19 57	[+ 8]	37 18	?	74·8	78·6
Ootomari		148·4	314	18 47	[−66]	41 58	?SR_1	61·8	72·5
Mizusawa	E.	151·7	300	20 7	[+ 9]	42 42	?SR_1	—	—
	N.	151·7	300	20 5	[+ 7]	43 1	?SR_1	—	—
Simla	E.	152·5	78	20 12	[+12]	34 48	?	81·3	93·8
Tokyo		153·3	293	20 4	[+ 4]	34 22	?	70·5	76·4
Nagoya		155·6	292	20 5	[+ 2]	—	—	—	—
Osaka		156·9	291	20 22	[+17]	44 17	?SR_1	64·3	90·8
Kobe		157·2	291	20 8	[+ 3]	31 42	?	45·4	92·8
Calcutta	E.	160·3	104	20 22	[+14]	31 58	?	—	—
	N.	160·3	104	20 10	[+ 2]	32 8	?	—	—
Manila		161·8	220	20 12	[+ 3]	—	—	78·5	88·5
Nagasaki		161·8	287	20 14	[+ 5]	—	—	45·8	88·1
Taihoku		168·2	253	20 27	[+13]	32 21	?	46·0	101·4
Zi-ka-wei		169·3	285	e 20 34	[+20]	e 32 0	?	—	94·9
Hong Kong		171·9	216	20 20	[+ 4]	—	—	—	73·5

Additional readings and notes: Rio de Janeiro readings have been diminished by 1h. Porto Rico gives also $PR_1 = +10m.43s.$, eN = +13m.11s., PSE? = +16m.8s., $SR_1E = +18m.45s.$, $eSR_1N = +19m.7s.$, LE = +25·7m., eLN = +29·5m., iN = +27m.5s., $T_e = 4h.32m.34s.$ Port au Prince eP = +8m.33s. Vera Cruz SN = +17m.10s. Mobile ePEN = 4h.24m.40s. Mazatlan MZ = +30·4m., all readings increased by 1h.20m. Cheltenham $PR_1N = +14m.4s.$, $PR_2N = +15m.39s.$, PSE? = +20m.19s., $SR_1EN = +25m.9s.$, $SR_2E = +27m.23s.$, $eSR_4N = +27m.48s.$, eLE = +37·0m., eLN = +40·7m., $T_e = 4h.32m.46s.$ Ithaca $SR_1 = +26m.12s.$ and several L's. Tucson PSE? = +21m.37s., PSN? = +21m.24s., $SR_1E = +26m.15s.$, $SR_2EN =$

Continued on next page.

+29m.34s., eE = +30m.45s., eN = +31m.9s., LE = +37·5m., and +38·3m., LN = +36·6m., T_0 = 4h.32m.33s. Ann Arbor MN = +39·1m., T_0 = 4h.32m.54s. Toronto i = +14m.30s., i = +30m.48s., and +32m.30s., iL = +52·9m. and +53·2m., T_0 = 4h.32m.29s. Halifax PR_2E = +16m.53s., SR_2?E = +29m.58s., LE = +47·0m. and +72·0m., T_0 = 4h.32m.58s. Ottawa SR_2? = +30m.30s., MN = +43·5m., T_0 = 4h.32m.37s. Denver MN = +43·5m. ? All readings have been diminished by 1h. Lick iPR_1EN = +15m.57s., iPSE = +23m.47s., i? = +26m.47s., iSR_1E = +27m.38s., iSR_1N = +28m.20s., MZ = +39·3m. Berkeley iPZ = +12m.50s., PSN = +23m.17s., and +24m.1s., PSE = +23m.55s., SR_1N = +28m.4s., SR_1E = +28m.9s., SR_1N? = +28m.26s., SR_2E = +31m.51s., SR_2N = +31m.53s. Johannesburg S has been increased by 10m. Christchurch PR_1 = +16m.48s., SR_1 = +30m.18s. Wellington PR_1 = +16m.48s., SR_2 = +32m.24s. San Fernando MN = +56·7m. Coimbra PR_1 = +16m.50s., PR_2 = +19m.46s., iE = +24m.24s., and +26m.6s., iN = +24m.46s., and +25m.32s., SR_1E = +29m.38s., SR_1 = +34m.20s., T_0 = 4h.32m.25s. Victoria T_0 = 4h.32m.59s., the second line in the table for this station gives the M-S readings from which T_0 = 4h.33m.5s. was deduced. Granada PS = +24m.55s., MN = +43·4m., T_0 = 4h.32m.54s. Apia PR_1 = +17m.23s., a reading +26m.6s., SR_1 = +31m.56s., T_0 = 4h.33m.2s. Toledo PR_1NE = +16m.38s., PR_1NW = +16m.48s., PR_2NE = +19m.10s., PR_2NW = +20m.27s., PR_2NE = +20m.53s., SR_1NW = +30m.57s., SR_1NE = +31m.7s., SR_2NE = +34m.46s., SR_2NW = +34m.52s., SR_2NW = +38m.7s., SR_2NE = +38m.31s., MNW = +50·2m. Tortosa SE = +24m.19s. Barcelona PS? = +25m.54s., MN = +60·2m., T_0 = 4h.32m.58s. Honolulu PR_1 = +17m.51s., i=+18m.10s., PR_2=+20m.14s., iE=+32m.30s., iPS=+27m.2s., SR_1E = +31m.15s., SR_1N = +31m.20s., SR_2E = +37m.45s., SR_2N = +36m.55s., LEN = +44·9m., L (rep.) E = +99·8m., L (rep) N = +99·7m. Marseilles PR_1 = +17m.50s. Oxford PR_1 =17m.54s. Sitka PR_1E = +18m.13s., ePR_1N = +17m.48s., PR_2E= +20m.32s., eE = +24m.12s., eN = +24m.40s., PSE? = +26m.50s., SR_1E = +32m.35s., SR_1N = +32m.47s., SR_2E = +36m.48s., SR_2N = +36m.44s., eN = +40m.35s., LE = +51·2m., LN = +53·5m., T_0 = 4h.32m.38s. Paris PR_1 = +18m.8s., MN = +47·5m. Uccle PR_1 = +18m.24s., i = +28m.11s., MN = +60·7m. Rocca di Papa iPZ = +14m.19s., ePN = +14m.24s., eL = +52·5m. Strasbourg PN = +14m.10s., MN = +62·5m., T_0 = 4h.33m.5s. De Bilt MN = +64·8m., T_0 = 4h.32m.37s. Sydney PR_1 = +18m.30s., SR_1 = +31m.30s. Riverview ePR_1 = +16m.50s., PS = +25m.42s., e = +28m.27s., +28m.59s., +33m.36s., and +34m.23s., eL = +45·7m., MZ = +51·3m., MN = +56·3m., T_0 = 4h.30m.42s. Innsbruck MNW = +68·0m. Hamburg ePR_1Z = +18m.13s., ePR_1N = +18m.47s., ePR_1E = +18m.57s., iPR_1E = +19m.20s., iPR_1Z = +19m.22s., SR_1Z = +38m.1s., MN = +61·4m., MZ = +61·6m. Bergen PR_1 = +20m.0s., SR_1 = +35m.2s., iE = +67m.22s., L = +115·0m., M = +136·8m. Mostar eL = +37·8m., L = +46·6m. Vienna i = +19m.5s., iN = +19m.7s., iPR_1 = +19m.31s., i = +23m.33s., PSZ = +25m.32s., iPSE = +25m.39s., PSN = +25m.47s., iE = +28m.53s., PSN = +29m.9s., PSE = +29m.24s., PSZ = +29m.29s., SR_1E = +34m.47s., MN = +40·5m., Adelaide e = 4h.25m.0s.? eS? = +19m.30s., e = +23m.30s., iSR? = +25m.30s., i = +29m.30s., eSR_1? = +31m.30s., i = +34m.30s. Athens ePN = +19m.3s., PR_1 = +19m.15s., SR_1 = +35m.9s., MN = +55·2m. Belgrade PR_1 = +18m.10s., +20m.21s., +20m.53s., and +21m.58s., SR_1 = +29m.19s., MN = +57·6m. Helwan PR_1 = +19m.30s. Upsala PR_1 = +20m.9s., MN = +53·3m. Konigsberg PR_2? = +16m.52s., SR_1N = +29m.57s., SR_2N = +35m.40s., SR_2N = +39m.0s. Perth PR_1 = +15m.23s., PR_2 = +27m.51s., PR_3 = +31m.40s., SR_1 = +37m.23s., SR_2 = +42m.30s., SR_3 = +46m.49s. Tiflis gives several other e readings. Malabar iN = +25m.38s., iE = +42m.25s., LE = +52·4m. Batavia i = +19m.55s., +27m.16s., +36m.4s., and +48m.49s. Colombo P = 4h.27m.30s. Kodaikanal L has been increased by 1h. Ootomari MN = +90·4m. Simla SN = +38m.48s., LN = +63·7m. Tokyo PR_1 = +25m.40s., PR_2 = +29m.17s., PR_3 = +31m.49s., PS = +37m.39s., eSR_1 = +46m.3s., SR_2 = +49m.38s. Osaka MN = +91·0m. Kobe MN = +91·0m. Manila MN = +87·5m. Zi-ka-wei SR_1N = +47m.10s., SR_1E = +48m.28s., MN = +103·0m.

This disastrous earthquake was felt over the whole of Chile, "between Antofagasta (lat. −23°) in the north and Valdivia (lat. −40°) more than a thousand miles to the south of it." (London *Times* of Nov. 13). "The town of Coquimbo (30°S. 71°·5W.) was partly destroyed by a seismic wave and by fires. . . . Great loss of life and property is reported from Copiapo (27°·5S. 71°·0W.)." "The earthquake was felt at Buenos Aires (34°·5S. 58°·5E.), where it was violent enough to extinguish lights and stop clocks." "At Hilo in Hawaii (20°N. 160°W.) a seismic wave washed away many boats." For some days the newspapers continued to give sensational details of this and the following associated shocks :—

Continued on next page.

1800 killed, 35,000 homeless, and so on. The Carnegie Institution commissioned Professor Bailly Willis to investigate the details, and on 1923 June 12 some account was given of his results. He assigned the origin as "near the solitary islands of St. Felix and St. Ambrose, about 670 miles off the coast of Caldera." Lobsters which used to be abundant near St. Felix had been nearly all killed, and only a few young seabirds were found to have survived.

But it seems highly improbable that the origin was so far west as this (say 26°·5S. 80°·0W.). An epicentre 26°·0S. 80°·0W. was adopted on 1917 Feb. 15 and 1918 Sept. 28, so that comparison is easily made. We can only infer that the macroseismic evidence does not help us, and unfortunately the information from the South American stations (except La Paz and Rio de Janeiro) is curiously vague and unsatisfactory just when it might have been expected to be at its best.

The following points may be specially noted, in view of the great importance of this earthquake :—

Time of T_0. The S and P residuals enable us to calculate the error of T_0 in the manner often previously described. The values assigned for δT_0 are

Values	−25s.	−15s.	−5s.		+5s.	+15s.	+25s.	+35s.
No. Obs.	3	3	6		7	2	3	

The actual mean is $\delta T_0 = +3$s., which accords well with this distribution.

Time at Antipodes. The values of [P] near the Antipodes are distinctly positive, as given above. Collecting those for $\Delta > 140°$ in order of magnitude, we have

Value	−5s.	0s.	+5s.	+10s.	+15s.	+20s.
No. Obs.	2	6	4	4	2	

The actual mean is +8s., which accords well with the distributions shewn. Dividing the 18 observations into groups according to Δ, the mean values are

Δ =	145°	155°	165°
Mean	+4·5s.	+8s.	+9s.

So that the corrections indicated to the adopted formula are small. If we increase T_0 by 3s. or 4s., as above, the mean value of the [P] residual is about [+5s], indicating a focal depth slightly *above* normal, say ·020 at most.

Depth of focus. It is not easy to test whether this suggestion of a high focus is supported by the observations near the epicentre, for they cluster near a particular azimuth. Excluding for a moment stations for which $\Delta > 89°$ (where the errors of the tables are sensible) no less than 23 stations have azimuths between 321° and 373° ; the remaining stations being

	Δ	Az.	P.	S.
	°	°	s.	s.
Rio de Janeiro	25·7	83	−15	−10
Johannesburg	84·8	117	+ 1	−11
Cape Town	73·9	120	+13	+17
Christchurch	87·0	220	−17	−17

These observations suggest rather accidental errors (or errors possibly in time determination) than errors in epicentre or depth of focus.

As regards the stations with $\Delta > 89°$, especially the European ones, the large negative residuals resemble those noticed elsewhere as being probably due to the adopted tables, and we may get useful information on such points from this earthquake. The available results may be summarised thus :—

Corrections to tables for $\Delta > 90°$.

Δ	No. Obs.	P.	S.
°		s.	s.
91·8	4	− 5	−20
96·8	4	−17	−50
101·1	6	−15	−61
104·7	11	−19	−75
105·6	3	−38	−91
108·7	3	−17	+54

The discontinuity at $\Delta = 106°$ suggests that more than one phenomenon is liable to be recorded as S, as already noticed in the "Large Earthquakes of 1913." There is also apparently a discontinuity about $\Delta = 92°$, possibly due to the same cause. A number of facts could be explained if there is some phenomenon which occurs about 30s.−90s., before S and is therefore liable to be mistaken for it, especially if this phenomenon occurs sometimes and not always.

1922. Nov. 11d. 18h. 9m. 12s. Epicentre **29°·0S. 71°·0W.**
(as at 4h.).

A = +·285, B = −·827, C = −·485 ; D = −·946, E = −·326 ;
G = −·158, H = +·458, K = −·875.

The identity of the focus with that at 4h. is well supported by direct comparison of the observations near the epicentre, except those at Rio de Janeiro. But it is curious that the European observations show P some 20 sec. later, and S some 20 sec. earlier than at 4h.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	N.	4·4	73	0 18	−50	—	—	0·4	2·1
Mendoza		4·5	150	4 36	?	—	—	5·5	7·0
Pilar		6·7	115	2 12	+30	(3 0)	− 2	3·0	6·7
La Quiaca	N.	8·4	36	2 0	− 7	—	—	4·3	6·0
Cipolletti		10·3	167	2 48	+14	—	—	4·9	8·8
Chacarita		12·0	121	2 54	− 5	—	—	6·9	7·2
La Paz		12·8	13	i 3 17	+ 7	i 5 21	−18	6·6	7·4
Rio de Janciro		25·7	83	e 5 48	+ 3	10 24	+ 8	13·2	16·6
Vera Cruz		54·0	331	9 8	−25	—	—	—	—
Tacubaya	E.	55·5	328	9 45	+ 2	17 21	− 7	25·2	30·1
	N.	55·5	328	9 44	+ 1	16 20	−68	25·3	30·0
Georgetown	E.	68·2	355	e 11 9	+ 4	i 20 4	0	e 41·1	—
	N.	68·2	355	i 11 11	+ 6	e 20 3	− 1	e 41·2	—
Washington		68·2	355	11 8	+ 3	19 59	− 5	e 37·8	—
Ithaca		71·7	356	—	—	—	—	38·8	—
Ann Arbor		72·3	351	11 36	+ 4	20 42	−12	e 34·8	—
Chicago		72·5	348	i 11 33	0	20 38	−18	34·4	—
Toronto		73·0	354	11 48	+12	20 6	−56	30·3	51·4
Cape Town		73·9	120	21 34	?S	(21 34)	+21	—	40·8
Ottawa		74·5	357	11 46	0	21 10	−10	e 35·3	—
Lick	E.	81·6	321	e 12 44	+16	22 42	0	i 40·3	45·0
	N.	81·6	321	e 12 42	+14	22 38	− 4	—	—
Berkeley	E.	82·7	321	—	—	e 22 52	− 2	e 42·8	—
Johannesburg		84·8	117	—	—	—	—	44·8	—
San Fernando		89·3	46	13 36	+24	24 6	0	—	55·5
Coimbra	E.	90·4	42	e 12 31	−47	22 35	−103	40·5	52·5
	N.	90·4	42	—	—	—	—	41·3	52·7
Victoria		90·5	329	23 33	?S	(23 33)	−46	47·2	51·2
	E.	90·5	329	13 17	− 2	24 7	−12	40·5	50·7
Granada		91·4	47	13 23	0	e 24 20	− 8	e 37·8	50·8
Toledo		92·8	45	13 21	−10	24 1	−42	e 37·8	55·8
Algiers		95·6	50	e 13 40	− 7	24 15	−57	42·8	56·8
Tortosa	N.	96·2	46	12 52	−58	24 21	−57	37·7	58·4
Bidston		101·2	35	—	—	25 48	−19	—	54·8
Oxford		101·4	37	—	—	24 40	−89	44·2	61·1
Kew		101·5	37	—	—	—	—	—	66·8
Paris		101·6	40	—	—	e 24 35	−96	47·8	59·8
Stonyhurst		101·7	35	e 18 12	?PR_1	24 48	−84	—	60·8
Eskdalemuir		102·1	32	e 14 16	− 5	e 24 46	−90	43·8	46·3
Edinburgh		102·5	32	—	—	24 0	−140	44·8	55·8
Besançon		102·8	42	—	—	—	—	51·8	—
Uccle		103·6	39	e 14 24	− 4	e 24 54	−95	e 44·8	60·1
Dyce	N.	103·7	30	—	—	i 24 58	−92	39·9	46·9
Strasbourg		104·5	42	14 27	− 5	—	—	48·8	62·8
Rocca di Papa		104·5	50	e 24 48	?S	(e 24 48)	−110	e 52·3	65·2
Florence		104·5	47	25 18	?S	(25 18)	−80	43·3	62·8
De Bilt		104·7	39	14 28	− 5	e 25 11	−88	e 44·8	61·2
Melbourne		105·2	209	—	—	25 48	−56	47·5	58·4
Sydney		105·5	215	25 18	?S	(25 18)	−89	52·0	56·7
Innsbruck		106·1	43	—	—	—	—	e 55·8	—
Hamburg		108·0	38	—	—	—	—	e 53·8	60·8
Vienna		109·6	44	14 4	−51	—	—	e 55·8	69·8
Adelaide		110·2	206	—	—	e 29 36	+126	e 57·6	59·8
Helwan		113·8	69	e 19 51	?PR_1	29 36	+96	64·8	66·0
Tiflis		127·1	57	21 34	?PR_1	—	—	e 42·5	75·4
Colombo		144·7	122	20 48	[+60]	—	—	—	86·8
Batavia		144·7	174	20 2	[+14]	—	—	—	—
Kodaikanal		145·0	117	72 54	?L	—	—	79·8	88·0
Manila		161·8	220	20 16	[+ 7]	—	—	—	—
Zi-ka-wei		169·3	285	e 23 44	?PR_1	—	—	e 87·8	—

For Notes see next page.

Notes to Nov. 11d. 18h. 9m. 12s.

Additional readings and notes: Ithaca L = +41·8m. and +44·8m. Toronto eL = +48·1m. and +62·7m. Ottawa L = +43·8m. and +48·1m., T_e = 18h.9m.33s. Berkeley eLE = +53·9m. and +58·9m., eLN = +44·7m., and +51·6m. Coimbra PS = +23m.23s., iN = +23m.48s., T_e = 18h.9m.38s. Victoria (first line) S = +32m.18s., the second line is composed of M-S readings. Paris MN = +52·8m. Eskdalemuir e = +18m.27s., iE = +24m.58s., e = +27m.17s., SR_1? = +33m.16s., MN = 46·5m. Uccle PR_1 = +18m.36s., MN = +63·2m. Strasbourg MN = +61·2m. Rocca di Papa eS = +32m.12s. De Bilt PR_1 = +18m.45s., e = +28m.1s., MNZ = +58·9m. Vienna iZ = +19m.3s. Adelaide gives four other "e" readings. Tiflis e = +22m.16s. and +28m.3s., MN = +91·6m. Manila P is increased by 10m., also e = +20m.48s.

Nov. 11d. 22h. 13m. 0s. Epicentre 37°·5N. 23°·0E. (as on 1922 Aug. 19d.).
A = +·730, B = +·310, C = +·609; D = +·391, E = −·921.; G = +·560, H = +·238, K = −·793.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	0·7	51	i 0 34	+23	—	—	—	0·8
Pompeii	7·3	299	1 51	0	2 31	−47	—	—
Belgrade	7·5	347	i 1 57	+ 3	i 3 56	?L	(i 3·9)	4·9
Rocca di Papa	9·0	58	i 2 15	− 1	i 3 56	− 7	—	5·5
Florence	10·9	309	5 0	?L	—	—	(5·0)	7·0
Vienna	11·5	338	i 2 53	+ 1	i 5 29	+22	—	8·1
Innsbruck	13·0	323	i 5 10	?S	(i 5 10)	−34	(i 7·4)	—
Moncalieri	13·7	308	1 44	−98	6 4	+ 3	8·0	—
Zurich	14·5	318	e 3 27	− 6	i 6 11	− 9	—	—
Strasbourg	15·6	320	3 48	+ 1	e 8 27	?L	9·4	—
Besançon	15·8	313	e 3 49	0	—	—	—	—
Algiers	15·9	273	e 3 43	− 8	6 51	− 2	—	—
Tortosa	17·7	286	4 11	− 2	7 36	+ 3	e 20·0	—
Hamburg Z.	18·5	335	e 4 19	− 4	—	—	—	—
Uccle	18·8	321	4 25	− 2	e 7 48	−10	e 10·0	—
De Bilt	19·2	325	4 31	0	8 6	0	9·8	—
Granada	21·1	277	4 55	+ 1	i 8 43	− 3	—	—
Toledo	21·2	285	e 4 53	− 2	8 57	+ 9	—	—
Coimbra	24·5	286	e 4 50	−43	9 23	−31	e 18·0	—
Eskdalemuir	25·1	324	—	—	i 9 55	−10	—	—
Edinburgh	25·4	325	—	—	—	—	—	10·0

Vienna gives also i = +4m.7s.

Nov. 11d. 23h. 26m. 0s. Epicentre 29°·0S. 71°·0W. (as at 18h.).

