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The Location of Epicentres, 1921

BY

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LOCATION OF EPICENTRES, 1921

The determination of seismic epicentres is confined to those earthquakes of which at least a trace was registered at Ottawa. During the year 1921 one hundred and seven records, serially numbered from 1144 to 1250, were registered by the seismographs at the Dominion Observatory. Fifteen of these were sufficiently well marked in phase to yield accurate values for O , the Greenwich Mean Time of the disturbance at its origin, and Δ , the distance in kilometres from Ottawa to the epicentre. Nine other seismograms were read for time and distance, but the results obtained were regarded as doubtful. Using all the data available from other stations in conjunction with that from our own, it was possible to locate thirty-seven epicentres accurately and fifteen others approximately, while five were assigned doubtful locations. Of the fifty-four other earthquakes, designated in the tables as "No Locations" because of the impossibility of determining an epicentre, due to insufficient or discordant data, seven were located either accurately or approximately through press despatches or reports from other stations. These latter, however, are listed in the column "Other Locations," as column five contains the geographical coördinates of only those epicentres which were obtained by means of the stereographic projection method. The apparent discrepancy in the total number of quakes is accounted for by the fact that four records, viz. 1162 of Feb. 27th, 1179 of Mar. 30th, 1208 of June 28th, and 1240 of Oct. 15th, are dual, and two sets of geographical coördinates were given for each of these earthquakes.

It is to be noted that the values for O and Δ given in columns three and four, opposite their respective stations, are not always in agreement with those supplied by the station furnishing the data, as in all cases the readings given for P and S are accepted as correct and the quantities O and Δ are computed on the basis of the Klotz Seismological Tables. By this practice uniformity is obtained in the location work. In some instances it is possible to interpret e or i phases in terms of P or S , thereby gaining further evidence in support of the listed values of λ , φ , and O . All Δ values which vary greatly from the measured distance from the station to the epicentre are tabulated in the last column.

DOMINION OBSERVATORY,
OTTAWA, CANADA, March, 1924.

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Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1144 Jan. 2	Strasbourg..... Algiers..... Wien..... Hamburg..... Tokio..... Manila..... Uccle..... Naples..... Paris.....	7-05-24 7-06-19 7-06-28 (7-05-58) 7-07-56 7-06-46 7-06-53 7-06-45 7-06-41	9300 10640 9000 (9300) 545 2580 8640 9400 9160	$\varphi = 35^\circ \text{ N}$ $\lambda = 134^\circ \text{ E}$ O = 7-06-34		Victoria (5200) Cartuja 2780 La Paz (11930)
1145 Jan. 7	No Location				Sydney gives $\varphi = 13^\circ \text{ S}$ $\lambda = 151^\circ \text{ E}$	La Paz (10320) Cartuja 11400 Perth 2440 Wellington 3070 Sydney 2260
1146 Jan. 8	Ottawa..... Ithaca..... Chicago La Paz	6-35-23 (6-36-00) 6-35-41 6-35-38	3910 (3470) 2980 4410	$\varphi = 14^\circ.5 \text{ N}$ $\lambda = 93^\circ \text{ W}$ O = 6-35-40		Georgetown 4200
1147 Jan. 9	Ottawa..... Georgetown Chicago..... Balboa Cartuja La Paz.....	12-55-03 12-54-59 12-54-56 12-54-57 12-55-06 12-55-13	6480 5780 6220 2540 9280 680	$\varphi = 13^\circ \text{ S}$ $\lambda = 73^\circ.5 \text{ W.}$ O = 12-55-02		Coimbra 10140 Uccle 9450
1148 Jan. 9	No Location					Chicago (6350) La Paz (8600) Sydney 3550 Batavia 8540
1149 Jan. 19	No Location					Sydney (6080)
1150 Jan. 20	Washington..... Balboa..... La Paz.....	21-01-33 21-02-44 21-02-24	3450 435 3130	$\varphi = 12^\circ \text{ N}$ $\lambda = 83^\circ.5 \text{ W}$ O = 21-02-14		Ottawa (2600) Toronto 5100 Chicago 5200

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Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1151 Feb. 4	Ottawa.....	8-22-37	3420	$\varphi = 16^\circ \text{ N}$ $\lambda = 91^\circ.5 \text{ W}$ $O = 8-22-41$	Victoria gives near Guatemala. Toronto and Harvard give Tehautepec, Mexico.	Denver 545
	Halifax.....	(8-22-36)	(4340)			Chicago 5860
	Ithaca.....	8-21-56	3680			Belgrade 8680
	Wien.....	8-22-08	10600			Naples 9080
	Strasbourg.....	8-22-52	9100			
	Victoria.....	8-23-12	3950			
	Toronto.....	8-22-36	3600			
	Vieques.....	8-23-07	2560			
	Cheltenham.....	8-21-43	3360			
	Paris.....	8-23-00	8750			
	Tucson.....	8-22-27	2580			
	Cartuja.....	8-22-39	8700			
	La Paz.....	8-22-40	4300			
	Besançon.....	8-23-19	8600			
	Georgetown.....	8-21-41	3500			
	Washington.....	8-20-44	3440			
	St. Louis.....	8-22-41	2440			
	Fordham.....	8-23-19	2960			
	Balboa.....	8-22-14	1620			
	Northfield.....	8-22-36	3440			
	Stonyhurst.....	8-23-2	8320			
	Athens.....	8-22-37	10200			
	Algiers.....	8-23-02	9020			
	Hamburg.....	8-22-58	9090			
	Harvard.....	8-22-26	3420			
	Coimbra.....	8-21-53	8220			
	Lemberg.....	8-23-5	9280			
Firenze.....	(8-22-58)	(8800)				
Dyce.....	8-22-06	8800				
Uccle.....	8-22-45	8980				
Lick.....	8-23-23	3150				
Königsberg.....	8-23-12	9220				
Berkeley.....	8-24-23	3230				
1152 Feb. 6	No Location					Wien (9600) Chicago (8640) Harvard (5325) Uccle 8450
1153 Feb. 10	No Location					Sydney 4300
1154 Feb. 11	No Location					