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	4·4	73	0 36	−32	—	—	1·7	2·0
	N.	4·4	73	0 30	−38	—	—	1·5	1·6
Pilar	E.	6·7	115	1 12	−30	—	—	3·9	4·7
La Quiaca	E.	8·4	36	1 24	−43	—	—	3·5	4·3
	N.	8·4	36	2 0	− 7	—	—	4·1	4·8
Cipolletti		10·3	167	2 48	+14	—	—	5·2	7·2
La Paz		12·8	13	e 3 27	+17	5 33	− 6	6·4	7·1
Coimbra		90·4	42	e 40 32	?	—	—	e 51·0	—
Toledo		92·8	45	—	—	—	—	52·0	—
Tortosa	N.	96·2	46	—	—	—	—	e 52·0	57·4
Stonyhurst		101·7	35	e 49 0	?L	—	—	(e 49·0)	61·0
Eskdalemuir		102·1	32	e 46 0	?	—	—	60·0	—
Edinburgh		102·5	32	—	—	—	—	e 55·5	—
Uccle		103·6	39	—	—	—	—	e 51·0	—
Strasbourg		104·5	42	—	—	—	—	e 60·4	—
De Bilt		104·7	39	—	—	—	—	e 52·0	—
Colombo		144·7	122	85 0	?L	—	—	(85·0)	92·0

Coimbra gives also e = +46m.22s., eLN = +52·0m.

Nov. 11d. Readings also at 1h. (near Tokyo), 2h. (La Paz), 5h. (Mendoza and near Mizusawa), 6h. (Florence), 7h. (Washington, Granada, Toledo, La Quiaca, and Batavia), 8h. (Hamburg), 9h. (Azores), 10h. (Pilar (2), La Quiaca, Mendoza (2), and Cipolletti (2)), 11h. (Eskdalemuir, De Bilt, Uccle, Strasbourg, La Quiaca (2), Pilar (2), Cipolletti (2), and Mendoza), 12h. (Tortosa), 16h. (near Tokyo and near Mizusawa), 17h. (Batavia, Pilar, Mendoza, and Vienna), 20h. (La Paz), 21h. (La Paz), 22h. (La Paz). See also Appendix.

Nov. 12d. 7h. 9m. 0s. Epicentre 29°·S. 71°·0W. (as on 11d. 4h., 18h., and 23h.)

A = +·285, B = −·827, C = −·485 ; D = −·946, E = −·326 ; G = −·158, H = +·458, K = −·875.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	4·4	73	−0 30	?	—	—	0·6	1·7
	N.	4·4	73	−0 24	?	—	—	0·8	1·5
Mendoza		4·5	150	4 54	?	—	—	6·0	7·4
Pilar	E.	6·7	115	1 42	0	—	—	3·8	5·1
	N.	6·7	115	1 48	+ 6	—	—	3·9	4·5
La Quiaca		8·4	36	—	—	—	—	5·0	5·8
Cipolletti		10·3	167	2 36	+ 2	—	—	3·9	4·2
Chacarita	E.	12·0	121	5 30	?S	(5 30)	+11	6·6	8·1
	N.	12·0	121	5 12	?S	(5 12)	− 7	6·6	7·9
La Paz		12·8	13	—	—	5 39	0	7·0	7·8
Rio de Janeiro		25·7	83	i 6 48	+63	11 42	+86	17·0	18·3
Tacubaya	E.	55·5	328	9 46	+ 3	17 24	− 4	—	—
Toronto		73·0	354	—	—	—	—	55·0	—
Ottawa		74·5	357	—	—	i 21 22	+ 2	—	—
Coimbra		90·4	42	10 13	?	23 20	−58	51·0	—
Victoria		90·5	329	23 54	?S	(23 54)	−25	45·9	51·1
Algiers		95·6	50	e 16 43	?	24 10	−62	—	51·5
Tortosa	N.	96·2	46	—	—	—	—	e 45·0	60·2
Bidston		101·2	35	—	—	54 0	?L	(54·0)	90·0
Oxford		101·4	37	—	—	i 24 40	−89	47·4	60·2
Kew		101·5	37	—	—	—	—	—	66·0
Stonyhurst		101·7	35	e 44 30	?L	—	—	(e 44·5)	62·0
Edinburgh		102·5	32	—	—	—	—	e 57·0	67·0
Moncalieri		102·8	45	e 15 32	+68	25 49	−33	54·6	62·9
Uccle		103·6	39	—	—	e 24 54	−95	e 47·0	67·0
Florence		104·5	47	e 39 0	?	—	—	—	59·0
Strasbourg		104·5	42	—	—	—	—	e 64·7	—
Rocca di Papa		104·5	50	—	—	—	—	52·8	83·0
De Bilt		104·7	39	—	—	e 25 36	− 63	e 51·0	66·5
Hamburg		108·0	38	—	—	—	—	e 58·0	—
Vienna	Z.	109·6	44	e 19 10	?PR_1	—	—	—	—
Colombo		144·7	122	72 0	?L	—	—	(72·0)	90·0
Kodaikanal		145·0	117	79 0	?L	—	—	(79·0)	—

Additional readings: Tacubaya gives also PN = +9m.42s. Victoria S = +30m.24s. (?SR_1). Moncalieri MN = +62·6m. De Bilt MN = +62·2m., MZ = +65·8m.

Nov. 12d. Readings also at 0h. (La Paz), 1h. (Pilar, Cipolletti, La Paz, and Mendoza), 4h. (La Paz), 5h. (La Paz and Apia), 9h. and 10h. (3) (near Athens), 13h. (Pilar, Andalgala, and Mendoza), 16h. (near Mizusawa, near Tacubaya, and near Tokyo (5)), 17h. (near La Paz and Mendoza, and near Tokyo (4)), 18h. (La Paz (2)), 19h. (Colombo), 22h. (Florence). See also Appendix.

Nov. 13d. 3h. 56m. 0s. Epicentre 65°·5N. 19°·5W.

A = +·391, B = −·138, C = +·910 ; D = −·334, E = −·943 ; G = +·858, H = −·304, K = −·415.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Edinburgh		12·4	133	—	—	—	—	6·0	14·3
Eskdalemuir		12·9	134	e 4 0	+48	e 6 20	?L	(e 6·3)	—
Stonyhurst		14·4	136	i 7 30	?L	—	—	(i 7·5)	8·2
Bidston		14·6	138	5 29	?S	(5 29)	−53	8·8	10·5
Oxford		16·5	137	4 21	+22	i 7 13	+ 6	i 8·9	11·9
Kew		17·1	136	—	—	—	—	—	10·0
Upsala		17·6	91	e 4 14	+ 2	7 34	+ 3	—	—
De Bilt		18·2	125	4 20	+ 1	7 45	+ 1	9·6	—
Hamburg		18·8	115	e 4 21	− 6	i 7 54	− 4	—	—
Uccle		19·1	129	4 30	0	—	—	e 9·0	—
Moncalieri		25·3	131	5 40	− 1	9 32	−37	13·1	—
Vienna	Z.	25·5	115	e 5 58	+15	—	—	—	—
Coimbra		26·1	160	5 23	−26	(10 10)	−14	—	—
Toledo		27·1	153	4 57	−62	11 0	+17	13·8	16·6
Tortosa		27·2	145	6 0	0	e 16 30	?L	(e 16·5)	—

Additional readings: Bidston gives also P = +7m.0s., S = +7m.50s. Coimbra eSN = +18m.20s., eSE = +18m.45s.

Nov. 13d. Readings also at 0h. (La Paz), 1h. (Pilar, Mendoza, Cipolletti, and La Paz), 2h. (La Paz, Pilar, Mendoza, and near Tokyo), 3h. (La Paz and Mendoza), 4h. (La Paz (3), Cipolletti (2), Pilar (3), La Quiaca (2), Mendoza (3), Andalgala (3), Eskdalemuir, Tortosa, Toledo, Uccle, Victoria, Coimbra, and Florence. Some of these readings are given as late phases of the 3h.56m.0s. shock tabulated above), 5h. (De Bilt, Hamburg, Edinburgh, and Colombo), 6h. (La Paz), 7h. (Pilar, Cipolletti, Mendoza, and Andalgala, La Paz (2), Pompeii, and Rocca di Papa), 8h. (La Paz, Cipolletti, Pilar, and Mendoza), 9h. (Colombo and La Paz), 10h. and 17h. (La Paz), 19h. (La Paz, Mendoza, and Pilar), 21h. (La Paz), 22h. (La Paz, Pilar, Mendoza, and Cipolletti). See also Appendix.

Nov. 14d. Readings at 1h. (Mendoza and La Paz), 2h. (Mendoza and La Paz), 5h. (De Bilt, Eskdalemuir, Coimbra, Vienna, Uccle, Toledo, Colombo, Kodaikanal, Johannesburg, Cape Town, La Paz, Mendoza, and Pilar), 6h. (Victoria), 8h. (near La Paz), 15h. (Algiers), 17h. (La Paz), 19h. (Marseilles).

Nov. 15d. Readings at 0h. (Lick), 1h. (Colombo), 2h. (Lick), 6h. (La Paz (2), Mendoza (2), Pilar (2), Cipolletti (2), and Andalgala (2)), 8h. (La Paz, Pilar, Cipolletti, Mendoza, and Andalgala), 11h. (La Paz and near Tokyo and Mizusawa), 13h., 14h. (2), and 18h. (La Paz), 23h. (La Paz and near Mizusawa). See also Appendix.

Nov. 16d. Readings at 0h. (La Paz), 1h. (Lick and La Paz), 2h. (La Paz (2), Mendoza (2), Andalgala, Cipolletti (2), and Pilar), 4h. (Batavia, Mendoza, Andalgala (2), Cipolletti, La Paz (2), and Pilar), 10h. (Manila), 11h. (near Lick and Berkeley), 12h. (Manila), 13h. (Batavia), 17h. (near Tortosa), 21h. (La Paz), 22h. (La Paz and Batavia), 23h. (La Paz). See also Appendix.

1922. Nov. 17d. 11h. 2m. 42s. Epicentre 29°·0S. 71°·0W.

(as on 1922 Nov. 12d.).

$A = +\cdot285$, $B = -\cdot827$, $C = -\cdot485$; $D = -\cdot946$, $E = -\cdot326$; $G = -\cdot158$, $H = +\cdot458$, $K = -\cdot875$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	4·4	73	−1 36	?	—	—	−0·4	2·1
Pilar	E.	6·7	115	2 0	+18	—	—	4·0	5·5
	N.	6·7	115	1 54	+12	—	—	3·9	5·2
La Quiaca		8·4	36	2 42	+35	—	—	4·3	6·4
Cipolletti		10·3	167	3 36	+62	—	—	7·0	10·3
Chacarita		12·0	121	3 6	+ 7	5 54	+35	7·2	8·7
La Paz		12·8	13	i 3 7	− 3	i 5 43	+ 4	6·9	7·4
Rio de Janeiro		25·7	83	i 5 42	− 3	10 36	+20	13·1	14·3
Balboa Heights	N.	38·9	348	7 38	− 7	13 23	−28	—	21·3
Tacubaya	E.	55·5	328	9 51	+ 8	17 30	+ 2	26·0?	30·0
	N.	55·5	328	9 52	+ 9	17 29	+ 1	26·2	30·1
Georgetown	E.	68·2	355	e 10 20	−45	19 18	−46	—	—
	N.	68·2	355	e 10 20	−45	19 20	−44	e 37·9	—
Washington		68·2	355	11 12	+ 7	21 12	+68	37·8	—
Ithaca		71·7	356	e 11 35	+ 7	20 41	− 5	33·3	—
Tucson	N.	72·0	325	—	—	—	—	e 36·5	—
Ann Arbor		72·3	351	11 42	+10	20 48	− 6	35·2	—
Chicago		72·5	348	11 48	+15	20 48	− 8	34·5	—
Toronto		73·0	354	12 18	+42	21 12	+10	30·3	55·0
Northfield		73·2	359	—	—	21 10	+ 6	43·3	—
Cape Town		73·9	120	21 50	?S	(21 50)	+37	—	39·2
Ottawa		74·5	357	11 55	+ 9	21 16	− 4	e 32·3	—
Lick		81·6	321	e 12 40	+12	i 22 40	− 2	i 39·2	44·8
Berkeley		82·7	321	e 12 34	0	e 22 46	− 8	e 42·4	—
Johannesburg		84·8	117	23 18	?S	(23 18)	+ 1	42·3	47·8
San Fernando		89·3	46	13 48?	+36	24 0?	− 6	—	73·9
Rio Tinto		89·9	45	27 18	?	—	—	—	61·3

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Victoria		90·5	329	13 38	+19	23 53	−26	40·1	51·0
Granada		91·4	47	e 13 44	+21	i 24 37	+ 9	e 41·3	—
Toledo	N.E.	92·8	45	—	—	—	—	—	57·5
Algiers		95·6	50	e 13 48	+ 1	e 24 18	−54	42·3	60·3
Tortosa	N.	96·2	46	—	—	25 9	− 9	37·6	59·4
Barcelona		97·5	46	—	—	e 24 14	−77	e 42·2	56·4
Honolulu	E.	97·8	290	24 26	?	32 8	?SR_1	44·6	46·3
	N.	97·8	290	i 24 36	?	—	—	41·2	46·3
Marseilles		100·5	46	—	—	e 25 18	−43	e 36·3	58·3
Bidston		101·2	35	17 21	?PR_1	25 53	−14	—	57·8
Oxford		101·4	37	—	—	24 58	−71	40·7	61·1
Kew		101·5	37	—	—	—	—	—	63·3
Paris		101·6	40	—	—	i 25 4	−67	48·3	55·3
Sitka		101·6	330	—	—	—	—	56·3	58·3
Stonyhurst		101·7	35	—	—	—	—	—	57·8
Eskdalemuir		102·1	32	—	—	i 25 54	−22	44·3	46·6
Edinburgh		102·5	32	—	—	e 25 6	−74	46·3	66·3
Moncalieri		102·8	45	13 48	−36	25 8	−74	41·2	64·7
Besançon		102·8	42	—	—	25 16	−66	47·3	—
Uccle		103·6	39	—	—	e 25 18	−71	e 45·3	52·1
Dyce	N.	103·7	30	—	—	i 25 12	−78	44·4	57·0
Florence		104·5	47	22 28	?PR_1	—	—	—	48·8
Rocca di Papa		104·5	50	e 18 42	?PR_1	i 26 30	− 8	e 52·5	72·4
Strasbourg		104·5	42	e 16 48?	+136	e 25 33	−65	45·9	63·0
De Bilt		104·7	39	—	—	e 26 16	−23	e 44·3	53·0
Melbourne		105·2	209	—	—	e 26 42	− 2	50·8	57·7
Innsbruck		106·1	43	—	—	—	—	e 48·3	—
Hamburg		108·0	38	—	—	—	—	e 52·3	61·3
Bergen		108·6	30	—	—	—	—	67·3	—
Vienna		109·6	44	e 0 34	?	—	—	e 48·3	64·3
Belgrade		110·9	49	—	—	—	—	e 60·0	—
Helwan		113·8	69	19 58	?PR_1	29 41	+101	—	72·8
Konigsberg		114·2	39	—	—	e 26 6	−118	e 56·3	65·8
Malabar		143·7	177	i 20 4	[+18]	—	—	—	—
Colombo		144·7	122	—	—	—	—	74·8	94·8
Batavia		144·7	174	i 19 44	[− 4]	—	—	e 73·5	—
Kodaikanal		145·0	117	29 36	?S	—	—	77·6	86·9
Mizusawa	E.	151·7	300	20 17	[+19]	20 36	?	—	—
Simla	N.	152·5	78	—	—	e 33 30	?	—	—
Manila		161·8	220	e 20 18	[+ 9]	—	—	—	—
Zi-ka-wei		169·3	285	e 20 31	[+17]	e 39 25	?	—	80·4

Additional readings and notes: Rio de Janeiro gives its readings as at 10h., T_o = 10h.2m.9s. Ithaca gives also PR_1 = +14m.46s., L = +41·3m., and +52·3m. Toronto L = +46·8m. and +49·9m. Ottawa L = +34·3m., T_o = 11h.3m.15s. Azores (Δ = 79°·0) gives P = 11h.1m.12s. Lick ePN = +12m.51s. Berkeley gives several other L readings. San Fernando MN = +58·5m. Granada i = +15m.17s. Algiers MN = +50·3m. Oxford ePR$_1$ = +18m.24s. Honolulu LN = +44·2m. and +45·4m. Bidston P = +19m.33s., S = +26m.49s. Paris MN = +69·3m. Sitka e = +51m.26s., eE = +54m.16s., LN = +56·2m., MN = +60·1m. Eskdalemuir e(?S) = +24m.59s., ?SR_1 = +33m.18s. Melbourne eS = +25m.12s., eSR_1 = +33m.12s., iSR_1 = +34m.18s. Moncalieri MN = +51·8m. Uccle MN = +63·8m. Dyce i = +33m.16s. Rocca di Papa ePE = +19m.4s., ePN = +19m.6s., ePV = +19m.30s., eLN = +32·7m. Strasbourg MN = +66·6m. De Bilt ePR$_1$Z = +18m.54s., MNZ = +63·8m. Hamburg MN = +69·3m. Bergen e = +55m.18s. Belgrade L = +66·9m., and +70·0m. Konigsberg MN = +65·3m., S has been increased by 1h. Batavia i = +20m.19s., iN = +20m.51s., eL = +92·4m. Zi-ka-wei PR$_1$Z = +25m.31s.

Nov. 17d. Readings also at 1h. (La Paz), 3h. (Granada), 6h. (La Paz), 8h. (near Belgrade), 9h., 12h., and 13h. (La Paz), 17h. (near Oaxaca and Tacubaya), 18h. (near Tacubaya), 19h. (La Paz, Pilar, and Mendoza), 21h. (Manila).

Nov. 18d. 18h. 56m. 24s. Epicentre 24°·0N. 120°·0E. (as on 1922 Sept. 4d.).

A = −·457, B = +·792, C = +·407 ; D = +·866, E = +·500 ;
G = −·204, H = +·352, K = −·914.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Taihoku	1·8	53	0 28	0	—	—	0·6	0·7
Hong Kong	5·6	254	—	—	—	—	—	5·1
Zi-ka-wei	7·3	10	e 1 49	− 2	e 3 15	− 3	—	4·0
Manila	9·5	172	e 3 36	?S	(e 3 36)	−40	8·9	—
Hamburg	81·9	328	—	—	—	—	e 44·6	—
De Bilt	85·2	326	—	—	—	—	e 44·6	49·6
Strasbourg	85·7	322	—	—	—	—	e 48·8	—
Edinburgh	86·8	332	—	—	—	—	47·6	—
Eskdalemuir	87·2	332	—	—	e 36 46	?	43·6	48·6
Stonyhurst	87·8	330	—	—	—	—	—	51·6
Kew	88·2	329	—	—	—	—	—	51·6
Paris	88·4	326	—	—	—	—	47·6	—
Oxford	88·6	329	—	—	—	—	45·4	49·7
Algiers	95·1	315	—	—	—	—	e 47·6	48·6

Additional readings and notes: Zi-ka-wei gives also MN = +4·2m., MZ = +5·3m. De Bilt MN = +49·5m. Algiers readings have been increased by 1h.

Nov. 18d. Readings also at 2h. (near Batavia), 3h. (La Paz), 6h. (Algiers), 8h. (La Paz), 9h. (Pompeii and Rocca di Papa), 10h. (near Colima), 11h. (Tiflis), 13h. (La Paz), 14h. (near Tacubaya), 16h. and 22h. (La Paz), 23h. (near Tokyo).

Nov. 19d. 17h. 4m. 26s. Epicentre 36°·5N. 1°·5E. (as on 1922 August 25d.).

A = +·804, B = +·021, C = +·595 ; D = +·026, E = −1·000 ;
G = +·595, H = +·016, K = −·804.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Algiers		1·3	76	0 30	+10	0 56	+20	—	1·3
Granada		4·1	280	i 1 3	− 1	i 1 53	0	i 2·0	2·1
Tortosa	N.	4·4	351	1 8	0	2 0	− 1	2·3	5·9
Barcelona		5·0	6	—	—	—	—	e 2·8	3·7
Toledo		5·5	310	1 31	+ 6	2 24	− 7	2·7	3·1
Moncalieri		9·7	28	e 1 36	−50	—	—	5·0	—
Uccle		14·5	8	—	—	—	—	e 6·6	—
De Bilt		15·8	8	—	—	—	—	e 8·6	—
Eskdalemuir		19·1	352	—	—	—	—	9·6	—
La Paz		84·3	245	53 3	?L	—	—	(53·0)	—

Toledo gives also MNW = +3·4m.

Nov. 19d. Readings also at 2h. (Coimbra), 5h. (Zi-ka-wei), 7h. (Batavia and Manila), 8h. (Zi-ka-wei), 9h. (Porto Rico), 10h. (Vera Cruz), 11h. (Vienna, and near Tacubaya), 12h. (Hong Kong and Zi-ka-wei), 13h. (Azores and De Bilt), 15h. and 19h. (La Paz), 23h. (Granada).

Nov. 20d. 4h. 24m. 44s. Epicentre 37°·5N. 29°·0E. (as on 1920 July 4d.).

A = +·694, B = +·385, C = +·609 ; D = +·485, E = −·875 ;
G = +·533, H = +·295, K = −·793.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	4·2	277	e 1 4	− 1	1 53	− 2	2·0	2·2
Pompeii	11·7	291	e 6 21	?L	—	—	(e 6·4)	—
Uccle	22·0	315	e 5 8	+ 3	—	—	e 12·3	—
De Bilt	22·2	319	—	—	e 9 16	+ 7	e 12·9	—
Eskdalemuir	28·1	320	—	—	—	—	15·3	—

Athens gives also MN = +2·7m.

Nov. 20d. 15h. 29m. 20s. Epicentre 8°·0N. 37°·5W. (as on 1915 Sept. 12d.).

A = +·786, B = −·603, C = +·139 ; D = −·609, E = −·793 ;
G = +·111, H = −·085, K = −·990.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
La Paz		39·0	231	7 39	− 7	—	—	19·6	22·6
La Quiaca	E.	40·9	222	22 34	?L	—	—	24·5	26·2
Pilar	E.	47·0	211	23 10	?L	—	—	26·9	28·5
	N.	47·0	211	22 58	?L	—	—	27·5	28·2
Mendoza		50·3	216	27 40	?L	—	—	31·5	32·0
Bidston		53·2	25	28 15	?L	—	—	(28·2)	30·8
Besançon		53·9	39	—	—	—	—	26·7	—
Eskdalemuir		54·5	23	e 12 40	?	e 17 40	+25	24·7	—
Uccle		55·0	32	—	—	—	—	e 23·7	—
Edinburgh		55·0	23	—	—	—	—	e 24·7	—
Strasbourg		55·6	36	—	—	e 25 40	?L	29·7	—
De Bilt		56·1	31	—	—	e 17 47	+12	27·7	—

La Paz gives also MN = +21·5m.

Nov. 20d. Readings also at 1h. (near Mizusawa and Tokyo), 6h. and 11h. (La Paz), 12h. (Rocca di Papa and Pompeii), 14h. (near Mizusawa), 21h. (Melbourne, La Paz, Mendoza, La Quiaca, Cipolletti, Chacarita, Andalgala, and Pilar), 22h. (Eskdalemuir, De Bilt, and near Puebla, Uccle, Vera Cruz, Tacubaya, Colima, and Oaxaca). See also Appendix.

Nov. 21d. Readings at 0h. (Batavia), 3h. (La Paz, Chacarita, Andalgala, Mendoza, Pilar, and Cipolletti), 4h. (De Bilt, Sydney, Uccle, and Eskdalemuir), 8h. (Rocca di Papa), 11h. (Azores), 13h. (Honolulu), 15h. (Tacubaya), 17h. (Cape Town), 21h. (Tiflis) and near Mizusawa). See also Appendix.

Nov. 22d. Readings at 3h. (La Paz and near Tokyo), 5h. (Batavia), 14h. (Apia, De Bilt, Sydney, and near Mizusawa), 15h. (Vienna, Granada, Honolulu, Victoria, and Ottawa), 16h. (De Bilt), 19h. (near La Paz).

Nov. 23d. Readings at 0h. (Zi-ka-wei), 2h. (near Manila), 9h. and 11h. (La Paz), 12h. (near Algiers), 14h. (Simla), 18h. (La Paz).

Nov. 24d. 2h. 15m. 40s. Epicentre 45°·5N. 19°·0E.

A = +·663, B = +·228, C = +·713 ; D = +·326, E = −·946 ;
G = +·674, H = +·232, K = −·701.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Belgrade		1·2	124	i 2 28	+130	i 2 48	+135	—	2·9
Mostar		2·3	202	i 2 55	+139	—	—	—	4·0
Sinj		2·4	208	i 2 49	+132	3 33	+147	—	3·9
Vienna		3·3	327	i 0 53	+ 1	1 49	+18	—	2·0
Pompeii		5·7	216	e 4 11	?L	—	—	(e 4·2)	5·0
Florence		5·7	255	1 59	+31	—	—	—	3·6
Rocca di Papa	E.	5·9	233	e 1 40	+ 9	2 50	+ 9	—	—
	N.	5·9	233	e 1 32	+ 1	2 56	+15	—	—
Zurich		7·4	289	e 1 48	− 4	i 3 26	+ 5	i 3·9	4·2
Moncalieri		7·9	270	1 54	− 6	3 42	+ 8	4·8	5·3
Strasbourg		8·3	296	e 2 54	+48	e 4 25	+40	e 4·7	5·5
Besançon		9·1	286	2 59?	+41	—	—	—	—
Hamburg		10·0	328	—	—	—	—	e 5·3	—
Uccle		11·1	304	e 4 50	?S	(e 4 50)	− 7	(e 6·0)	—
De Bilt		11·2	311	—	—	—	—	e 6·2	7·6
Coimbra		20·7	265	—	—	—	—	e 13·0	—

Additional readings : Belgrade gives also MN = +3·0m. Vienna P = +1m.8s., PR_2 = +1m.34s. Rocca di Papa PR_1N = +1m.56s., PR_1E = +2m.2s. Zurich eE = +1m.51s. Strasbourg eP = +2m.56s., eS = +4m.26s., MN = +5·1m. Coimbra e = +12m.20s.

Nov. 24d. Readings also at 0h. (La Paz (2) and Algiers), 5h. (Manila), 6h. (Algiers (2)), 8h. (Algiers), 10h. (La Paz).

Nov. 25d. Readings at 9h. (Colombo and near Tokyo), 10h. (Lick), 13h. (Taihoku), 14h. (Azores), 16h. (Manila), 17h. (La Paz), 18h. (Paris and near Tortosa), 20h. (La Paz).

Nov. 26d. 13h. 30m. 0s. Epicentre 29°·0S. 71°·0W. (as on Nov. 17d.).

$A = +\cdot285$, $B = -\cdot827$, $C = -\cdot485$; $D = -\cdot946$, $E = -\cdot326$; $G = -\cdot158$, $H = +\cdot458$, $K = -\cdot875$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala		4·4	73	5 24	?	—	—	6·5	7·3
Mendoza		4·5	150	—	—	—	—	2·8	4·8
Pilar	E.	6·7	115	1 12	−30	(2 48)	−14	2·8	3·9
	N.	6·7	115	1 24	−18	(3 0)	− 2	3·0	3·7
La Quiaca	E.	8·4	36	2 48	+41	—	—	4·3	5·4
	N.	8·4	36	3 0	+53	—	—	4·3	5·5
Cipolletti		10·3	167	2 12	−22	(4 0)	−37	4·0	5·2
Chacarita	E.	12·0	121	2 42	−17	(5 12)	− 7	5·2	6·8
	N.	12·0	121	2 48	−11	(5 36)	+17	5·6	7·7
La Plata	E.	12·6	120	2 59	− 8	5 15	−19	6·0	9·5
	N.	12·6	120	2 55	−12	5 16	−18	6·0	7·6
La Paz		12·8	13	i 3 14	+ 4	i 5 40	+ 1	i 6·0	9·2
Washington		68·2	355	11 0	− 5	20 20	+16	—	—
Chicago		72·5	348	11 16	−17	20 37	−19	44·0	—
Toronto		73·0	354	—	—	(21 30)	+28	21·5	—
Northfield		73·2	359	—	—	e 20 38	−26	—	—
Coimbra		90·4	42	—	—	—	—	46·0	—
Victoria		90·5	239	23 59	?S	(23 59)	−20	45·0	46·4
Toledo		92·8	45	—	—	—	—	e 37·0	51·0
Algiers		95·6	50	—	—	e 23 41	−91	48·0	87·0
Bidston		101·2	35	—	—	—	—	—	60·0
Oxford		101·4	37	—	—	i 24 20	−109	—	60·0
Edinburgh		102·5	32	—	—	—	—	e 55·0	63·0
Moncalieri		102·8	45	—	—	e 25 15	−67	90·5	—
Uccle		103·6	39	—	—	—	—	—	53·0
Rocca di Papa		104·5	50	e 18 12	?PR_1	25 54	−44	e 56·6	59·8
De Bilt	E.	104·7	39	—	—	—	—	e 51·0	59·4
	N.	104·7	39	—	—	e 25 52	−47	e 56·0	61·3
Colombo		144·7	122	20 0	[+12]	—	—	—	45·0
Batavia		144·7	174	i 19 35	[−13]	—	—	—	—

La Paz gives also L = +7·1m. and +7·4m. Mendoza readings increased by 10m. Moncalieri e has been diminished by 1h.

Nov. 26d. Readings also at 1h. (La Paz), 2h. (Granada), 3h. (Manila), 8h. (near Berkeley), 13h. (Zi-ka-wei), 14h. (Coimbra, La Paz, Pilar, Chacareta, Cipolletti, Andalgala, Mendoza, and La Quiaca), 20h. (near Lick), 21h. (near Taihoku). See also Appendix.

Nov. 27d. Readings at 10h. (near Batavia), 12h. (La Paz), 14h. (La Paz and near Granada), 17h. (near Rocca di Papa), 20h. and 23h. (La Paz).

Nov. 28d. Readings at 0h. (La Paz), 5h. (Rocca di Papa), 13h. (Taihoku and Zi-ka-wei), 17h. (Lick and La Paz), 21h. (Algiers), 22h. (Zi-ka-wei).

Nov. 29d. Readings at 7h. (Osaka, Zi-ka-wei, Manila, and Nagasaki, also near Tokyo), 10h. (Tiflis and near Tacubaya), 11h. (near Tacubaya (2)), 13h. (Manila), 14h. (La Paz), 15h. (Manila), 16h. (Batavia and La Paz), 17h. (Manila), 18h. (Rio Tinto), 20h. (2) and 21h. (La Paz).

Nov. 30d. Readings at 0h. (Granada), 2h. (near Vera Cruz), 3h. (near Colima), 10h. (La Paz), 11h. (Oaxaca, near Tacubaya, and near Tokyo), 17h. (Manila).

Dec. 1d. Readings at 1h. (near Tacubaya), 2h. (near Tacubaya, Merida, Oaxaca, and Puebla), 6h. (La Paz), 13h. (Azores), 18h. (near Hong Kong), 20h. (Florence), 23h. (Colombo, Batavia, and Sydney).

Dec. 2d. 3h. 46m. 36s. Epicentre 24°·0N. 120°·0E. (as on 1922 Nov. 18d.).

$A = -\cdot457$, $B = +\cdot792$, $C = +\cdot407$; $D = +\cdot866$, $E = +\cdot500$; $G = -\cdot204$, $H = +\cdot352$, $K = -\cdot914$.

	Δ	Az.	P.	O−C.	S.	O−C.	L	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Hokoto	0·6	222	1 22	+73	—	—	1·9	2·0
Taihoku	1·8	53	0 6	−22	—	—	0·3	0·9
Hong Kong	5·6	254	1 54	+27	—	—	4·4	5·1
Zi-ka-wei	7·3	10	1 55	+ 4	e 3 10	− 8	—	—
Manila	9·5	172	e 2 42	+19	—	—	—	—
Nagasaki	12·3	42	2 51	−12	—	—	6·0	9·7
Kobe	17·0	47	—	—	—	—	12·0	12·2
Osaka	17·2	48	6 11	+124	—	—	9·4	13·7
Tokyo	20·7	51	e 4 19	−30	e 9 51	+73	e 12·4	12·8
Calcutta E.	29·1	273	6 34	+15	—	—	18·0	—
N.	29·1	273	6 37	+18	—	—	17·8	—
Batavia	32·8	205	6 45	−10	—	—	25·8	—
Simla E.	38·4	290	7 12	−29	—	—	24·7	—
Colombo	42·1	252	—	—	—	—	28·4	29·9
Tiflis	63·6	309	—	—	—	—	e 42·8	—
Bergen	80·6	333	—	—	—	—	e 40·9	—
Vienna	80·8	320	e 12 29	+ 5	e 22 45	+12	e 41·4	49·9
Hamburg	81·9	328	—	—	—	—	e 42·4	52·4
De Bilt	85·2	326	12 50	+ 1	23 19	− 2	e 41·4	49·2
Dyce N.	85·6	334	—	—	i 23 22	− 4	43·4	47·9
Strasbourg	85·7	322	—	—	—	—	e 45·1	55·4
Rocca di Papa	86·1	314	e 12 54	0	23 30	− 1	e 50·5	58·9
Florence	86·1	319	47 11	?L	—	—	(47·2)	103·5
Uccle	86·3	327	—	—	e 23 24	− 9	e 41·4	48·4
Edinburgh	86·8	332	—	—	e 23 24	−15	44·4	48·5
Eskdalemuir E.	87·2	332	—	—	e 23 37	− 6	40·4	48·0
Besançon	87·4	322	—	—	—	—	48·4	—
Moncalieri	87·6	319	8 47	?	23 48	0	48·1	—
Stonyhurst	87·8	330	e 24 12	?S	(e 24 12)	+22	—	51·9
Kew	88·2	329	—	—	—	—	—	55·4
Victoria	88·2	37	23 19	?S	(23 19)	−35	48·3	51·8
Bidston	88·4	330	39 10	?L	42 39	?L	(42·6)	51·4
Oxford	88·6	329	—	—	i 23 58	− 1	43·2	49·7
Barcelona	93·0	320	—	—	—	—	e 52·3	—
Tortosa N.	94·3	320	—	—	—	—	51·7	64·0
Toledo	97·6	320	—	—	—	—	e 45·4	56·4
Coimbra	99·8	323	e 30 24	?	e 41 24	?	54·4	56·6
Ottawa	109·1	12	—	—	—	—	e 56·9	—
Chicago	109·4	22	—	—	—	—	e 59·7	—
Toronto	110·0	14	—	—	—	—	e 65·4	74·6
La Paz	169·3	47	e 20 26	[+12]	—	—	—	—

Additional readings: Taihoku gives also MN = +5·0m., another set of readings are also given. Kobe MN = +12·6m. Osaka MN = +16·9m. Tokyo MN = +12·6m. Simla PN = +11m.36s., LN = +22·1m. Tiflis e = +48m.12s., e(?L) = +52·3m. Bergen L = +44·6m. Vienna iZ = +13m.59s., iPR_1Z = +15m.41s., ePR_2N = +18m.28s. Hamburg MN = +45·4m. De Bilt PR_1Z = +16m.11s., MZ = +55·7m. Strasbourg MN = +50·8m. Bidston P = +40m.54s. Toledo MNW = +64·4m. Ottawa e = +52m.46s. Chicago eE = +52m.24s. Toronto eL = +74·0m.

Dec. 2d. Readings also at 0h. (Coimbra, Cipolletti, Chacareta, De Bilt, Uccle, La Paz, and Victoria), 1h. (La Paz), 5h. (Kodaikanal), 10h. (La Paz), 18h. (Batavia), 19h. (La Paz), 23h. (Perth).

Dec. 3d. 14h. 42m. 48s. Epicentre 45°·2N. 140°·2E.

A = −·541, B = +·451, C = +·710 ; D = +·640, E = +·768 ;
G = −·545, H = +·454, K = −·705.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Sapporo		2·3	159	—	—	1 0	− 3	1·7	—
Ootomari		2·3	51	0 53	+17	—	—	1·4	1·4
Mizusawa	F.	6·2	173	1 34	− 1	2 45	− 4	—	—
Tokyo		9·6	182	i 2 33	+ 9	i 4 17	− 1	—	5·8
Osaka		11·2	201	2 48	+ 1	(5 2)	+ 3	5·0	6·2
Kobe		11·2	202	e 2 10	−37	(5 1)	+ 2	5·0	5·2
Zi-ka-wei		20·3	233	e 4 45	0	—	—	—	—

Additional readings: Mizusawa gives also SN = +2m.43s. P has been increased by 20m. Tokyo MN = +6·2m. Osaka MN = +5·5m. Kobe MN = +5·1m.

Dec. 3d. Readings also at 0h. (Christchurch, De Bilt, and Perth), 1h. (near Vera Cruz and Puebla), 4h. (Apia), 16h. (Zi-ka-wei, Manila, Hong Kong, Almeria, Malaga, and near Granada), 17h. (De Bilt), 19h. (Kong Kong).

Dec. 4d. Readings at 1h. (near Tacubaya, Merida, Colima, Oaxaca, and La Paz, 2h. (De Bilt), 3h. (near Manila), 5h. (Pilar), 6h. (La Paz, Andalgala, and Cipolletti), 7h. (De Bilt), 13h. (near Mizusawa), 16h. (Tiflis), 22h. (Batavia), 23h. (near Tacubaya (2)).

Dec. 5d. Readings at 4h. (Coimbra), 6h. (Sydney and La Paz), 7h. (Christchurch and Sydney), 8h. (Strasbourg and De Bilt), 12h. (Manila and Zi-ka-wei), 14h. (La Paz).

1922. Dec. 6d. 13h. 55m. 26s. Epicentre 36°·8N. 69°·5E.

A = +·280, B = +·750, C = +·599 ; D = +·937, E = −·350 ;
G = +·210, H = +·561, K = −·801.

A depth 0·020 of focus is assumed. See note at end.

		Corr. for Focus	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	°	m. s.	s.	m. s.	s.	m.	m.
Simla	E.	−0·1	8·5	129	2 10	+ 3	—	—	3·7	—
	N.	−0·1	8·5	129	1 58	− 9	—	—	3·3	—
Dehra Dun		−0·2	9·6	130	3 4	+42	—	—	—	—
Bombay		−0·7	18·1	170	4 5	− 5	—	—	—	—
Tiflis		−0·8	19·7	292	7 40	?S	(7 40)	−20	12·4	—
Calcutta	E.	−0·9	21·6	126	4 36	−13	(8 8)	−30	8·1	8·2
	N.	−0·9	21·6	126	4 38	−11	(8 10)	−28	8·2	8·3
Kodaikanal		−1·2	27·5	163	7 4	?PR_1	(9 34)	−54	9·6	52·7
Colombo		−1·5	31·3	162	—	—	—	—	12·9	14·6
Helwan		−1·5	32·4	268	i 6 32	− 5	—	—	—	21·2
Lemberg		−1·6	34·9	306	e 6 58	− 1	e 13 34	+65	e 14·8	16·4
Athens	E.	−1·6	36·1	283	e 7 3	− 6	—	—	i 8·0	8·2
	N.	−1·6	36·1	283	e 7 4	− 5	—	—	8·0	9·3
Konigsberg		−1·6	37·1	315	e 7 14	− 4	—	—	—	20·6
Belgrade		−1·6	37.4	298	i 7 17	− 3	e 10 6	−181	e 16·6	19·0
Vienna		−1·7	39·9	305	e 7 35	− 5	14 40	+59	—	18·1
Upsala		−1·7	40·0	322	i 7 34	− 6	i 13 33	− 9	—	18·8
Hong Kong		−1·7	41·0	99	7 21	−28	—	—	—	13·2
Pompeii		−1·8	42·3	291	7 59	0	35 18	?	—	—
Zi-ka-wei		−1·8	42·9	83	i 7 42	−22	e 13 40	−42	—	—
Innsbruck		−1·8	43·4	302	i 8 4	− 4	e 15 48	+79	—	18·8
Rocca di Papa		−1·8	43·5	293	i 8 1	− 8	(e 15 40)	+69	i 21·3	22·2
Hamburg		−1·8	43·7	312	8 5	− 5	—	—	—	18·5

Continued on next page.

		Corr. for Focus	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	°	m. s.	s.	m. s.	s.	m.	m.
Florence		−1·9	44·1	298	8 10	− 2	14 34	− 4	25·6	32·6
Zurich		−1·9	45·3	301	i 8 17	− 4	—	—	—	—
Strasbourg		−1·9	45·6	305	8 19	− 5	e 15 1	+ 3	e 19·6	19·9
Bergen		−1·9	46·1	321	8 26	− 1	i 16 36	+91	18·7	29·5
De Bilt		−2·0	46·3	310	i 8 29	+ 1	15 14	+ 8	—	19·8
Moncalieri		−2·0	46·3	300	i 7 27	−61	i 15 3	− 3	19·2	20·9
Besançon		−2·0	47·0	302	(8 33)	0	(15 34)	+19	15·6	—
Uccle		−2·0	47·4	309	i 8 34	− 2	i 15 21	+ 1	i 16·8	19·7
Marseilles		−2·0	48·3	296	8 55	+13	13 10	?	19·6	—
Paris		−2·1	48·9	305	e 8 48	+ 2	—	—	—	20·6
Kew		−2·1	50·1	310	—	—	—	—	—	21·6
Dyce	N.	−2·1	50·2	318	e 9 0	+ 5	17 20	+85	—	20·0
Le Mans		−2·1	50·6	305	e 9 4	+ 7	e 17 34	+94	30·6	—
Oxford		−2·1	50·7	310	i 8 58	0	i 16 3	+ 2	—	—
Manila		−2·1	50·8	102	e 8 37	−21	—	—	—	—
Stonyhurst		−2·1	50·9	312	9 4	+ 5	16 4	0	—	21·6
Edinburgh		−2·1	51·0	315	i 9 0	+ 1	i 17 31	+86	—	21·3
Eskdalemuir		−2·1	51·1	315	i 9 2	+ 2	i 16 5	− 1	—	—
Barcelona		−2·1	51·1	296	i 9 3	+ 3	i 17 40	+94	e 20·4	—
Bidston		−2·2	51·4	312	10 4	+63	18 34	+145	—	22·6
Algiers		−2·2	52·1	290	9 5	− 1	17 48	+90	e 29·6	34·6
Kobe		−2·2	52·2	73	8 57	−10	9 48	?	11·7	13·2
Osaka		−2·2	52·4	73	9 2	− 6	(16 29)	+ 8	16·5	20·5
Tortosa	N.	−2·2	52·5	296	i 9 13	+ 4	16 25	+ 2	21·8	21·8
Ootomari		−2·2	53·5	54	9 29	+14	(16 22)	−13	16·4	—
Mizusawa	E.	−2·3	55·0	65	9 14	−10	9 59	?	—	—
Tokyo		−2·3	55·3	69	e 9 19	− 7	—	—	—	—
Batavia		−2·3	55·3	134	9 30	+ 4	i 18 7	+71	—	19·9
Toledo		−2·3	56·1	296	9 37	+ 5	18 36	+90	e 29·6	36·8
Granada		−2·3	56·8	292	i 9 41	+ 5	i 19 3	+108	23·1	29·2
Rio Tinto		−2·4	58·8	295	11 34	+106	—	—	—	21·6
San Fernando		−2·4	59·1	293	9 58	+ 8	19 16	+94	—	19·6
Coimbra		−2·4	59·1	299	i 9 59	+ 9	19 12	+90	23·1	25·3
Cape Town		−2·7	85·2	220	12 31	− 2	—	—	—	24·2
Ottawa		−2·8	92·0	336	—	—	—	—	42·6	—
Northfield		−2·8	92·1	334	—	—	e 26 34	? SR_1	—	—
Victoria		−2·9	94·0	8	25 5	? S	(25 5)	+40	35·1	44·8
Toronto		−2·9	94·8	338	—	—	—	—	39·2	—
Ann Arbor		−2·9	97·2	340	—	—	—	—	53·2	—
Washington		−3·0	98·3	334	—	—	e 24 54	−15	—	—
Chicago		−3·0	98·7	343	22 37	?	(25 17)	+ 4	44·4	—
Sydney		−3·0	103·7	122	19 40	? PR_1	—	—	45·6	48·2
Berkeley		−3·0	104·5	9	e 22 27	?	e 28 31	+141	—	—
Lick		−3·0	105·1	9	—	—	i 27 34	+78	—	—
La Paz		—	137·5	286	19 17	[−18]	21 36	?	22·6	23·0

Additional readings: Tiflis gives also i = +8m.46s., e = +8m.58s. Athens iPE = +7m.5s., iPN = +7m.6s., i = +7m.50s. Konigsberg iPZ = +7m.16s., PR_2NEZ = +9m.56s., PSN = +14m.8s., SR_1N = +16m.8s., SR_1E = +16m.16s., SR_1Z = +16m.28s. Belgrade i = +8m.0s., SR_1E = +10m.31s., SR_1N = +11m.17s. Vienna iPZ = +7m.38s., iZ = +8m.31s., +8m.42s., and +9m.18s., PR_2?E = +10m.8s., iE = +10m.31s., iN = +10m.33s., and +11m.5s., iZ = +10m.44s., SN = +14m.49s., i = +16m.48s., MN = +21·6m. Upsala iE = +10m.17s., iSR_2 = +16m.43s. Zi-ka-wei PSE = +13m.47s. Innsbruck PR_1 = +11m.7s. Rocca di Papa iS = +9m.12s. (?PR_1), eS is given as eL. Hamburg iPE = +8m.6s., PR_2 = +10m.34s., SR_1 = +18m.4s., MZ = +24·1m., MN = +24·2m., T_g = 13h.55m.3s. Zurich iPN = +8m.18s., i = +11m.27s.. Epicentre 37°·N. 70°·E. Strasbourg P = +8m.20s., MN = +20·4m., T_g = 13h.55m.17s. Bergen e = +11m.27s., MN = +23·3m. De Bilt iPE = +8m.31s., PR_1 = +10m.26s., e = +18m.53s. Moncalieri MN = +20·2m. Besançon gives P as S and S as L. Uccle iP = +11m.34s. Marseillies PR_1 = +10m.9s. Paris MN = +11·6m. Dyce i = +12m.15s. and +16m.55s. Oxford PR_1 = +12m.55s., i = +17m.24s. Eskdalemuir iE = +10m.11s., iPR_1E? = +11m.4s. Bidston S = +11m.9s. Kobe MN = +12·8m. Osaka MN = +19·0m. Mizusawa SN = +10m.1s. Toledo PR_1NW = +12m.57s., PR_1NE = +12m.58s., PR_2 = +14m.21s., PR_2NE = +15m.28s., PR_2NW = +15m.38s., SR_1NW = +24m.28s., SR_1NE = +24m.32s., SR_2NW = +25m.40s., SR_2NE = +25m.44s., MNW = +37·2m. Granada i = +14m.34s., T_g = 13h.53m.43s. San Fernando MN = +44·0m. Coimbra i = +19m.24s., LN = +24·7m., MN = +25·2m., T_g = 13h.54m.11s. Ottawa eLE = +34·6m. Victoria S = +29m.30s. Toronto L = +58·5m. Chicago gives S as PR_1, also S? = +31m.34s. Berkeley ePN = +22m.3s., eN = +28m.13s. Sydney L = +32·3m. and +40·4m.

The solution is well supported by the Japanese and Indian observatories, and by a number of European observatories, but there are also a number of others which show large S residuals, as follows :—

	s.		s.		s.
Lemberg	+65	Le Mans	+94	Batavia	+ 71
Vienna	+59	(Oxford	+79)	Toledo	+ 90
Innsbruck	+79	Edinburgh	+86	Granada	+108
Rocca di Papa	+69	Barcelona	+94	San Fernando	+ 94
Bergen	+91	(Bidston	+85)	Coimbra	+ 90
Dyce	+85	Algiers	+90		

The Oxford observation is given in the Notes ; the Bidston residual has been diminished by 1 minute.

If there was a second shock from the same epicentre following the first by about 85 sec., there ought to be a second P also following at this interval. The following observatories record impulses which might be thus interpreted :—

	s.		s.
Athens	+40	Rocca di Papa	+63
Belgrade	+40	Eskdalemuir	+71
Vienna	+51, +62, +98	Bidston	+68
Upsala	+97		

The Athens readings (in the text) suggest, however, a separate shock near Athens, which may account for some of the additional readings mentioned in the notes.

Dec. 6d. Readings also at 1h. (Mizusawa), 2h. (La Paz), 9h. (near Algiers), 12h. (Innsbruck), 13h. (near Batavia), 14h. (Kobe and La Paz), 15h. (near Granada), 16h. (Florence).

Dec. 7d, 16h. 22m. 10s. (I) } Epicentre 40°·0N. 20°·0E. (as on 1922 Jan. 12d.).
37m. 6s. (II) }

A = +·720, B = +·262, C = +·643 ; D = +·342, E = −·940 ;
G = +·604, H = +·220, K = −·766.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I	Athens	3·6	123	1 32	+36	i 2 33	+54	2·8	3·7
II		3·6	123	1 36	+40	2 35	+56	2·9	3·0
I	Mostar	3·7	335	i 0 52	− 6	1 15	−27	—	1·6
II		3·7	335	i 0 52	− 6	1 23	−19	—	1·6
I	Pompeii	4·2	281	1 35	+30	2 40	?L	(2·7)	4·2
II		4·2	281	e 2 19	?S	(e 2 19)	+24	(3·4)	—
I	Sinj	4·5	327	i 0 50	−20	i 1 35	−29	—	2·0
II		4·5	327	i 1 14	+ 4	i 2 4	0	—	2·3
I	Belgrade	4·8	4	i 1 9	− 5	i 2 13	+ 2	—	2·4
II		4·8	4	i 1 1	−13	i 1 53	−18	—	2·0
I	Rocca di Papa	5·8	291	i 1 46	+16	2 50	+11	i 3·8	6·4
II		5·8	291	1 36	+ 6	i 2 36	− 3	—	—
I	Florence	7·5	303	3 25	?S	(3 25)	+ 1	—	4·8
II		7·5	303	2 46	+52	—	—	—	5·3
I	Vienna z.	8·6	344	e 2 1	− 9	i 3 47	− 6	i 5·0	5·8
II	z.	8·6	344	e 2 4	− 6	i 3 52	− 1	i 4·5	5·4
I	Innsbruck	9·6	322	e 2 22	− 2	e 3 50	−28	—	6·0
II		9·6	322	e 2 21	− 3	i 3 53	−25	—	—
I	Lemberg	10·2	15	e 2 8	−25	e 4 56	+21	—	6·6
I	Moncalieri	10·3	303	2 19	−15	5 25	+48	6·3	7·6
II		10·3	303	1 35	−59	3 26	−71	5·1	—
I	Zurich	11·0	316	e 2 41	− 3	i 4 50	− 4	—	—
II		11·0	316	e 2 41	− 3	e 4 46	− 8	—	—
I	Strasbourg	12·2	318	3 2	0	e 5 26	+ 2	e 5·8	7·1
II		12·2	318	5 0	+118	5 42	+18	—	6·7

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I Besançon		12·4	310	e 5 19	?S	(e 5 19)	−10	9·8	—
II		12·4	310	e 5 46	?S	(e 5 46)	+17	—	—
I Barcelona		13·6	288	—	—	—	—	e 8·4	10·4
I Algiers		13·7	261	—	—	—	—	—	11·8
I Helwan		13·7	134	e 3 44	+22	6 50	+49	—	11·5
I Konigsberg		14·8	1	—	—	e 5 56	−31	e 7·3	8·6
I Tortosa	N.	14·8	279	—	—	—	—	e 8·8	10·5
I Paris		15·2	311	—	—	e 7 14	+37	8·3	9·8
II		15·2	311	—	—	—	—	e 7·8	—
I Hamburg		15·2	337	e 3 37	− 5	—	—	8·0	12·5
I Uccle		15·3	320	e 3 44	+ 1	—	—	7·8	9·8
I De Bilt		15·8	325	—	—	(e 6 50)	0	e 6·8	10·6
I Toledo		18·4	278	e 4 55	+33	—	—	e 10·8	14·1
I Granada		18·6	269	i 4 51	+27	e 8 49	+56	e 10·3	11·0
I Oxford		18·8	316	—	—	(7 50)	− 8	7·8	11·2
I Stonyhurst		20·5	320	e 4 50	+ 3	—	—	—	13·8
I Bidston		20·6	318	5 5	+17	7 56	−40	—	14·3
I San Fernando		20·8	269	—	—	—	—	—	12·8
I Rio Tinto		20·8	272	7 50	?S	(7 50)	−50	—	17·8
I Coimbra	E.	21·7	280	5 25	+24	i 9 23	+24	12·9	15·2
I	N.	21·7	280	—	—	—	—	12·4	14·4
I Edinburgh		22·0	324	e 5 2	− 3	—	—	e 10·8	14·7
I Bergen		22·3	341	—	—	—	—	e 11·8	—
I Dyce	N.	22·4	328	—	—	i 9 5	− 8	—	12·8
I Cape Town		73·9	181	—	—	—	—	—	42·8

Additional readings and notes: Athens gives also for I iP = +1m.54s., MN = +3·6m., T_o = 16h.22m.28s., and for II MN = +3·4m. Mostar I iP = +1m.3s., II iP = +1m.13s. Belgrade I iP = +1m.18s., II i = +1m.13s., origin 40°·7N. 20°·6E. Rocca di Papa I SE = +3m.2s., II iSE = +2m.54s., Vienna I iPZ = +2m.9s., iNZ = +3m.11s., iEZ = +4m.7s., II i = +4m.5s. Moncalieri I MN = +7·8m. Strasbourg I PE = +3m.5s., MN = +6·8m. Hamburg I MNZ = +9·6m. De Bilt I MN = +10·1m., MZ = +10·2m. Stonyhurst eP increased by 1h.30m. San Fernando I MN = +13·0m. Eskdalemuir (Δ = 21°·7 Az. = 322°) gives simply 16h.

Dec. 7d. 16h. 50m. 0s. Epicentre 31°·5N. 130°·0E.

A = −·548, B = +·653, C = +·522 ; D = +·766, E = +·643 ; G = −·336, H = +·400, K = −·853.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Nagasaki		1·3	356	−0 3	−23	—	—	0·0	0·1
Kobe		5·3	52	1 22	0	2 14	−11	2·6	2·9
Osaka		5·6	53	1 49	+22	—	—	3·1	4·2
Zi-ka-wei		7·3	268	2 2	+11	e 3 22	+ 4	—	—
Tokyo		9·1	60	i 2 52	+34	4 37	+31	—	6·0
Taihoku		9·8	231	e 3 3	+36	—	—	6·4	7·2
Mizusawa	E.	11·8	47	2 55	− 1	5 39	+25	—	—
Ootomari		18·1	29	4 23	+ 5	(7 44)	+ 2	7·7	11·3
Manila		18·8	208	e 4 49	+22	—	—	9·3	11·3
Calcutta	E.	37·9	269	16 48	?SR_1	—	—	—	—
Batavia		43·7	216	i 8 24	0	i 15 3	+ 5	30·0	—
Simla	N.	44·7	283	18 36	?SR_1	—	—	25·1	—
Colombo		52·7	255	8 30	−54	21 30	?SR_1	33·5	38·0
Kodaikanal		52·9	260	33 36	?L	—	—	(33·6)	—
Sydney		68·3	162	19 48	?S	(19 48)	−18	33·0	36·0
Konigsberg		74·2	326	—	—	—	—	e 39·4	42·0
Victoria		76·8	41	—	—	—	—	46·2	47·5
Bergen		77·4	336	—	—	—	—	e 40·5	—
Hamburg		80·4	329	—	—	—	—	e 42·7	46·2
Vienna		80·6	323	i 12 24	+ 1	22 28	− 2	e 43·0	45·5
Dyce	N.	82·6	337	—	—	—	—	29·0	44·9
De Bilt		83·5	330	—	—	—	—	e 41·0	49·2
Innsbruck		83·8	324	—	—	—	—	e 42·0	—
Edinburgh		84·0	336	—	—	e 28 0	?SR_1	45·0	54·4
Uccle		84·8	330	—	—	—	—	e 41·0	46·4
Strasbourg	N.	84·8	326	—	—	—	—	e 44·5	45·2

Continued on next page.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Stonyhurst	85·3	334	25 30	?	—	—	—	49·5
Bidston	85·8	334	41 0	?L	47 25	?	(41·0)	53·6
Florence	86·2	321	—	—	—	—	—	27·5
Kew	86·2	332	—	—	—	—	—	55·0
Besançon	86·6	326	—	—	—	—	46·0	—
Rocca di Papa	86·8	319	—	—	—	—	e 45·7	55·3
Paris	87·0	329	—	—	—	—	47·0	48·0
Moncalieri	87·3	324	37 40	?	43 4	?	45·6	48·8
Barcelona	92·7	324	—	—	—	—	e 48·7	51·2
Tortosa	93·9	325	—	—	—	—	e 49·0	54·4
Toledo	96·9	326	—	—	—	—	51·0	64·0
Coimbra E.	98·6	329	32 41	?	41 0	?	50·0	65·7
Granada	98·8	325	—	—	43 50	?	56·5	60·5
Chicago	99·0	27	—	—	e 47 0	?L	e 56·0	—
Rio Tinto	99·8	327	54 0	?L	—	—	(54·0)	61·0
Toronto	100·2	21	—	—	—	—	52·2	—
San Fernando E.	100·7	325	—	—	—	—	—	57·7

Additional readings and notes: Osaka gives also MN = +4·5m. Taihoku MN = +7·5m. Mizusawa SN = +5m.41s. Ootomari MN = +9·8m. Manila MN = +10·2m. Calcutta PN = +16m.52s. (?SR_1N). Batavia L has been increased by 10m. Hamburg e = +39m.0s., MN = +46·3m., MZ = +50·1m. Vienna i = +29m.20s. (?SR_1). Uccle MN = +49·0m. Strasbourg ME = +49·2m. Bidston alternative P = +43m.0s. Paris MN = +49·0m. Moncalieri MN = +57·2m. De Bilt eSR_1 = +28m.35s., eSR_2 = +32m.55s., MN = +49·0m., MZ = +54·4m. Toledo MNW = +62·0m. Coimbra MN = +58·8m. Toronto eL = +55·4m. San Fernando MN = +69·0m.

Dec. 7d. 22h. 4m. 6s. Epicentre 40°·0N. 20°·0E. (as at 16h.).

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Mostar	3·7	335	i 0 55	− 3	i 1 44	+ 2	—	1·8
Pompeii	4·2	281	e 2 4	?S	(e 2 4)	+ 9	—	—
Sinj	4·5	327	e 2 4	?S	(e 2 4)	0	—	—
Belgrade	4·8	4	i 1 6	− 8	i 1 55	−16	—	2·3
Rocca di Papa	5·8	291	i 2 18	+48	—	—	—	3·2
Vienna	8·6	344	e 2 7	− 3	i 4 26	+33	e 4·9	5·4
Innsbruck	9·6	322	i 2 0	−24	i 3 51	−27	—	—
Strasbourg N.	12·2	318	—	—	—	—	e 6·7	—
De Bilt	15·8	325	—	—	—	—	e 8·4	9·9

Mostar gives also iPS = +1m.28s.

Dec. 7d. 22h. 21m. 36s. Epicentre 31°·5N. 130°·0E. (as at 16h.50m.).

	Δ	Az.	P.	O−C.	S.	O−C	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Nagasaki	1·3	356	0 22	+ 2	—	—	0·4	—
Kobe	5·3	52	1 16	− 6	(2 29)	+ 4	2·5	3·7
Osaka	5·6	53	1 26	− 1	—	—	2·6	3·6
Zi-ka-wei	7·3	268	2 36	+45	e 3 56	+38	—	5·6
Tokyo	9·1	60	2 53	+35	e 4 43	+37	—	6·4
Manila	18·8	208	—	—	—	—	e 8·9	—
De Bilt	83·5	330	—	—	—	—	e 44·4	48·6

Additional readings: Kobe gives also MN = +2·6m. Osaka MN = +4·7m.

Dec. 7d. Readings also at 0h. and 1h. (La Paz), 5h. (near Taihoku), 6h. (Tiflis and near Nagasaki), 7h. (Zi-ka-wei, Osaka, Kobe, and near Nagasaki (6)), 8h. and 9h. (near Nagasaki), 12h. (La Paz and near Nagasaki), 13h. (2) and 14h. (near Nagasaki), 15h. (Chicago, Toronto, Victoria, and De Bilt), 16h. (Toronto and near Nagasaki (3)), 17h. (Osaka, Kobe, and near Nagasaki (5)), 18h. (Kobe and near Nagasaki (3)), 19h. (near Nagasaki (6)), 20h. (Tokyo, Kobe, Osaka, and Zi-ka-wei, and near Nagasaki (6)), 21h. (De Bilt and near Nagasaki (5)), 22h. (Kobe, Osaka, and near Nagasaki (5)), 23h. (Nagasaki).

Dec. 8d. 2h. 2m. 0s. I
5h. 16m. 50s. II
6h. 45m. 0s. III
7h. 15m. 20s. IV
13h. 39m. 0s. V
20h. 19m. 50s. VI
Epicentre 31°·5N. 130°·0E. (as on 7d.)

A = −·548, B = +·653, C = +·522; D = +·766, E = +·643; G = −·336, H = +·400, K = −·853.

		△	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I	Nagasaki	1·3	356	0 9	−11	—	—	0·2	0·4
II		1·3	356	0 11	− 9	—	—	0·2	—
IV		1·3	356	−0 6	−26	—	—	0·0	—
V		1·3	356	0 51	+31	—	—	—	—
VI		1·3	356	−0 49	−69	—	—	−0·7	—
I	Kobe	5·3	52	1 23	+ 1	(2 41)	+16	2·7	3·3
II		5·3	52	e 1 31	+ 9	(2 23)	− 2	2·4	3·4
III		5·3	52	1 20	− 2	(2 23)	− 2	2·4	3·5
IV		5·3	52	1 22	0	(2 4)	+16	2·7	2·7
V		5·3	52	2 17	?S	(e 2 17)	− 8	3·6	3·6
VI		5·3	52	0 59	−23	e 1 34	−51	2·2	2·6
I	Osaka	5·6	53	1 38	+11	—	—	2·9	—
II		5·6	53	1 33	+ 6	—	—	2·8	3·9
III		5·6	53	2 10	?S	(2 10)	−24	3·4	4·7
IV		5·6	53	1 53	+26	—	—	3·1	3·4
V		5·6	53	1 39	+12	—	—	2·9	3·7
VI		5·6	53	1 25	− 2	—	—	2·6	2·8
I	Zi-ka-wei	7·3	268	2 9	+18	e 4 4	?L	(4·1)	5·9
II		7·3	268	e 2 6	+15	—	—	—	6·0
III		7·3	268	e 2 28	+37	—	—	—	5·6
IV		7·3	268	e 2 39	+48	—	—	—	—
V		7·3	268	e 2 33	+42	—	—	—	—
VI		7·3	268	e 2 18	+27	—	—	—	—
I	Tokyo	9·1	60	i 2 49	+31	i 4 8	+ 2	—	6·0
II		9·1	60	e 4 0	?S	(4 0)	− 6	(e 5·6)	7·0
III		9·1	60	e 4 6	?S	(4 6)	0	(e 6·8)	8·2
IV		9·1	60	—	—	—	—	e 7·5	—
V		9·1	60	—	—	e 3 59	− 7	—	—
VI		9·1	60	—	—	e 3 58	− 8	—	—
I	Taihoku	9·8	231	8 0	?	—	—	—	—
I	Mizusawa E.	11·8	47	2 48	− 8	5 27	+13	—	—
I	N.	11·8	47	2 47	− 9	5 28	+14	—	—
I	Ootomari	18·1	29	4 16	− 2	—	—	8·9	—
I	Manila	18·8	208	e 4 46	+19	—	—	8·5	9·4
I	Simla	44·7	283	—	—	—	—	e 19·3	—
I	Konigsberg	74·2	326	—	—	e 35 0	?	e 40·5	47·0
I	Bergen	77·4	336	—	—	—	—	e 42·0	—
I	Hamburg	80·4	329	—	—	—	—	e 42·0	51·0
I	Vienna	80·6	323	12 24	+ 1	e 23 0	+30	e 44·0	53·0
I	Dyce	82·6	337	—	—	—	—	44·8	50·2
I	De Bilt	83·5	330	—	—	—	—	e 42·0	48·9
II		83·5	330	—	—	—	—	e 44·2	48·6
III		83·5	330	—	—	—	—	e 48·0	—
I	Uccle	84·8	330	—	—	—	—	e 42·0	—
I	Strasbourg E.	84·8	326	—	—	—	—	e 46·6	—
I	Bidston	85·8	334	—	—	50 27	?L	(50·4)	59·0
I	Florence	86·2	321	—	—	—	—	48·5	—
I	Kew	86·2	332	—	—	—	—	—	58·0
I	Oxford	86·5	332	—	—	—	—	46·1	56 7
I	Rocca di Papa	86 8	319	—	—	—	—	e 36·3	55·6
I	Moncalieri	87·3	324	—	—	e 43 30	?L	47·3	48·9
I	Coimbra E.	98·6	329	—	—	e 28 30	?	e 50·0	—
I	N.	98·6	329	—	—	e 34 30	?	53·5	—

Additional readings and notes to Shock I: Kobe gives also S = +1m.59s., MN = +2·8m. Zi-ka-wei MN = +5·3m. Tokyo MN = +6·2m. Manila MN = +8·7m. Hamburg MN = +46·4m., MZ = +51·5m. Eskdalemuir (△ = 84·4) gives simply 2h. De Bilt MZ = +54·3m. Coimbra LE = +56·5m.

Dec. 8d. 8h. 8m. 40s. Epicentre 15°·5N. 77°·5W. (as on 1914 Aug. 3d.).

A = +·209, B = −·941, C = +·267 ; D = −·976, E = −·216 ; G = +·058, H = −·261, K = −·964.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Balboa Hts.	E.	6·8	198	1 54	+10	3 2	− 3	3·6	3·3
	N.	6·8	198	1 54	+10	2 54	−11	3·5	3·4
Merida		12·8	297	3 3	− 7	—	—	6·6	7·6
Tacubaya	E.	21·1	284	4 54	0	(8 28)	−18	8·5	—
Toronto		28·2	357	—	—	—	—	20·1	—
La Paz		33·3	164	7 5	+ 6	—	—	—	—
Victoria		49·8	322	—	—	—	—	30·8	**35·5**
Coimbra		64·2	53	—	—	e 22 20	?SR_1	e 35·3	—
De Bilt	N.	73·3	40	—	—	—	—	e 36·3	—

Additional readings: Merida gives also MN = +7·5m. Tacubaya PN = +4m.53s. De Bilt eLE = +41·3m.

1922. Dec. 8d. 22h. 33m. 10s. Epicentre 41°·9N. 142°·1E.

(as on 1921 Jan. 25d.).

A = −·587, B = +·457, C = +·668 ; D = +·614, E = +·789 ; G = −·527, H = +·410, K = −·744.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Sapporo		1·3	335	0 41	+21	—	—	0·9	—
Mizusawa	E.	2·9	195	0 42	− 3	1 7	−13	—	—
	N.	2·9	195	0 43	− 2	1 8	−12	—	—
Ootomari		4·8	5	1 32	+18	—	—	2·5	4·1
Tokyo		6·5	197	i 1 34	− 5	i 2 40	−17	—	—
Osaka		8·9	218	2 16	+ 1	—	—	4·4	5·5
Kobe		9·0	219	2 11	− 5	(4 6)	+ 3	4·1	5·4
Zi-ka-wei		19·7	244	4 32	− 5	8 6	−11	—	11·5
Hong Kong		30·5	238	6 12	−21	(11 8)	−35	11·1	—
Manila		32·9	221	e 6 45	−11	—	—	—	—
Simla	E.	52·0	280	e 9 20	0	—	—	—	—
Batavia		57·8	223	e 9 55	− 3	—	—	—	—
Victoria		62·6	49	10 53	+24	19 6	+10	30·4	34·4
Berkeley		69·3	59	e 11 25	+12	e 20 16	− 2	e 32·4	—
Konigsberg		71·2	330	11 29	+ 5	21 35	+55	e 37·8	44·8
Bergen		71·8	340	e 11 10	−18	e 20 50	+ 2	—	46·8
Hamburg		76·1	334	i 11 59	+ 3	e 22 8	+30	e 37·8	47·7
Dyce	N.	76·4	342	i 21 53	?S	(i 21 53)	+11	40·3	43·7
Edinburgh		77·9	341	—	—	e 21 50	− 9	—	44·8
Vienna		77·9	327	e 12 8	+ 2	22 37	+38	43·8	49·8
Belgrade		78·8	322	e 12 14	+ 2	e 22 12	+ 2	e 47·3	53·0
De Bilt		78·9	335	i 12 13	+ 1	22 14	+ 3	e 36·8	47·9
Stonyhurst		79·5	340	e 19 20	?PR_1	—	—	—	46·5
Bidston		80·0	340	—	—	24 2?	+99	—	51·3
Uccle		80·2	335	e 12 20	0	e 22 32	+ 7	e 37·8	47·6
Innsbruck		80·7	329	e 12 20	− 3	—	—	—	—
Strasbourg		81·0	332	e 12 22	− 3	e 24 26	+111	e 46·8	48·3
Kew		81·1	338	—	—	—	—	—	56·8
Oxford		81·1	338	12 26	0	22 36	0	36·9	52·8
Zurich		81·7	330	e 12 27	− 1	—	—	—	—
Paris		82·5	336	e 12 34	+ 1	e 23 22	+30	40·8	48·8
Besançon		82·8	331	—	—	—	—	44·8	—
Moncalieri		84·0	330	e 13 53	+71	e 23 26	+18	47·2	52·8
Helwan		84·1	306	12 38	− 5	23 40	+31	52·8	—
Rocca di Papa		84·7	325	i 12 38	− 8	22 38	−38	e 46·6	55·1
Chicago		85·1	35	22 58	?S	(22 58)	−22	e 49·8	—
Toronto		86·6	29	—	—	e 33 32	?	e 52·0	57·4
Tortosa	N.	90·3	332	—	—	—	—	e 43·8	55·5
Toledo		92·1	335	e 13 17	−11	24 24	−12	e 39·8	57·9
Algiers		92·9	329	—	—	—	—	—	58·8
Coimbra	E.	93·6	339	e 14 20	+44	24 30	−22	e 48·3	—
	N.	93·6	339	e 17 20	?	—	—	e 47·3	60·9
Granada		95·0	334	i 13 20	−23	i 17 21	?	—	—
Rio Tinto		95·4	336	52 50	?S	—	—	(52·8)	63·8
San Fernando	E.	96·5	335	—	—	—	—	—	55·8
La Paz		143·7	54	19 50	[+ 4]	—	—	—	—

For Notes see next page.

NOTES TO DEC. 8d. 22h. 33m. 10s.

Additional readings and notes: Kobe gives also MN = +4·3m. Simla eN = 22h.30m.54s. Berkeley eSZ = +20m.35s., eLZ = +32·8m. Konigsberg SN = +21m.2s. Hamburg MN = +47·9m., MZ = +48·1m. Dyce SN = +31m.23s. Vienna iPZ = +12m.9s., iN = +13m.2s. and +14m.37s. Eskdalemuir (Δ = 78°·4) gives simply 22h. Belgrade L = +53·0m. De Bilt iPR$_1$Z = +15m.16s., MN = +49·6m., MZ = +49·8m. Uccle MN = +50·4m. Strasbourg MN = +49·0m. Paris MN = +46·8m. Moncalieri MN = +54·7m. Helwan gives S as M. Chicago L = +57·8m. San Fernando MN = +53·9m.

Dec. 8d. Readings also at 0h. (De Bilt), 1h. (La Paz), 2h. (Nagasaki (2) and near Osaka), 3h. (near Nagasaki (2) and near Granada), 4h. (La Paz and near Nagasaki), 5h. (near Nagasaki (2), near Belgrade, and near Tacubaya), 7h. (Nagasaki and near Tacubaya), 8h. (near Belgrade), 12h. (near Nagasaki (2)), 13h. (La Paz and Nagasaki (2)), 14h. (Nagasaki), 15h. (La Paz and near Nagasaki), 16h. (De Bilt, Strasbourg, and near Nagasaki), 17h. (La Paz and Nagasaki), 18h. (Nagasaki), 19h. (Taihoku, De Bilt, and Nagasaki), 20h. (Nagasaki (4)), 21h. (Nagasaki (2)), 22h. (Manila), 23h. (Batavia). See also Appendix.

Dec. 9d. Readings at 0h. (Uccle), 1h. (Nagasaki), 2h. (near Taihoku and Zi-ka-wei), 3h. (Nagasaki, near Osaka, and near Belgrade), 4h. (near Osaka and Nagasaki), 7h. (Nagasaki), 8h. (Nagasaki, De Bilt, Strasbourg, and Victoria), 10h., 11h., 12h., 13h., and 14h. (Nagasaki), 15h. (La Paz and near Tokyo), 16h. (near Port au Prince and near Tokyo), 19h. (Nagasaki (2) and near Mizusawa), 20h. (Rocca di Papa and Nagasaki), 21h. (Nagasaki) 22h,. (Tiflis and Nagasaki), 23h. (Florence).

Dec. 10d. Readings at 0h. (near Nagasaki and near La Paz), 2h. (Hong Kong, Manila, and near Zi-ka-wei), 3h. (Tortosa), 5h. (near Nagasaki), 6h. (near Colima), 9h. (Manila), 11h. (Apia), 16h. (Zi-ka-wei and near Nagasaki (2)), 17h. (near Nagasaki (2)), 21h. (2) and 23h. (Manila).

Dec. 11d. Readings at 1h. (near Athens), 4h. (near Nagasaki), 5h. (near Taihoku and Zi-ka-wei), 6h. (near Nagasaki), 7h. (La Paz), 11h. (near Batavia), 12h. (near Taihoku), 15h. (near Granada), 17h. (Algiers), 18h. (Nagasaki and near Batavia). See also Appendix.

Dec. 12d. Readings at 14h. and 16h. (near Nagasaki), 17h. (Zi-ka-wei, Manila, and Batavia), 20h. (Victoria and near Nagasaki (2)), 21h. and 22h. (Mizusawa).

Dec. 13d. 14h. 3m. 52s. Epicentre 24°·5N. 122°·0E.

A = −·482, B = +·772, C = +·415; D = +·848, E = +·530;
G = −·220, H = +·352, K = −·910.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Taihoku	0·6	321	0 10	+ 1	—	—	0·4	0·5
Hokoto	2·5	247	0 48	+ 9	—	—	e 1·3	—
Zi-ka-wei	6·7	356	e 1 45	+ 3	e 3 7	+ 5	—	4·0
Hong Kong	7·5	255	2 8	+14	—	—	—	5·3
Manila	10·0	186	e 3 29	+59	—	—	—	—
De Bilt	85·7	327	—	—	—	—	e 47·1	—

Zi-ka-wei gives also MZ = +4·8m., MN = +4·9m.

Dec. 13d. Readings also at 0h. (Manila), 5h. (Ottawa, Manila, and Victoria), 9h. (Merida), 10h. (near La Paz), 11h. (near Taihoku), 16h. (near Batavia), 23h. (Hong Kong).

Dec. 14d. 23h. 3m. 48s. Epicentre 3°·5S. 146°·5E. (as on 1922 Jan. 1d.).

$A = -\cdot832$, $B = +\cdot551$, $C = -\cdot061$; $D = +\cdot552$, $E = +\cdot834$; $G = +\cdot050$, $H = -\cdot034$, $K = -\cdot998$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Sydney	30·6	172	7 18	+44	12 18	+34	17·0	18·2
Manila	31·2	308	e 6 38	− 2	—	—	—	—
Adelaide	32·3	191	—	—	i 12 0	−13	e 15·2	20·7
Melbourne	34·3	181	—	—	—	—	—	21·1
Osaka	39·6	347	8 1	+10	(14 2)	+ 2	14·0	15·0
Tokyo	39·7	353	e 7 57	+ 5	e 14 27	+25	—	15·5
Perth	40·4	221	13 57	?S	(13 57)	−16	23·7	24·8
Hong Kong	40·8	311	8 0	− 1	14 17	− 1	20·4	—
Zi-ka-wei	42·1	328	e 8 5	− 7	—	—	—	—
Wellington	45·5	150	—	—	e 15 54	+33	i 21·9	25·2
Christchurch	46·3	154	—	—	15 48	+16	23·6	27·8
Honolulu	59·7	63	e 11 42	+92	18 17	− 2	28·2	29·8
Colombo	67·3	279	22 12	?	—	—	—	—
Kodaikanal	70·1	282	20 36	?S	(20 36)	+ 9	—	—
Victoria	92·7	41	23 59	?S	(23 59)	−43	43·6	59·0
Chicago	118·5	42	—	—	e 29 52	+74	56·7	—
Hamburg	118·6	332	—	—	—	—	e 61·2	70·2
Dyce N.	120·8	340	—	—	—	—	—	75·8
Ann Arbor N.	120·9	40	—	—	37 54	?SR_1	e 51·2	—
De Bilt	121·8	332	—	—	e 23 21	?	e 58·2	63·8
Edinburgh	122·3	339	—	—	—	—	e 58·2	64·2
Eskdalemuir	122·7	339	—	—	—	—	52·2	66·1
Strasbourg	122·8	328	—	—	—	—	e 65·2	—
Toronto	123·0	38	—	—	—	—	57·8	81·7
Uccle	123·0	332	e 26 12?	?S	(e 26 12?)	−180	e 58·2	—
Florence	123·6	322	61 42	?L	—	—	(61·7)	74·2
Stonyhurst	123·6	337	e 28 12	?S	(e 28 12)	−64	—	132·7
Rocca di Papa	123·8	320	e 21 12	?PR_1	—	—	e 66·7	e 68·1
Ottawa	124·2	34	e 27 37	?S	(e 27 37)	−103	e 51·2	—
Kew	124·6	334	—	—	—	—	—	86·2
Besançon	124·6	328	—	—	—	—	68·2	—
Oxford	124·8	335	—	—	—	—	53·2	70·2
Ithaca	125·4	38	—	—	—	—	65·2	—
Cipolletti	126·9	146	66 48	?L	—	—	68·3	78·6
Washington	127·0	41	—	—	—	—	e 66·2	—
Mendoza	130·9	140	61 42	?L	—	—	68·1	76·4
Tortosa N.	131·7	325	—	—	—	—	e 62·6	78·2
Algiers	132·7	319	23 2	?PR_1	e 33 4	?	e 49·2	79·2
Pilar E.	134·5	143	64 18	?L	—	—	70·9	78·2
N.	134·5	143	64 6	?L	—	—	67·6	74·2
Toledo	134·9	328	—	—	—	—	66·2	80·0
Andalgala E.	135·7	138	58 6	?L	—	—	64·2	69·2
Coimbra	136·9	331	—	—	e 48 5	?SR_1	68·7	—
La Paz	140·4	124	e 19 33	[− 7]	—	—	76·4	78·7

Additional readings: Manila gives also P = +7m.51s. Adelaide eSR_1? = +13m.48s., eSR_2? = +14m.30s. Osaka MN = +16·2m. Perth PR_1 = +14m.54s., S = +19m.32s., SR_1 = +21m.24s. Wellington e = +10m.24s. and +11m.54s., iP? = +14m.54s., iS? = +19m.36s., e = +23m.6s. Christchurch PR_1 = +11m.12s., SR_1 = +18m.36s., SR_2 = +20m.36s., L_2 = +33·0m. Honolulu PR_1E = +13m.57s. Victoria S = +30m.49s. De Bilt eE = +37m.18s., eN = +37m.54s., MN = +64·4m., MZ = +71·0m. Eskdalemuir e = +30m.38s. and +37m.48s. Toronto eL = +64·3m. and +68·3m. Uccle eS = +37m.48s.? Rocca di Papa iPV = +21m.24s., eP = +21m.42s. Ottawa eS = +37m.37s., T_0 = 23h.19m.23s. Coimbra e = +34m.2s. and +59m.35s., eLE = +64·7m., LN = +73·2m.

Dec. 14d. Readings also at 2h. (La Paz and near Port au Prince), 3h. (Berkeley), 9h. (Nagasaki), 15h. (La Paz), 16h. (near Mizusawa), 17h. (near Nagasaki (3)), 18h. (near Tokyo), 19h. (near Mizusawa and Tokyo), 20h. (Tokyo), 22h. (Batavia).

Dec. 15d. Readings at 1h. (near Tokyo), 2h. (La Paz), 5h. (Nagasaki and near Tokyo (2)), 6h. and 7h. (near Tokyo), 8h. (near Tokyo), 9h. (near Tokyo), 10h. (near La Paz), 13h. (Colombo), 14h. (near Mizusawa), 16h. (near Tathoku), 19h. (near La Paz), 21h. (near Tokyo).

Dec. 16d. 10h. 39m. 40s. Epicentre 19°·5N. 144°·0E.

A = −·763, B = +·554, C = +·334 ; D = +·588, E = +·809 ;
G = −·270, H = +·196, K = −·943.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Tokyo		16·6	348	e 4 47	+47	e 7 17	+ 8	—	7·5
Mizusawa		19·8	354	4 36	− 3	8 17	− 2	—	—
Manila		22·6	261	e 5 46	+34	—	—	10·3	—
Zi-ka-wei		23·5	305	5 24	+ 1	9 34	− 1	—	—
Batavia		44·7	238	—	—	i 14 51	−20	—	—
Victoria		77·3	44	—	—	—	—	—	22·4
De Bilt	N.	99·9	336	—	—	e 27 50	+115	e 54·3	59·2
La Paz		149·3	91	19 49	[− 6]	—	—	—	—

Additional readings : Mizusawa gives also SN = +8m.21s. Zi-ka-wei PMZ = +6m.17s. De Bilt eLE = +53·3m.

Dec. 16d. Readings also at 0h. (near Tacubaya), 8h. (near Zurich), 11h. (Nagasaki), 13h. (Nagasaki, Wellington, and near Tacubaya), 15h. (Merida), 18h. (Nagasaki), 20h. (near Taihoku), 23h. (La Paz).

1922. Dec. 17d. 0h. 50m. 48s. Epicentre 39°·0N. 73°·0E.

(as on 1918 Dec. 1d.).

A = +·227, B = +·743, C = +·629 ; D = +·956, E = −·292 ;
G = +·184, H = +·602, K = −·777.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Dehra Dun		9·6	153	—	—	3 42	−36	—	—
Bombay		20·1	181	4 43	+ 1	—	—	—	—
Calcutta	E.	21·0	137	5 0	+ 7	(8 38)	− 6	8·6	—
	N.	21·0	137	5 1	+ 8	(8 40)	− 4	8·7	—
Tiflis		21·6	286	e 5 33	+33	—	—	e 9·5	12·1
Kodaikanal		29·1	171	—	—	(10 12)	−67	10·2	11·0
Colombo		32·7	167	7 54	+60	10 48	−91	12·5	17·2
Helwan		35·2	268	i 6 54	−21	—	—	—	15·1
Lemberg		35·9	304	e 7 28	+ 7	e 14 54	+105	—	17·0
Konigsberg		38·1	313	e 7 37	− 2	13 22	−17	16·1	17·2
Hong Kong		38·7	105	7 46	+ 2	—	—	—	—
Belgrade		38·9	297	e 7 35	−10	e 9 37	?	—	10·2
Zi-ka-wei		39·9	85	8 6	+12	e 14 0	− 5	—	—
Upsala		40·0	321	i 7 55	0	—	—	—	18·8
Vienna		41·0	303	e 7 55	− 8	—	—	i 18·5	19·3
Pompeii		44·1	291	e 9 19	+52	—	—	—	—
Hamburg		44·3	312	e 8 26	− 2	—	—	—	24·2
Innsbruck		44·5	302	i 8 28	− 2	—	—	e 18·2	—
Rocca di Papa	N.	45·1	295	e 8 24	−10	14 12	−64	—	—
Florence		45·5	298	8 12	−25	—	—	—	20·4
Bergen		46·1	322	8 43	+ 2	15 15	−14	19·0	21·5
Zurich		46·4	304	i 8 42	− 1	—	—	—	—
Strasbourg		46·6	305	i 8 43	− 1	e 15 33	− 3	e 22·2	24·3
De Bilt		47·4	310	i 8 51	+ 1	—	—	e 19·6	20·1
Moncalieri		47·6	299	8 49	− 2	15 30	−19	19·8	21·4
Besançon		48·1	304	e 8 51?	− 4	—	—	29·2	—
Uccle		48·2	309	8 56	+ 1	—	—	e 19·6	—
Manila		48·5	104	e 9 12	+15	—	—	—	—
Paris		49·9	307	e 9 6	0	—	—	e 20·8	—
Dyce	N.	50·4	319	—	—	i 14 22	−122	i 21·4	—
Kew		50·8	311	—	—	—	—	—	31·2
Edinburgh		51·3	317	i 9 24	+ 9	—	—	—	24·0
Oxford		51·4	311	9 7	− 9	i 16 30	− 6	—	—
Stonyhurst		51·4	313	e 9 12	− 4	—	—	—	22·7
Algiers		53·9	290	e 9 29	− 3	e 17 41	+33	24·2	—

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Tortosa	N.	54·3	298	i 9 33	− 2	16 56	−17	—	—
Batavia	E.	54·9	136	e 10 21	+43	i 20 7	+167	—	—
Toledo		57·5	299	9 59	+ 3	19 3	+70	—	—
Granada		58·4	295	e 10 5	+ 4	i 20 16	+132	—	—
Coimbra		60·4	299	10 22	+ 7	19 42	+74	27·5	—
Cape Town		88·6	222	—	—	—	—	—	23·2
Ottawa	E.	91·0	339	—	—	e 23 34	−50	e 38·7	—
Victoria		91·4	10	—	—	(25 27)	+59	25·4	26·9
Toronto		93·7	340	—	—	—	—	50·2	—
Ann Arbor		96·0	343	—	—	e 24 6	−70	e 34·7	—
Washington		97·3	336	—	—	e 24 12	−77	—	—
Chicago		97·4	346	e 13 47	− 9	—	—	e 42·2	—
La Paz		139·4	293	e 19 33	[+ 5]	—	—	—	—

Additional readings and notes: Simla (Δ = 8°·6, Az = 156°), gives PE = 0h.35m.24s., PN = 0h.35m.18s., LEN = 0h.36m.36s. Tiflis gives also e = +5m.42s., i = +5m.49s., e = +6m.28s., i = +6m.38s. Konigsberg iPZE = +7m.38s., iPE = +9m.11s. and +10m.7s., SE = +14m.28s., LNZ = +16·2m. Belgrade PR_1 = +8m.19s. Upsala iPR_2E = +10m.28s., SR_1 = +17m.15s. Vienna iPZ = +8m.1s., i = +9m.41s., +10m.33s., +10m.37s., +10m.46s., and +17m.49s. Hamburg iPZ = +8m.29s., ePE = +8m.30s., PR_2 = +10m.50s., PR_3 = +11m.20s., SR_1E = +18m.32s., MZ = +20·1m., MN = +25·3m. Innsbruck iPNW = +8m.25s., iNE = +10m.7s. Rocca di Papa iPE = +8m.27s. Bergen PR_1 = +10m.36s. Strasbourg PR_1 = +10m.45s., e = +19m.22s., SR_3 = +20m.18s., MN = +22·6m. De Bilt iPE = +8m.53s., PR_1Z = +10m.47s. Moncalieri MN = +20·6m., all readings diminished by 6h. Dyce i = +17m.32s., i = +20m.17s. Eskdalemuir (Δ = 51°·5, Az. = 316°) gives simply 0h. Coimbra S? = +14m.54s., L = +25·3m. Ottawa eE = +22m.10s.

Dec. 17d. Readings also at 0h. (near Nagasaki), 4h. and 12h. (Batavia), 13h. (Athens, Zi-ka-wei, and La Paz), 14h. (Batavia), 17h. (Colombo), 22h. (Colombo and near Osaka).

Dec. 18d. 7h. 23m. 20s. Epicentre 40°·0N. 20°·0E. (as on 1922 Dec. 7d.).

A = +·720, B = +·262, C = +·643.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mostar		3·7	335	i 1 9	+11	i 1 40	− 2	—	1·8
Belgrade		4·8	4	e 1 15	+ 1	e 1 55	−16	—	2·1
Rocca di Papa	E.	5·8	291	e 2 53	?S	(e 2 53)	+14	5·6	—
	N.	5·8	291	e 2 50	?S	(e 2 50)	+11	5·5	—
Innsbruck	N.E.	9·6	322	—	—	e 4 4	−14	—	

Mostar gives also iP = +1m.13s. Rocca di Papa readings increased by 1h.

Dec. 18d. 12h. 34m. 48s. Epicentre 18°·5N. 68°·0W. (as on 1921 May 22d.).

A = +·355, B = −·879, C = +·317; D = −·927, E = −·375;
G = +·119, H = −·294, K = −·948.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Porto Rico	E.	2·5	98	0 43	+ 4	—	—	0·9	1·5
	N.	2·5	98	0 46	+ 7	—	—	1·3	1·8
Port au Prince		4·1	271	e 1 34	+30	—	—	2·4	3·3
Cheltenham	N.	21·7	341	5 4	+ 3	9 9	+10	14·3	15·0
Washington		21·9	341	6 9	+65	10 10	+67	e 14·2	—
Ithaca		25·0	345	e 5 36	− 2	9 57	− 6	e 12·2	—
Northfield		26·0	352	e 7 12	+84	—	—	e 13·5	—
Toronto		26·9	342	—	—	—	—	e 12·2	17·7
Ann Arbor		27·3	334	e 5 58	− 3	e 10 42	− 4	e 13·2	—
Ottawa		27·7	348	e 6 10	+ 5	e 10 12	−42	e 12·2	—
Chicago		28·6	329	6 12	− 2	11 2	− 8	14·0	—

Continued on next page.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Berkeley	50·8	304	e 9 10	− 2	—	—	e 28·7	35·4
Mendoza	51·4	180	16 36	?S	(16 36)	0	29·0	35·9
Victoria	53·5	317	17 7	?S	(17 7)	+ 4	29·5	37·0
Toledo	58·5	54	e 8 54	−68	—	—	—	—
Granada	58·8	56	9 52	−12	—	—	10·2	10·4
Stonyhurst	60·8	38	e 3 12	?	—	—	—	36·2
Kew	61·8	41	—	—	—	—	—	44·2
Uccle	64·7	41	—	—	—	—	—	32·2
De Bilt	65·2	40	—	—	—	—	e 33·2	40·7
Strasbourg	66·9	44	—	—	—	—	e 37·2	—
Hamburg	68·1	38	e 11 11	+ 6	—	—	e 39·2	41·2
Rocca di Papa	71·0	51	e 11 30	+ 7	—	—	—	—
Cape Town	97·4	125	—	—	—	—	—	42·1
Colombo	139·3	50	95 12	?L	—	—	(95·2)	100·2
Manila	145·8	344	19 52	[+ 2]	—	—	—	—

Additional readings: Port au Prince MNW = +3·2m. Cheltenham LE = +20·6m., T_0 = 12h.34m.45s. Washington L = +15·2m. Ithaca L = +12·7m., +17·2m. and +19·2m. Toronto iL = +14·4m., L = +16·9m., eL = +24·0m. Ann Arbor LN = +16·6m. Ottawa e = 12h.27m.41s. De Bilt MN = +38·7m. Rocca di Papa eN = +9m.48s., PR_1 = +11.m36s. Cape Town reading is increased by 1h.

Dec. 18d. 22h. 29m. 0s. Epicentre 33°·5N. 131°·9E. (as on 1921 Jan. 21d.).

A = −·557, B = +·621, C = +·552.

	Δ	P.	O−C.	S.	O−C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Kobe	2·9	0 46	+ 1	1 14	− 6	1·8	3·4
Tokyo	6·8	i 1 14	−30	i 2 18	−47	—	2·3
Zi-ka-wei	9·2	e 2 22	+ 3	e 4 42	?L	(e 4·7)	—
Simla	45·8	e 11 54	?PR_1	—	—	—	—

Kobe gives also MN = +3·6m.

Dec. 18d. Readings also at 2h. (Azores), 8h. (Tiflis), 10h. (La Paz), 15h. (near Athens), 19h. (La Paz), 21h. (Victoria, Chicago, Berkeley, Lick, and Ottawa), 22h. (Simla (2)), 23h. (Batavia and Colombo).

Dec. 19d. 3h. 0m. 30s. Epicentre 27°·5S. 72°·8W. (as on 1922 Nov. 7d.).

A = +·262, B = −·847, C = −·462; D = −·955, E = −·296;
G = −·137, H = +·441, K = −·887.

But see alternative solution below.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	5·8	93	0 6	−84	—	—	0·9	1·4
	N.	5·8	93	0 6	−84	—	—	0·5	0·7
Mendoza		6·6	146	−1 6	?	—	—	−0·5	0·3
La Quiaca	E.	8·4	52	—	—	—	—	5·1	5·5
Pilar	E.	8·8	121	1 0	−73	—	—	1·7	2·8
	N.	8·8	121	1 54	−19	—	—	2·5	3·4
La Paz		11·8	22	2 56	0	5 10	− 4	6·1	8·0
Cipolletti		12·1	162	(3 24)	+24	—	—	3·4	4·5
Chacarita	E.	14·2	123	5 36	?S	(5 36)	−37	6·2	6·6
	N.	14·2	123	5 30	?S	(5 30)	−43	6·2	6·9

No additional readings.

In the above solution T_0 is deduced from the La Paz observations; but the consistent observations at Mendoza indicate a much earlier T_0, unless they are in error. Accepting Mendoza as approximately correct, it seems possible that the La Paz S should be increased by 1min., or T_0 diminished by 70sec., and the epicentre must be close to Mendoza. Taking it actually at Mendoza the solution would stand thus :—

Dec. 19d. 2h. 59m. 20s. Epicentre 32°·9S. 68°·3W.

A = +·310, B = −·780, C = −·543.

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Mendoza		0·0	0 4	+ 4	—	—	0·7	1·5
Pilar	E.	4·0	2 10	?S	(2 10)	+20	2·9	4·0
	N.	4·0	3 4	?	—	—	3·7	4·6
Andalgala	E.	6·0	1 16	−16	—	—	2·1	2·6
	N.	6·0	1 16	−16	—	—	1·7	1·9
Cipolletti		6·1	—	—	—	—	4·6	5·7
Chacarita	E.	8·4	6 46	?	—	—	7·4	7·8
	N.	8·4	6 40	?	—	—	7·4	8·1
La Quiaca	E.	11·0	—	—	—	—	6·3	6·7
La Paz		16·4	4 6	+ 9	6 20	−44	7·3	9·2

The former solution seems preferable. An additional reason for not altering the La Paz readings is that they are sensibly repeated on Dec. 23d. 17h., when the other observatories are even more erratic. We may compare also Dec. 28d. 12h., which may possibly have the same epicentre. Possibly there is some misunderstanding about the time determinations ?

Dec. 19d. Readings also at 7h. (La Paz), 8h. (Batavia), 9h. (near Tokyo), 11h. (Colombo), 14h. (La Paz), 16h. (Colombo and Athens), 17h. (Zi-ka-wei), 18h. (Chicago, De Bilt, Honolulu, Berkeley, Victoria, Ottawa, Lick, Toronto, and near Athens), 21h. (Colombo, near Nagasaki, and near Belgrade and Mostar), 23h. (Athens).

Dec. 20d. Readings at 1h. (near Athens), 8h. (Colombo), 9h., 11h. (3), and 12h. (3) (near Athens), 13h. (near Nagasaki and near Athens), 14h. (near Athens), 15h. (Zi-ka-wei, Colombo, and Hong Kong), 16h. (De Bilt), 19h. (near Manila).

Dec. 21d. Readings at 1h. (near Nagasaki), 2h. (near Belgrade), 5h. (La Paz), 7h. (Merida, Vera Cruz, and Tacubaya), 9h. (La Paz), 10h. (near Tacubaya (2)), 11h. (Batavia and Vera Cruz), 14h. (Manila (2)), 17h. and 18h. (2) (near Nagasaki), 19h. (La Paz), 23h. (Wellington and near Lick and Berkeley).

Dec. 22d. Readings at 0h. (Wellington), 1h. (Vera Cruz, Wellington (2), and La Paz), 4h. (near Tokyo), 9h. (near Port au Prince and near Nagasaki), 15h. (near Tacubaya), 17h. (near Manila), 23h. (Zi-ka-wei, Hong Kong, and Manila). See also Appendix.

Dec. 23d. 17h. 22m. 24s. Epicentre 27°·5S. 72°·8W. (as on 1922 Dec. 19d.).

A = +·262, B = −·847, C = −·462 ; D = −·955, E = −·296 ;
G = −·137, H = +·441, K = −·887.

(See note at end.)

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	5·8	93	1 48	+18	—	—	3·0	3·5
	N.	5·8	93	1 36	+ 6	—	—	2·3	3·2
Mendoza		6·6	146	0 42	−59	—	—	1·8	2·7
La Quiaca	E.	8·4	52	0 48	−79	—	—	2·9	3·6
	N.	8·4	52	0 24	−103	—	—	3·1	3·8
Pilar		8·8	121	2 6	− 7	(4 12)	+14	4·2	5·5
La Paz		11·8	22	i 2 58	+ 2	i 5 13	− 1	6·2	6·8
Cipolletti		12·1	162	4 36	+96	(5 6)	−15	5·1	6·5
Chacarita	E.	14·2	123	6 42	?S	(6 42)	+29	9·0	9·6
Stonyhurst		101·4	36	—	—	—	—	—	60·6
De Bilt		104·5	40	—	—	—	—	e 52·6	—
Strasbourg		104·5	43	—	—	—	—	e 60·6	—

Andalgala readings have been increased by 3min. to avoid large negative residuals ; Mendoza and La Quiaca also seem to require some increase. But see note to Dec. 19 ; the readings at the South American Stations are generally erratic.

Dec. 23d. 21h. 54m. 30s. Epicentre 19°·0S. 173°·0W. (as on 1921 Feb. 27d.).

A = −·939, B = −·115, C = −·326 ; D = −·122, E = +·993 ; G = +·323, H = +·040, K = −·946.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Apia		5·3	13	1 20	− 2	2 35	+10	3·4	4·2
Wellington		24·6	202	—	—	e 9 42	−13	e 12·7	—
Sydney		35·1	237	8 12	+58	12 42	−15	16·1	20·0
Honolulu	E.	42·9	21	—	—	—	—	e 20·6	—
Adelaide		45·5	240	—	—	—	—	e 20·5	30·0
Perth		64·5	244	32 9	?L	37 42	?	42·0	42·9
Manila		73·2	293	—	—	e 22 30?	+86	—	—
Berkeley	N.	74·2	40	—	—	—	—	e 33·2	—
Lick	E.	74·3	40	—	—	—	—	e 38·6	—
Batavia		78·7	269	e 13 8	+57	e 22 8	0	—	—
Victoria		80·7	30	23 22	?S	(23 22)	+51	41·1	44·2
Cipolletti		89·2	132	43 0	?L	—	—	49·6	54·5
Mendoza		91·4	126	23 24	?S	(23 24)	−64	44·5	56·4
Andalgala	N.	95·2	121	44 54	?L	—	—	(44·9)	52·8
Pilar	E.	95·3	126	48 36	?L	—	—	54·5	58·5
La Paz		98·0	112	e 18 19	?PR$_1$	e 28 49	?	47·7	51·1
Chicago		99·2	49	26 0	?S	(26 0)	+12	52·5	—
Toronto		105·5	49	—	—	—	—	57·1	64·8
Ottawa		108·4	47	—	—	—	—	e 55·5	—
Kodaikanal		111·6	274	67 18	?L	—	—	(67·3)	—
Stonyhurst		144·5	12	—	—	—	—	—	90·0
Hamburg		145·3	358	i 20 14	[+25]	—	—	—	—
De Bilt		146·5	2	—	—	—	—	e 86·5	—
Kew		147·1	10	—	—	—	—	—	97·5
Uccle		148·1	4	—	—	—	—	—	87·5
Strasbourg		150·4	359	—	—	—	—	e 93·5	—

Additional readings: Wellington gives also e = +11m.48s., +13m.18s., and +13m.48s., eE = +23m.20s., eN = +23m.45s. and +30m.50s. Adelaide e = +24m.30s. Chicago S? = +34m.25s. Toronto eL = +59·7m. Ottawa eL = +59·5m. Eskdalemuir (Δ = 142°·9) gives simply 23h.

Dec. 23d. Readings also at 1h. (near Tacubaya), 6h. (Pilar, Mendoza, Cipolletti, Andalgala, and La Paz), 10h. (Wellington), 12h. (Colombo), 13h. (near Sapporo and Mizusawa), 14h. (Wellington), 17h. (Batavia (2)), 18h. (near Tacubaya (2)), 19h. (Batavia), 20h. (La Paz), 23h. (Batavia (2)). See also Appendix.

Dec. 24d. 0h. 6m. 26s. Epicentre 21°·0N. 97°·0E.

A = −·114, B = +·927, C = +·358 ; D = +·993, E = +·122 ; G = −·044, H = +·356, K = −·934.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Calcutta	E.	8·2	282	2 10	+ 6	3 48	+ 6	5·4	—
	N.	8·2	282	2 13	+ 9	3 45	+ 3	5·3	—
Hong Kong		16·0	82	—	—	—	—	—	9·6
Manila		23·7	102	e 9 38	?S	(e 9 38)	0	—	—
Zi-ka-wei		24·1	60	e 5 15	−14	e 9 39	− 7	—	13·5
Batavia		28·8	159	—	—	e 11 14	+ 1	i 15·6	—
Tokyo		40·0	59	—	—	e 13 26	−41	—	—
De Bilt	E.	74·7	320	—	—	—	—	e 43·6	—

De Bilt gives also eLN = +41·6m.

Dec. 24d. Readings also at 2h. (near Kobe), 5h. (Tokyo), 6h. (Colombo), 7h. (Lick and near Tacubaya), 8h. (near Nagasaki), 12h. (Colombo), 17h. (Chicago and Victoria), 19h. (De Bilt and La Paz), 21h. (Christchurch (2) and La Paz). See also Appendix.

Dec. 25d. 3h. 33m. 0s. Epicentre 43°·0S. 173°·0E.

$A = -·726$, $B = +·089$, $C = -·682$; $D = +·122$, $E = +·993$; $G = +·677$, $H = -·083$, $K = -·731$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Christchurch	0·6	209	0 0	− 9	—	—	—	—
Wellington	2·2	37	i 0 36	+ 2	i 1 0	0	—	2·0
Riverview	19·3	291	i 4 35	+ 2	i 8 11	+ 3	e 9·1	10·1
Sydney	19·3	291	4 24	− 9	—	—	9·2	11·2
Melbourne	21·9	274	4 18	−46	9 0	− 3	11·1	13·6
Adelaide	27·8	275	—	—	i 10 48	− 7	e 14·2	17·5
Apia	32·0	29	—	—	—	—	—	16·0
Perth	45·8	267	15 15	?S	(15 15)	−10	36·0	—
Batavia	68·4	281	i 11 20	+13	i 20 15	+ 8	36·2	—
Manilla	74·7	309	e 12 0	+13	—	—	—	—
Cipolletti	81·2	137	37 6	?	—	—	43·5	47·9
Hong Kong	84·8	309	15 40	?PR_1	23 3	−14	—	53·0
Mendoza	85·6	133	17 54	?	—	—	39·0	51·3
Zi-ka-wei	88·0	320	13 0	− 5	e 23 15	−37	—	46·2
Pilar E.	89·0	135	24 30	?S	(24 30)	+27	49·4	51·3
N.	89·0	135	24 24	?S	(24 24)	+21	48·3	51·0
Andalgala	90·8	132	20 54	?	—	—	42·0	43·2
Colombo	96·9	273	24 36	?S	(24 36)	−49	48·0	68·0
La Paz	98·3	123	e 17 7	?	26 37	+58	46·8	67·9
Kodaikanal	101·0	275	—	—	—	—	58·0	62·1
Victoria	107·1	38	50 58	?L	—	—	54·7	56·7
Chicago	122·9	60	e 37 25	?SR_1	—	—	59·0	—
Toronto	129·1	62	—	—	—	—	67·6	74·8
Ottawa	132·2	61	—	—	—	—	e 64·4	—
Hamburg	164·6	319	—	—	—	—	e 88·0	96·0
Rocca di Papa	165·4	272	—	—	—	—	e 100·3	115·9
Edinburgh	166·9	351	—	—	—	—	e 95·0	114·0
De Bilt	167·8	322	i 20 14	[0]	—	—	e 78·0	98·3
Stonyhurst	168·7	346	—	—	—	—	—	97·5
Uccle	169·0	319	—	—	i 32 2	?	e 79·0	93·0
Moncalieri	169·2	286	—	—	—	—	95·8	99·3
Algiers	170·1	234	—	—	e 42 21	?SR_1	e 89·0	97·0
Kew	170·4	334	—	—	—	—	—	106·0
Oxford	170·4	340	—	—	—	—	91·3	97·4
San Fernando	173·4	185	—	—	—	—	—	102·4
Granada	173·6	206	20 37	[+21]	—	—	20·9	21·1
Tortosa N.	174·0	251	—	—	—	—	e 82·0	97·3
Toledo	176·1	215	—	—	—	—	93·0	95·0
Coimbra E.	177·0	159	32 10	?	47 40	?SR_1	e 84·0	98·2
N.	177·0	159	e 37 10	?	i 48 10	?SR_1	e 90·0	100·7

Additional readings and notes: Riverview gives also $PR_1 = +4$m.51s., PS = +8m.35s., and +8m.46s., MZ = +11·2m., $T_g = 4$h.32m.57s. Melbourne $PR_1 = +4$m.48s., $SR_1 = +10$m.0s. Adelaide ePR_1? = +6m.0s., eSR_1? = +13m.12s., e = +15m.0s. Perth $PR_1 = +19$m.19s., S = +24m.10s., $SR_1 = +28$m.52s., $SR_2 = +31$m.53s. Batavia i = +21m.9s. Zi-ka-wei $PR_1Z = +16$m.39s., PSZ = +24m.48s. Andalgala MN = +44·1m. Colombo S = +32m.0s. Toronto eL = +70·3m., +89·3m., and +100·4m. Ottawa eE = +32m.0s. and +38m.0s. Hamburg MZ = +101·0m. Eskdalemuir (Δ = 167°·4, Az. = 350°) gives simply 5h. De Bilt e = +36m.0s. and +52m.4s., MZ = +96·8m., MN = +97·2m. Uccle eL = +50·0m. San Fernando MN = +103·2m. Coimbra LE = +88·2m.

Dec. 25d. Readings also at 0h. (near Algiers), 1h. (Granada), 2h. (Manila and near Colima), 3h. (Granada), 10h. (Colombo and La Paz), 11h. (La Paz, 12h. (Colombo (2), 14h. (Ottawa), 20h. (Colombo), 21h. (Christchurch), 23h. (Zi-ka-wei). See also Appendix.

Dec. 26d. Readings at 2h. (Tacubaya (2)), 4h. (near Mizusawa), 6h. (near Tokyo, Sapporo, and Mizusawa), 7h. and 8h. (near Tokyo), 9h. (near Batavia), 13h. (near Tokyo), 14h. (near Tacubaya), 15h. (Colombo and La Paz), 16h. (Colombo, La Paz, and near Nagasaki), 18h. (Colombo and near Algiers), 23h. (La Paz).

Dec. 27d. 9h. 31m. 0s. Epicentre 35°·5N. 140°·0E.

A = −·624, B = +·523, C = +·581.

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Tokyo		0·3	i 0 7	+ 2	i 0 11	+ 3	—	0·3
Mizusawa	E.	3·7	0 52	− 6	1 35	− 7	—	—
	N.	3·7	0 54	− 4	1 36	− 6	—	—
Osaka		3·8	0 59	0	—	—	2·0	2·7
Kobe		4·1	e 1 13	+ 9	1 59	+ 6	2·4	3·6

Additional readings: Osaka gives also MN = +2·5m. Kobe MN = +2·4m.

Dec. 27d. Readings also at 2h. (Zi-ka-wei), 3h. (near Porto Rico, Port au Prince, and near Tokyo), 10h. (La Paz), 12h. (near Tokyo), 13h. (near Nagasaki), 16h. (Apia and La Paz), 17h. (Algiers), 20h. (Zi-ka-wei, Manila, and Hong Kong). See also Appendix.

Dec. 28d. 12h. 40m. 42s. Epicentre 29°·0S. 71°·0W. (as on 1922 Nov. 26d.).

A = +·285, B = −·827, C = −·485; D = −·946, E = −·326;
G = −·158, H = +·458, K = −·875.

The reappearance of this shock at Zi-ka-wei, after feeble manifestations in North America and Europe, is noteworthy.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	N.	4·4	73	1 18	+10	—	—	2·0	3·1
Mendoza		4·5	150	1 42	+32	—	—	2·5	3·0
Pilar	E.	6·7	115	2 12	+30	—	—	3·7	4·8
	N.	6·7	115	2 12	+30	—	—	3·6	4·2
La Quiaca	E.	8·4	36	1 42	−25	—	—	2·8	3·3
	N.	8·4	36	1 6	−61	—	—	2·5	3·1
Cipolletti		10·3	167	—	—	—	—	3·7	5·3
Chacarita	E.	12·0	121	4 48	+109	—	—	7·0	9·1
	N.	12·0	121	4 54	+115	—	—	7·0	8·1
La Paz		12·8	13	3 14	+ 4	i 5 38	− 1	i 7·0	8·2
Coimbra		90·4	42	—	—	—	—	47·3	—
Victoria		90·5	329	—	—	—	—	48·6	50·9
Toledo		92·8	45	—	—	—	—	48·3	54·1
Uccle		103·6	39	—	—	—	—	—	55·3
De Bilt	E.	104·7	39	—	—	—	—	e 56·3	—
Konigsberg		114·2	39	—	—	—	—	e 47·9	51·3
Zi-ka-wei		169·3	285	20 3	[−11]	—	—	—	98·8

Additional readings and notes: Andalgala and Mendoza readings have been increased by 4m. De Bilt gives also eLN = +57·3m. Konigsberg readings have been increased by 1h.

Dec. 28d. Readings also at 2h. (Victoria and La Paz), 9h. (Barcelona, Tortosa, Strasbourg, and Besançon), 14h. and 15h. (La Paz), 17h. (near Balboa Heights), 23h. (near Nagasaki).

Dec. 29d. 12h. 22m. 10s. Epicentre 42°·0N. 13°·5E. (as on 1918 April 18d.).

A = +·722, B = +·173, C = +·669 ; D = +·233, E = −·972 ;
G = +·651, H = +·156, K = −·743.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Rocca di Papa		0·6	247	i 0 7	− 2	—	—	e 9·8	—
Pompeii		1·5	150	i 0 19	− 4	i 0 30	−12	—	1·0
Florence		2·4	317	0 45	+ 8	—	—	—	1·8
Mostar		3·5	67	i 1 2	+ 7	i 1 43	+ 6	—	2·4
Moncalieri		5·2	308	1 19	− 1	2 22	0	—	3·2
Innsbruck		5·5	345	i 1 21	− 4	i 2 55	+24	—	3·3
Belgrade		5·8	58	e 1 22	− 8	e 2 29	−10	—	4·8
Marseilles		6·1	281	e 1 36?	+ 3	2 50?	+ 4	—	4·2
Zurich		6·4	329	e 1 33	− 5	i 3 9	+14	—	—
Vienna		6·5	17	1 33	− 6	2 33	−24	i 3·3	4·1
Besançon		7·4	317	e 1 49?	− 3	3 30	+ 9	—	3·8
Strasbourg		7·7	331	1 37	−20	3 8	−21	e 3·5	5·2
Barcelona		8·5	250	(e 2 39)	+30	—	—	e 2·6	7·3
Athens		8·9	114	e 2 5	−10	3 45	−16	e 4·2	5·5
Algiers		9·6	241	e 2 13	−11	e 4 0	−18	e 5·5	6·3
Tortosa		9·8	267	2 26	− 1	4 16	− 7	—	9·3
Paris		10·2	315	—	—	e 5 2	+27	5·8	6·9
Uccle		10·8	328	e 3 8	+27	5 37	+47	—	—
De Bilt		11·5	334	—	—	—	—	e 6·3	7·8
Hamburg		11·8	350	—	—	e 4 50	−24	—	9·4
Toledo		13·4	266	3 52	+34	7 24	+91	7·8	10·4
Konigsberg		13·6	16	—	—	—	—	e 6·5	9·8
Granada		14·0	255	3 46	+20	7 3	+55	9·0	10·1
San Fernando	E.	16·2	256	—	—	—	—	—	10·0
Coimbra	E.	16·6	271	4 0	0	—	—	e 10·3	11·1
	N.	16·6	271	—	—	—	—	8·9	10·7

Additional readings and notes: Mostar gives also iP = +1m.18s., MN = +2·0m. Belgrade iS = +1m.44s., MN = +3·5m. Vienna iZ = +1m.51s., i = +3m.43s., iE = +3m.49s., MZ = +4·2m., MN = +4·3m. Strasbourg MN = +5·4m. Athens e = +2m.9s., MN = +6·0m. De Bilt MN = +8·2m., MZ = +8·5m. Hamburg MN = +7·4m., MZ = +7·7m. San Fernando MN = +9·4m.

Dec. 29d. Readings also at 4h. (Melbourne), 9h. (Belgrade), 12h. (near Lick), 13h. (near Tokyo), 15h. (near Mizusawa and Sapporo), 21h. (near La Paz).

Dec. 30d. Readings at 7h. (Malaga (2)), 10h. (near Nagasaki), 15h. (Granada and Malaga), 19h. (Malaga).

1922. Dec. 31d. 7h. 19m. 56s. Epicentre 45°·5N. 151°·2E.

A = −·614, B = +·338, C = +·713 ; D = +·482, E = +·876 ;
G = −·625, H = +·344, K = −·701.

See note at end.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari		5·8	284	0 39	−51	—	—	2·1	3·6
Sapporo		7·4	254	1 52	0	(3 22)	+ 1	3·4	—
Mizusawa	E.	9·8	233	2 32	+ 5	4 13	−10	—	—
Tokyo		13·1	225	i 3 19	+ 5	i 6 3	+17	—	10·3
Osaka		16·1	233	4 1	+ 8	(6 57)	0	7·0	13·3
Kobe		16·3	234	4 0	+ 4	7 14	+12	9·6	12·5
Zi-ka-wei		27·1	249	i 5 56	− 3	e 10 28	−15	—	17·5
Taihoku		31·4	239	—	—	e 12 32	+34	16·8	—

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Hong Kong		37·9	244	7 24	−13	13 14	−23	—	24·2
Manila		40·0	230	e 7 50	− 5	14 46	+39	22·1	25·3
Sitka	E.	45·0	48	8 16	−17	15 2	−13	22·4	23·6
	N.	45·0	48	—	—	15 9	− 6	29·6	19·4
Honolulu	E.	47·7	103	8 46	− 6	i 15 45	− 6	21·8	28·4
	N.	47·7	103	—	—	15 49	− 1	21·9	28·7
Calcutta	E.	55·3	269	9 44	+ 3	—	—	—	—
Victoria		55·3	54	17 21	?S	(17 21)	− 4	26·7	35·1
Simla	E.	57·7	283	9 52	− 5	—	—	32·5	37·2
	N.	57·7	283	9 46	−11	—	—	32·3	—
Berkeley		61·9	65	e 10 36	+12	(e 18 49)	+ 2	e 26·3	30·8
Lick		62·6	65	e 19 8	?S	(e 19 8)	+12	23·7	26·6
Batavia		65·0	230	i 10 49	+ 4	i 19 30	+ 5	e 37·4	48·4
Upsala		68·0	337	e 11 15	+11	20 12	+10	e 33·5	40·8
Bombay		68·6	275	20 8	?S	(20 8)	− 1	—	—
Bergen		70·5	344	—	—	e 20 1	−31	—	—
Tiflis		70·9	311	e 11 16	− 6	e 20 56	+19	33·1	48·0
Kodaikanal		71·3	268	10 34	−51	—	—	39·3	48·3
Konigsberg	E.	71·3	333	11 29	+ 4	21 36	+54	e 35·1	44·1
	N.	71·3	333	—	—	21 46	+64	—	46·1
Lemberg		74·2	327	—	—	e 21 22	+ 6	—	46·9
Dyce	N.	74·9	346	11 55	+ 7	21 25	0	36·0	45·7
Hamburg		75·6	338	e 11 55	+ 2	e 21 41	+ 8	e 36·7	45·9
Edinburgh		76·3	345	—	—	e 22 4	+23	—	47·2
Eskdalemuir		76·9	346	e 12 2	+ 2	i 21 50	+ 2	36·1	47·2
De Bilt		78·1	340	12 9	+ 1	22 9	+ 8	e 36·1	44·6
Stonyhurst		78·1	345	e 12 4	− 4	i 22 4	+ 3	41·6	50·8
Chicago		78·2	41	22 1	?S	(22 1)	− 1	30·4	—
Vienna		78·3	331	e 12 10	+ 1	22 5	+ 1	e 41·1	49·1
Bidston		78·7	345	35 4	?	42 4	?L	(42·1)	59·1
Sydney		79·3	180	22 4	?S	(22 4)	−11	43·6	45·3
Uccle		79·5	340	e 12 17	+ 1	e 22 17	− 1	e 37·1	47·2
Ann Arbor		79·5	38	—	—	22 22	+ 4	40·1	—
Belgrade		79·8	326	i 12 19	+ 1	e 22 12	− 9	e 32·4	
Oxford		79·9	344	—	—	—	—	31·1	50·5
Kew		80·0	343	22 4	?S	(22 4)	−19	—	50·1
Ottawa	E.	80·1	30	e 11 49	−31	22 19	− 5	e 33·1	50·1
Toronto		80·2	35	—	—	i 22 34	+ 9	e 44·8	60·0
Strasbourg		80·7	337	—	—	—	—	e 44·1?	49·1
Innsbruck		80·7	334	i 12 28	+ 5	e 22 28	− 3	e 41·1	53·2
Adelaide		81·3	191	—	—	i 22 34	− 4	e 46·7	55·6
Zurich		81·5	335	12 22	− 6	22 28	−13	—	—
Paris		81·8	341	—	—	e 22 23	−21	44·1	55·1
Northfield		82·3	29	—	—	—	—	e 45·1	—
Besançon		82·4	337	—	—	—	—	42·1	—
Ithaca		82·4	33	—	—	—	—	46·1	—
Melbourne		83·4	185	—	—	i 23 4	+ 3	42·5	55·1
Moncalieri		83·9	335	20 1	?	(i 23 22)	+14	41·4	50·2
Florence		83·9	332	24 59	?	—	—	—	55·3
Athens		84·2	321	e 12 38	− 5	23 2	− 8	e 41·6	47·7
Washington		85·1	36	—	—	—	—	e 43·1	—
Rocca di Papa		85·2	330	—	—	—	—	e 45·7	54·5
Pompeii		85·4	329	e 14 4	+74	23 19	− 4	43·1	54·1
Cheltenham	E.	85·4	36	—	—	23 38	+15	41·8	—
Marseilles		86·2	335	—	—	e 23 36	+ 4	33·1	—
Helwan		78·0	311	12 59	0	(23 17)	−24	—	56·5
Barcelona		88·8	337	—	—	i 23 53	− 8	e 34·1	53·6
Tortosa	N.	89·8	339	—	—	24 4	− 8	46·3	59·0
Christchurch		91·1	166	—	—	—	—	45·5	57·1
Toledo		91·8	342	e 12 45	−41	24 4	−29	e 42·1	62·2
Coimbra	E.	92·4	346	—	—	24 8	−31	e 49·1	55·1
	N.	92·4	346	e 13 28	− 1	—	—	e 50·6	60·2
Algiers		92·9	335	—	—	e 24 31	−13	e 46·1	58·1
Granada		94·2	341	—	—	—	—	51·1	54·6
Rio Tinto		94·4	344	26 4	?S	(26 4)	+64	—	70·1
San Fernando	E.	95·6	343	—	—	—	—	—	58·9
La Paz		136·3	60	e 19 36	[+ 3]	e 33 16	?	64·3	69·4
Cape Town		142·4	271	42 45	?SR_1	—	—	—	93·8
Andalgala	N.	145·4	71	35 34	?	—	—	—	93·1
Pilar	E.	149·7	75	33 34	?	—	—	74·6	82·6
Cipolletti		150·5	91	34 46	?	—	—	76·7	98·6

For Notes see next page.

NOTES TO DEC. 31d. 7h. 19m. 56s.

Additional readings and notes: Mizusawa gives also SN = +2m.33s. Tokyo MN = +9·9m. Osaka MN = +10·0m. Kobe MN = +12·4m. Zi-ka-wei PSE = +11m.19s., PSN = +11m.33s., PSZ = +12m.24s., MN = +16·2m., MZ = +17·3m. Si ka SR_1E = +18m.20s., SR_2E = +18m.28s., LE = +29·1m., T_e = 7h.19m.40s. Honolulu SR_1E = +19m.46s., SR_1N = +19m.34s., T_e = 7h.19m.54s. Calcutta PN = +9m.47s. Victoria S = +21m.21s. Simla readings have been increased by 19m. Batavia P and S given as i, also i = +13m.9s. and +14m.32s. Upsala MN = +46·7m. Bergen readings increased by 1h. Tiflis MN = +45·4m. Hamburg SR_2 = +30m.16s., MZ = +45·7m. Eskdalemuir SR_1 = +27m.24s., MN = +51·0m. De Bilt SR_1 = +27m.48s., MN = +52·7m., MZ = +54·3m. Chicago S = +27m.12s. Vienna iPZ = +12m.11s., iPNE = +12m.14s., iZ = +13m.7s. and +13m.53s., SN = +22m.9s., MZ = +54·1m. Bidston readings have been increased by 1h. Uccle SR_1 = +27m.40s., SR_2 = +31m.58s., MN = +45·6m. Ann Arbor e = +19m.46s. Belgrade LN = +49·8m., LE = +50·9m. Oxford iSR_1 = +27m.43s. Ottawa e = +15m.28s. Toronto gives 6 other L readings. Strasbourg MN = +54·0m. Adelaide eSR_1 = +30m.4s., eSR_2 = +35m.40s., e = +48m.16s., +51m.4s., and +52m.16s. Paris e = +32m.22s., MN = +54·1m. Ithaca L = +50·1m. and +55·1m. Melbourne SR_1 = +28m.28s., SR_2 = +31m.22s. Moncalieri S = +32m.36s., MN = +54·4m. Athens MN = +54·0m., T_e = 7h.20m.6s. Washington L = +47·0m. Rocca di Papa L = +53·2m. Cheltenham eE = +22m.50s. Helwan gives its S as PR_1. Barcelona MN = +52·7m., all readings diminished by 1h. Christchurch SR_1 = +16m.28s., SR_2 = +23m.58s. Toledo MNW = +62·0m. San Fernando MN = +62·3m. La Paz PR_1E = +23m.10s. Pilar PN = +43m.34s. (?SR_1).

NOTE ON 1922 DEC. 31d. 7h.

The material is here sufficient to give a good determination of the epicentre. Arranging the observatories according to azimuth and omitting a few obviously discordant readings, we get the following groups showing apparent corrections to the △ for each station.

Az.	δ△	Az.	δ△	Az.	δ△	Az.	δ△	Az.	δ△
°	°	°	°	°	°	°	°	°	°
30	−0·5	48	−1·3	180	−1·0	233	+0·6	254	0·0
35	+0·7	54	−0·3	185	+0·1	233	0·0	268	+1·3
36	+1·3	65	+0·8	191	−0·4	234	+0·4	269	+0 4
38	+0·4	65	+1·0	225	+0·6	239	+2·1	275	−0·1
41	0·0	103	−0·5	230	+1·1	244	−1·6	283	−1·2
				230	+0·4	249	−0·5	284	(−3·3)
36	+0·4	67	−0·1	207	+0·1	239	+0·2	270	+0·1
	±0·6		±0·8		±0·6		±0·9		±0·6
311	0·0	329	−0·4	337	+1·3	341	−1·8		
311	+0·1	231	+0·2	337	−0·7	344	−0·6		
321	−0·8	333	+0·6	338	+0·5	345	−0·1		
326	−0·3	334	+0·3	339	−0·7	346	+0·5		
327	+0·5	335	+0·3	340	0·0	346	+2·0		
		335	−1·0	340	+0·4	346	+0·2		
319	−0·1	333	0·0	338	+0·1	345	0·0		
	±0·3		±0·5		±0·6		±0·9		

The mean numerical errors for each group are also shown, and it will be seen that the average mean error is about ±0°·6. But the solution is satisfactory in that the algebrac mean for each group is small. Apparently the epicentre is determined in azimuth as closely as the observations and tables allow. We can therefore examine the residuals for errors of tables as follows:—

△	δP No. Obs.	δP Mean s.	δS No. Obs.	δS Mean s.
° °				
0 −20	5	+ 4	5	+4
21 −40	3	− 4	4	+9
41 −60	4	− 7	3	−6
61 −70	2	+12	5	+6
70 −74·9	4	+ 4	4	−1
75 −79·9	6	0	11	+3
80 −84·9	4	− 9	9	−3
85 −90	1	0	7	−5

These results indicate, as has been shown before, that the corrections required to the Tables are not large; and it will need a considerable number of good solutions to determine them so as to improve the Tables with certainty. Such results are being collected as opportunity offers.

Dec. 31d. Readings also at 7h. (Malaga and near Granada), 8h. (La Paz), 11h. (Batavia, Manila, Tokyo, and Zi-ka-wei), 15h. (La Paz), 16h. (Manila), 17h. and 20h. (Nagasaki), 22h. (Nagasaki and near Tokyo).

APPENDIX.

The following is a list of the P wave times for all the shocks recorded at La Paz from one or other of the South American epicentres.

1922 NOVEMBER.

	h.	m.	s.		h.	m.	s.		h.	m.	s.
Nov. 7	23	3	11	Nov. 13	10	43	15	Nov. 17	11	5	19
11	18	12	29		17	2	27		12	45	19
	20	49	37		19	21	42		13	12	23
	21	7	57		21	22	31		19	43	41
	21	29	20	14	1	43	32	18	3	0	0
	21	44	19		2	35	27		8	20	23
	22	23	3		(5	55	27 =L)		13	38	25
	22	53	3		17	7	35		22	13	24
	23	29	27	15	6	46	8	19	15	30	29
12	(0	40	11 =S)		6	57	29		17	57	29
	1	37	5		8	19	13		19	38	59
	(7	14	39 =S)		11	15	34	20	6	18	59
	15	25	12		13	2	18		21	16	49
	17	53	32		14	2	40	21	3	49	20
	18	3	15		14	56	23	23	9	1	16
	18	22	30		18	35	26		11	56	41
13	0	54	37	16	2	22	18		18	18	31
	1	16	33		2	41	7	24	0	43	16
	4	5	7		4	47	58	26	1	58	21
	4	16	27		4	57	23		13	33	14
	4	38	21		22	36	35		14	8	51
	6	54	27		23	26	59	27	12	23	47
	7	12	9	17	1	48	29	28	17	23	2
	8	50	25		6	43	44	29	16	57	35
	9	7	31		9	34	51		21	58	33

1922 DECEMBER.

Dec. 2	0	21	20	Dec. 11	5	57	4	Dec. 23	20	50	30
10	31	7		15	10	7	11	24	18	49	27
4	6	4	44	19	3	3	26		19	40	59
6	14	14	43		14	39	11	25	19	43	19
8	4	35	34	22	21	10	28	27	0	40	32
15	10	51		23	17	25	22	28	12	43	56

The following cases, originally relegated to the notes in the above text, seem on further scrutiny to have possible solutions. Many of them are after shocks of the Chile earthquakes, for which there was scarcely sufficient information until readings from several South American observatories were received (after the M^{s}. had been sent to the printers). Unfortunately there seem to be a good many mistakes of whole minutes in these readings, which has made the work of solution specially laborious and uncertain. It can only be offered as a hasty and approximate collation of defective material.

1922 Oct. 7d. 16h. 7m. 0s. Epicentre 62°·0N. 155°·0W. (as on Oct. 6d.).

	Δ	Az.	P.	O−C.	S.	O−C.	L.
	°	°	m. s.	s.	m. s.	s.	m.
Victoria	22·3	113	(5 8)	− 1	—	—	5·1
Chicago	43·7	87	—	—	i 14 55	− 3	—
Ann Arbor	45·2	82	—	—	19 18	?SR_1	—
Toronto	46·1	78	e 12 0	?	—	—	22·0
Ottawa	46·4	74	—	—	e 19 49	?SR_1	e 23·0

Toronto gives also L = +13·0m., and Ottawa gives iM = +19m.55s.

Oct. 17d. 17h. 46m. 15s. Epicentre 12°·0N. 95°·0E. (as at 9h.).

A = − ·085, B = + ·974, C = + ·208.

		Δ	Az.	P.	O − C.	S.	O − C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Calcutta	E.	12·3	330	3 29	+26	—	—	—	—
	N.	12·3	330	2 58	− 5	—	—	—	—
Colombo		15·8	252	7 45	?S	(7 45)	+55	—	11·3
Hong Kong		21·0	58	8 49	?S	(8 49)	+ 5	—	13·8
Batavia		21·6	150	4 53	− 7	—	—	—	—
Manila		25·5	83	6 57	+74	—	—	14·3	—
Zi-ka-wei		31·0	48	—	—	e 17 0	?L	—	—

The Batavia reading is for 18h.

Oct. 17d. 21h. 14m. 30s. Epicentre 12°·0N. 95°·0E., as above ?

		Δ	Az.	P.	O − C.	S.	O − C.
		°	°	m. s.	s.	m. s.	s.
Calcutta	E.	12·3	330	2 56	− 7	—	—
	N.	12·3	330	2 38	−25	—	—
Batavia		21·6	150	5 19	+19	i 10 42	+105
Manila		25·5	83	6 12	+29	—	—

1922 Nov. 7d. 17h. 2m. 18s. Epicentre 0°·7N. 117°·9E. (as on 1921 May 14d. 11h.).

A = − ·468, B = + ·884, C = + ·012 ; D = + ·884, E = + ·468 ;
G = − ·006, H = + ·011, K = −1·000.

	Δ	P.	O − C.	S.	O − C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Batavia	14·2	e 5 5	?S	(5 58)	+14	e 14·7	—
Manila	14·2	3 24	− 5	—	—	7·0	7·5
Hong Kong	21·9	8 19	?S	(8 19)	−44	—	11·2
Zi-ka-wei	30·7	e 6 25	−10	—	—	—	—

Nov. 7d. 18h. 15m. 0s. Epicentre 0°·7N. 117°·9E. (as at 17h.).

	Δ	Az.	P.	O − C.	S.	O − C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia	13·0	238	3 20	+ 7	i 5 38	− 6	i 6·2	7·4
Manila	14·2	12	e 6 15	?S	(6 15)	+ 2	11·7	—
Perth	32·7	182	(6 48)	− 6	9 44	?	13·4	—
Colombo	38·4	280	—	—	14 0	+16	26·8	30·0
Adelaide	40·6	150	12 0	?	(13 54)	−21	e 13·9	18·7
Kodaikanal	41·3	286	24 30	?	—	—	(24·5)	—
Melbourne	45·9	150	—	—	14 24	−63	18·6	23·4
Sydney	46·6	141	9 47	+63	—	—	22·0	23·0

1922 Nov. 11d. 20h. 45m. 40s. Epicentre 29°·0S. 71°·0W. (as at 18h.).

	Δ	P.	O − C.	S.	O − C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Pilar	6·7	2 44	?S	(2 44)	−18	3·3	3·1
La Quiaca	8·4	1 50	−17	—	—	2·8	3·8
Cipolletti	10·3	—	—	—	—	4·7	5·3
Chacarita E.	12·0	5 38	?S	(5 38)	+19	6·5	6·9
N.	12·0	5 20	?S	(5 20)	+ 1	6·2	—
La Paz	12·8	e 3 57	+47	e 5 53	+14	6·5	6·7
Stonyhurst	101·7	e 49 20	?L	—	—	(e 49·3)	—
Eskdalemuir	102·1	—	—	—	—	58·3	—
De Bilt	104·7	—	—	—	—	e 57·3	—

1922 Nov. 11d. 21h. 41m. 0s. Epicentre 29°·0S. 71°·0W. (as at 20h.).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Pilar		6·7	3 30	?S	(3 30)	+28	4·1	4·5
La Quiaca		8·4	1 36	−31	—	—	2·5	3·0
Cipolletti		10·3	3 48	+74	—	—	4·2	6·8
La Paz		12·8	e 3 19	+ 9	e 5 24	−15	6·1	6·3
Eskdalemuir		102·1	—	—	—	—	41·9	—

Nov. 11d. 22h. 19m. 30s. Epicentre 29°·0S. 71°·0W. (as at 21h.).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala		4·4	0 42	−26	—	—	1·4	1·7
Pilar		6·7	2 42	?S	(2 42)	−20	3·0	4·0
La Quiaca		8·4	3 30	?S	(3 30)	−17	4·7	5·0
Cipolletti		10·3	—	—	—	—	4·4	6·5
Chacarita	E.	12·0	5 54	?S	(5 54)	+35	7·8	8·2
	N.	12·0	5 12	?S	(5 12)	− 7	6·7	—
La Paz		12·8	3 33	+23	e 5 51	+12	5·9	8·0
Eskdalemuir		102·1	—	—	—	—	60·5	—
De Bilt		104·7	—	—	—	—	e 57·5	—

Nov. 12d. 15h. 21m. 29s. Epicentre 29°·0S. 71°·0W. (as on Nov. 12d. 7h., &c.).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	4·4	0 1	−67	—	—	1·2	1·3
	N.	4·4	—	—	—	—	0·7	0·8
Mendoza		4·5	—	—	—	—	5·8	6·0
Pilar	E.	6·7	1 31	−11	—	—	4·1	4·2
	N.	6·7	—	—	—	—	3·5	4·0
La Quiaca	E.	8·4	3 1	?S	(3 1)	−46	4·0	4·5
	N.	8·4	—	—	—	—	3·8	6·0
Cipolletti		10·3	4 19	?S	(4 19)	−18	—	4·7
La Paz		12·8	3 43	+33	—	—	6·7	7·1

Nov. 12d. 17h. 50m. 30s. Epicentre 29°·0S. 71°·0W. (as at 15h., &c.).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	4·4	—	—	—	—	0·0	0·4
	N.	4·4	−1 36	−164	—	—	−0·1	0·5
Mendoza		4·5	4 18	?	—	—	5·3	5·9
Pilar	E.	6·7	2 0	+18	—	—	4·2	4·9
	N.	6·7	2 30	+48	—	—	4·0	4·4
La Quiaca	E.	8·4	0 54	−73	—	—	2·5	2·8
	N.	8·4	2 30	+23	—	—	2·6	3·3
Cipolletti		10·3	—	—	—	—	3·5	4·5
Chacarita	E.	12·0	4 6	+67	—	—	7·2	7·4
	N.	12·0	3 48	+49	—	—	5·5	5·7
La Paz		12·8	3 2	− 8	5 42	+ 3	6·8	7·3
Eskdalemuir		102·1	—	—	—	—	59·5	—
Uccle		103·6	—	—	—	—	e 54·5	—
De Bilt		104·7	—	—	—	—	e 57·5	—

Nov. 12d. 21h. 53m. 30s. Epicentre 29°·0S. 71°·0W. (as at 17h., &c.).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Mendoza		4·5	—	—	—	—	5·2	7·5
Pilar	E.	6·7	—	—	—	—	3·6	3·7
	N.	6·7	—	—	—	—	5·4	5·6
La Quiaca	E.	8·4	—	—	—	—	2·9	5·5
	N.	8·4	—	—	—	—	3·0	5·8
Cipolletti		10·3	6 18	?L	—	—	—	7·5
La Paz		12·8	2 59	−11	7 27	+108	10·5	11·0

Nov. 13d. 4h. 1m. 45s. Epicentre 29°·0S. 71°·0W. (as on Nov. 12d.).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	4·4	−1 21	−149	—	—	−0·1	0·4
Mendoza		4·5	4 21	+191	—	—	5·4	5·8
Pilar	E.	6·7	4 7	+145	—	—	5·1	5·3
	N.	6·7	4 7	+145	—	—	4·6	4·8
La Quiaca	E.	8·4	—	—	—	—	2·8	3·6
Cipolletti		10·3	7 27	?S	(7 27)	+170	8·3	11·2
La Paz		12·8	3 22	+12	5 27	−12	6·5	8·5

Nov. 13d. 4h. 13m. 0s. Epicentre 29°·0S. 71°·0W. (as above).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	4·4	−0 54	−122	—	—	0·2	0·9
Mendoza		4·5	5 6	?	—	—	5·6	6·5
Pilar	E.	6·7	—	—	—	—	5·5	5·7
	N.	6·7	—	—	—	—	5·0	5·6
La Quiaca		8·4	—	—	—	—	3·8	4·5
Cipolletti		10·3	—	—	—	—	8·3	11·2
La Paz		12·8	e 3 27	+17	—	—	6·5	8·4
Victoria		90·5	13 23	+ 4	—	—	48·1	51·1
Toledo		92·8	—	—	—	—	44·0	53·2
Eskdalemuir		102·1	—	—	—	—	44·0	—
Edinburgh		102·5	—	—	—	—	e 55·0	—
Uccle		103·6	—	—	28 6	?	e 40·0	—
De Bilt		104·7	—	—	e 47 0	?	e 52·0	—
Hamburg		108·0	—	—	—	—	e 61·0	—

Nov. 13d. 4h. 35m. 0s. Epicentre 29°·0S. 71°·0W. (as above).

		Δ	P.	O−C.	L.	M.
		°	m. s.	s.	m.	m.
Andalgala	E.	4·4	−0 42	−110	0·6	0·8
	N.	4·4	−0 30	−98	0·5	0·7
Mendoza		4·5	—	—	0·1	0·4
Pilar	E.	6·7	—	—	4·3	5·0
	N.	6·7	—	—	4·9	5·3
La Paz		12·8	e 3 21	+11	6·5	8·0

Nov. 13d. 7h. 8m. 45s. Epicentre 29°·0S. 71°·0W. (as at 4h.).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala		4·4	—	—	—	—	0·4	0·8
Mendoza		4·5	—	—	—	—	5·3	5·5
Pilar	E.	6·7	5 9	?	—	—	5·6	5·8
	N.	6·7	2 45	?S	(2 45)	−17	3·4	3·7
Cipolletti		10·3	—	—	—	—	7·9	10·6
La Paz		12·8	e 3 24	+14	5 37	− 2	6·8	8·1

Nov. 13d. 8h. 51m. 0s. Epicentre 29°·0S. 71°·0W. (as at 7h.).

	Δ	P.	O−C.	L.	M.
	°	m. s.	s.	m.	m.
Mendoza	4·5	—	—	2·4	2·8
Pilar	6·7	1 18	−24	1·8	2·2
Cipolletti	10·3	3 0	+26	3·8	6·2

1922 Nov. 15d. 6h. 43m. 20s. Epicentre 27°·5S. 72°·8W. (as on Nov. 7d. 23h.).

A = +·262, B = −·847, C = −·462.

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	5·8	−0 26	−116	—	—	0·8	1·0
Mendoza		6·6	3 28	?S	(3 28)	+28	4·3	4·7
Pilar	E.	8·8	2 10	− 3	—	—	4·3	4·7
	N.	8·8	—	—	—	—	4·1	4·4
La Paz		11·8	2 48	− 8	5 28	+14	6·8	7·3
Cipolletti		12·1	—	—	—	—	3·5	4·7

Nov. 15d. 6h. 54m. 30s. Epicentre 27·5S. 72°·8W. (as above).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	5·8	0 24	−66	—	—	0·9	1·3
	N.	5·8	—	—	—	—	0·6	0·8
Mendoza		6·6	3 30	?S	(3 30)	+30	4·0	4·4
Pilar	E.	8·8	3 48	?S	(3 48)	−10	4·5	4·7
	N.	8·8	—	—	—	—	4·0	4·2
La Paz		11·8	i 2 59	+ 3	4 58	−16	6·0	7·2
Cipolletti		12·1	—	—	—	—	4·6	5·8

Nov. 15d. 8h. 16m. 20s. Epicentre 27°·5S. 72°·8W. (as above).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	5·8	0 28	−62	—	—	1·7	2·0
	N.	5·8	0 34	−56	—	—	1·2	1·5
Mendoza		6·6	3 40	?S	(3 40)	+40	4·8	5·4
Pilar	E.	8·8	4 4	?S	(4 4)	+ 6	—	6·1
	N.	8·8	4 34	?S	(4 34)	+36	4·9	6·0
La Paz		11·8	e 2 53	− 3	—	—	5·8	7·2
Cipolletti		12·1	—	—	—	—	4·6	5·5

Nov. 16d. 4h. 45m. 0s. Epicentre 27°·5S. 72°·8W. (as above).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	5·8	−1 12	−162	—	—	0·3	0·6
	N.	5·8	0 0	−90	—	—	0·5	0·7
Mendoza		6·6	—	—	—	—	5·8	6·8
Pilar	E.	8·8	3 48	?S	(3 48)	−10	—	4·9
	N.	8·8	3 42	?S	(3 42)	−16	4·6	4·0
La Paz		11·8	i 2 58	+ 2	5 10	− 4	6·4	6·6
Cipolletti		12·1	6 12	?S	(6 12)	+51	6·8	8·0

Nov. 17d. 19h. 38m. 30s. Epicentre 38°·0S. 73°·5W. (as on 1922 Mar. 12d.).

A = +·224, B = −·755, C = −·616.

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Mendoza		6·6	—	—	—	—	4·9	5·0
Pilar	E.	9·6	—	—	—	—	6·4	8·0
	N.	9·6	—	—	—	—	5·8	6·5
La Plata	E.	12·9	—	—	—	—	7·5	8·8
La Paz		22·0	e 5 11	+ 6	8 57	− 8	9·8	12·6

Nov. 20d. 21h. 13m. 40s. Epicentre 29°·0S. 71°·0W. (as on Nov. 11d.).

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mendoza		4·5	150	3 50	?S	(3 50)	+106	4·9	6·0
Pilar		6·7	115	3 50	?S	(3 50)	+48	5·0	5·3
La Quiaca	E.	8·4	36	3 38	?S	(3 38)	− 9	4·5	4·8
	N.	8·4	36	3 44	?S	(3 44)	− 3	4·5	5·0
Cipolletti		10·3	167	—	—	—	—	6·3	7·2
Chacarita	E.	12·0	121	6 38	?S	(6 38)	+79	7·4	9·1
La Plata	E.	12·5	121	2 29	−37	—	—	5·7	6·7
	N.	12·5	121	2 46	−20	5 7	−25	5·9	8·7
La Paz		12·8	13	e 3 9	− 1	5 37	− 2	6·5	11·1

La Plata gives T_0 = 21h.13m.12s. Epicentre 29°·2S. 70°·8W.

Nov. 21d. 3h. 46m. 8s. Epicentre 29°·0S. 71°·0W. (as above).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	4·4	1 16	+ 8	—	—	2·4	2·6
Mendoza		4·5	3 10	+120	—	—	3·7	3·9
Pilar		6·7	1 52	+10	—	—	4·6	4·9
Cipolletti		10·3	4 22	?S	(4 22)	−15	5·3	5·9
Chacarita	E.	12·0	5 40	?S	(5 40)	+21	8·4	8·7
	N.	12·0	5 40	?S	(5 40)	+21	7·1	7·5
La Plata	E.	12·5	i 4 14	+68	6 42	+70	7·4	8·6
	N.	12·5	4 31	+85	6 57	+85	7·3	8·5
La Paz		12·8	e 3 12	+ 2	5 36	− 3	—	9·0
Eskdalemuir		102·1	—	—	—	—	43·9	—
Uccle		103·6	—	—	—	—	e 50·9	—
De Bilt	E.	104·7	—	—	—	—	e 53·9	—

The Andalgala readings have been diminished by 6min. La Plata gives T_0 = 3h.47m.24s. Epicentre 28°·2S. 70°·8W. Its readings appear to be 1min. too large.

Nov. 26d. 14h. 5m. 45s. Epicentre 29°·0S. 71°·0W. (as above).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	4·4	1 15	+ 7	—	—	1·9	3·2
Mendoza		4·5	1 15	+ 5	—	—	2·0	2·9
Pilar		6·7	1 27	−15	—	—	3·1	4·4
La Quiaca	E.	8·4	2 15	+ 8	—	—	3·2	4·3
	N.	8·4	1 45	−22	—	—	3·2	4·2
Cipolletti		10·3	4 39	?S	(4 39)	+ 2	5·9	7·2
Chacarita	E.	12·0	5 21	?S	(5 21)	+ 2	—	—
	N.	12·0	5 15	?S	(5 15)	− 4	6·8	8·0
La Plata	E.	12·5	i 3 16	+10	5 34	+ 2	6·3	8·6
	N.	12·5	i 3 9	+ 3	5 30	− 2	6·2	8·0
La Paz		12·8	e 3 6	− 4	5 16	−23	6·3	7·9

Andalgala gives also MN = +2·6m. All the readings have been diminished by 4m. Mendoza readings have been increased by 4m. Pilar gives also MN = +3·7m. La Plata gives T_0 = 14h.6m.1s. Epicentre 27°·4S. 69°·0W. La Paz gives i = +6m.11s. T_0 = 14h.6m.12s.

Dec. 8d. 15h. 7m. 44s. Epicentre 27°·5S. 72°·8W. (as on Nov. 16d. 4h.).

A = +·262, B = −·847, C = −·462; D = −·955, E = −·296; G = −·137, H = +·441, K = −·887.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala		5·8	93	2 34	?S	(2 34)	− 5	3·6	4·6
La Quiaca		8·4	52	1 40	−27	—	—	4·0	4·7
Pilar		8·8	121	2 40	+27	—	—	4·5	5·6
La Paz		11·8	22	3 7	+11	5 3	−11	5·9	6·9
Cipolletti		12·1	162	—	—	—	—	8·1	11·4
Chacarita		14·2	123	6 34	?S	(6 34)	+21	7·3	8·7
La Plata	E.	14·7	124	3 41	+ 6	6 9	−16	7·2	8·3
	N.	14·7	124	3 32	− 3	5 54	−31	6·8	7·9
Stonyhurst		101·4	36	e 40 46	?L	—	—	(e 40·8)	58·3
Strasbourg		104·5	43	—	—	—	—	e 63·3	—
De Bilt	E.	104·5	40	—	—	—	—	e 52·3	—

La Quiaca gives also MN = +4·8m. Pilar LN = +4·3m., MN = +4·7m. Chacarita LN = +7·6m., MN = +7·9m.

Dec. 11d. 5h. 52m. 48s. Epicentre 34°·0S. 73°·0W. (as on 1922 Aug. 6d.).

A = +·242, B = −·793, C = −·559.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mendoza		4·1	74	—	—	—	—	3·6	4·2
Cipolletti		6·3	143	3 30	?S	(3 30)	+38	4·1	7·2
Pilar		8·0	76	3 0	?S	3 0	−37	3·6	4·0
Andalgala	E.	8·6	43	3 36	?S	(3 36)	−17	5·3	7·7
	N.	8·6	43	2 30	+20	—	—	4·1	4·6
Chacarita		12·1	97	3 18	+18	(5 24)	+ 3	6·1	7·6
La Plata	E.	12·5	98	e 3 15	+ 9	5 7	−25	6·3	7·2
	N.	12·5	98	3 12	+ 6	5 5	−27	6·3	7·0
La Paz		18·0	15	i 4 16	− 1	5 19	?	7·0	8·7

La Plata gives also $PR_1E? = +3m.43s.$, $PR_1N? = +3m.37s.$

Dec. 22d. 21h. 7m. 13s. Epicentre 29°·0S. 71°·0W. (as on 1922 Nov. 26d.).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala		4·4	1 5	− 3	—	—	1·6	2·3
Mendoza		4·5	−0 1	−71	—	—	0·6	1·1
Pilar	E.	6·7	1 59	+17	—	—	3·7	4·0
	N.	6·7	2 35	+53	—	—	3·2	3·5
La Quiaca		8·4	1 41	−26	—	—	3·1	3·4
Cipolletti		10·3	2 35	+ 1	—	—	2·8	4·8
Chacarita		12·0	5 23	?S	(5 23)	+ 4	6·8	7·4
La Plata	E.	12·5	2 29	−37	4 38	−54	5·3	6·5
	N.	12·5	2 32	−34	4 48	−44	5·9	6·6
La Paz		12·8	3 15	+ 5	5 19	−20	6·4	8·2

Andalgala readings have been increased by 3min. and Chacarita readings decreased by 2min. La Quiaca gives also MN = +3·5m.

Dec. 23d. 9h. 11m. 40s. Epicentre 29°·0S. 71°·0W. (as above).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala		4·4	1 56	+48	—	—	2·7	2·8
Mendoza		4·5	0 32	−38	—	—	1·5	1·7
Pilar	E.	6·7	1 14	−28	—	—	2·2	2·4
Cipolletti		10·3	2 56	+22	—	—	3·6	4·2
La Plata	E.	12·5	3 0	− 6	5 26	− 6	6·3	8·2
	N.	12·5	3 9	+ 3	5 34	+ 2	6·6	7·1

Andalgala readings have been increased by 3min. and Pilar readings decreased by 2min.

Dec. 24d. 18h. 44m. 12s. Epicentre 29°·0S. 71°·0W. (as above).

		Δ	P.	O−C.	L.	M.
		°	m. s.	s.	m.	m.
Andalgala		4·4	1 0	− 8	1·5	1·6
Mendoza		4·5	1 42	+22	2·2	2·5
Pilar	E.	6·7	1 42	0	5·8	7·0
	N.	6·7	1 48	+ 6	6·2	6·7

Dec. 24d. 18h. 46m. 25s. Epicentre 29°·0S. 71°·0W. (as above).

(Apparently the above shock did not register at the rather more distant stations.)

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
La Quiaca		8·4	4 11	?S	(4 11)	+24	4·5	5·1
Cipolletti		10·3	4 35	?S	(4 35)	− 2	6·5	7·2
Chacarita		12·0	5 47	?S	(5 47)	+28	6·2	6·6
La Plata	E.	12·5	—	—	5 48	+16	7·1	7·3
	N.	12·5	—	—	5 46	+14	7·1	7·8
La Paz		12·8	3 2	− 8	5 31	− 8	6·4	7·4
De Bilt		104·7	—	—	—	—	50·6	—

The Chacarita readings have been decreased by 2min.

Dec. 25d. 11h. 25m. 33s. Epicentre 10°·0N. 121°·0E. (as on 1917 Jan. 10d.).

A = −·507, B = +·848, C = +·174.

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Manila		4·6	e 1 27	+16	—	—	—	—
Hong Kong		13·9	—	—	—	—	—	18·4
Zi-ka-wei		21·2	5 4	+ 9	—	—	—	21·0
Batavia	E.	21·5	e 4 52	− 7	—	—	—	—
Perth		42·3	—	—	—	—	21·9	—
Adelaide		48·0	e 15 27	?S	(e 15 27)	−27	—	18·0
Sydney		52·5	8 39	−44	—	—	15·3	16·7
Victoria		98·7	—	—	—	—	55·6	57·6
Chicago		121·9	—	—	—	—	e 57·4	—
Ottawa		122·5	—	—	—	—	e 55·4	—
Toronto		123·2	—	—	—	—	72·0	—

The Manila reading has been decreased by 10min. Ottawa gives also e = +52m.27s.

Dec. 25d. 19h. 40m. 20s. Epicentre 29°·0S. 71°·0W. (as on Dec. 23d., &c.).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	N.	4·4	—	—	—	—	2·9	3·2
Mendoza		4·5	1 4	− 6	—	—	2·0	2·7
Pilar		6·7	2 22	+40	(3 16)	+14	3·3	3·7
La Quiaca	E.	8·4	3 52	?S	(3 52)	+ 5	4·7	6·7
Cipolletti		10·3	—	—	—	—	6·3	7·6
La Plata	E.	12·5	2 45	−21	5 12	−20	6·0	6·7
	N.	12·5	3 5	− 1	5 9	−23	—	6·8
La Paz		12·8	2 59	−11	5 12	−27	6·3	8·6

Andalgala readings have been increased by 4min. and Mendoza by 2min.

Dec. 27d. 0h. 37m. 26s. Epicentre 29°·0S. 71°·0W. (as above).

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	4·4	−1 50	−178	—	—	2·0	2·4
	N.	4·4	1 4	− 4	—	—	1·7	2·1
Mendoza		4·5	0 58	−12	—	—	1·9	3·1
Pilar		6·7	2 4	+22	—	—	3·0	3·6
La Quiaca		8·4	—	—	—	—	3·2	3·6
Chacarita	E.	12·0	5 40	?S	(5 40)	+21	6·8	6·9
	N.	12·0	5 46	?S	(5 46)	+27	6·7	7·3
La Plata	E.	12·5	2 39	−27	4 51	−41	5·9	7·6
	N.	12·5	2 40	−26	4 42	−50	6·0	6·8
La Paz		12·8	3 6	− 4	5 28	−11	6·9	8·3

Andalgala readings have been increased by 4min. and Mendoza by 3min. La Plata E = +5m.30s., N = +5m. 18s.

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TABLE.

Degrees.	P sec.	S sec.	S – P sec.	Degrees.	P sec.	S sec.	S – P sec.	Degrees.	P sec.	S sec.	S – P sec.
1	15	28	13	51	553	991	438	101	855	1565	710
2	31	55	24	52	560	1004	444	102	860	1575	715
3	47	83	36	53	566	1016	450	103	865	1584	719
4	62	110	48	54	573	1029	456	104	870	1593	723
5	77	137	60	55	579	1041	462	105	874	1602	728
6	92	164	72	56	586	1054	468	106	879	1612	733
7	106	190	84	57	592	1066	474	107	884	1621	737
8	121	217	96	58	599	1079	480	108	888	1630	742
9	136	243	107	59	605	1091	486	109	893	1639	746
10	150	269	119	60	612	1103	491	110	897	1648	751
11	164	294	130	61	619	1116	497	111	902	1657	755
12	179	319	140	62	625	1128	503	112	907	1666	759
13	193	344	151	63	632	1141	509	113	911	1674	763
14	206	368	162	64	638	1153	515	114	916	1682	766
15	219	392	173	65	645	1165	520	115	920	1690	770
16	232	415	183	66	651	1177	526	116	925	1698	773
17	245	438	193	67	658	1190	532	117	929	1706	777
18	257	460	203	68	664	1202	538	118	934	1714	780
19	269	482	213	69	671	1214	543	119	938	1722	784
20	281	503	222	70	677	1226	549	120	942	1729	787
21	293	524	231	71	683	1238	555	121	947	1737	790
22	305	545	240	72	690	1250	560	122	952	1744	792
23	317	565	248	73	696	1262	566	123	957	1752	795
24	328	584	256	74	702	1274	572	124	961	1759	798
25	338	603	265	75	709	1286	577	125	966	1766	800
26	348	622	274	76	715	1297	582	126	970	1773	803
27	358	641	283	77	721	1309	588	127	974	1780	806
28	368	659	291	78	727	1320	593	128	978	1787	809
29	378	677	299	79	733	1332	599	129	983	1794	811
30	388	694	306	80	739	1343	604	130	988	1801	813
31	398	711	313	81	745	1355	610	131	992	1807	815
32	407	728	321	82	750	1366	616	132	996	1814	818
33	416	744	328	83	756	1377	621	133	1001	1821	820
34	425	760	335	84	762	1388	626	134	1005	1827	822
35	433	775	342	85	768	1399	631	135	1009	1833	824
36	442	790	348	86	773	1410	637	136	1014	1840	826
37	450	804	354	87	779	1421	642	137	1018	1846	828
38	458	818	360	88	785	1432	647	138	1023	1852	829
39	466	832	366	89	790	1443	653	139	1027	1858	831
40	475	847	372	90	796	1454	658	140	1031	1864	833
41	483	861	378	91	801	1464	663	141	1035	1869	834
42	491	875	384	92	807	1475	668	142	1039	1875	836
43	498	888	390	93	812	1485	673	143	1043	1881	838
44	506	902	396	94	818	1496	678	144	1047	1886	839
45	513	915	402	95	823	1506	683	145	1051	1892	841
46	520	928	408	96	829	1516	687	146	1055	1897	842
47	527	941	414	97	834	1526	692	147	1059	1902	843
48	534	954	420	98	840	1536	696	148	1063	1907	844
49	540	966	426	99	845	1546	701	149	1067	1912	845
50	547	979	432	100	851	1556	705	150	1071	1917	846

I.W. County Press. 1000/5/26.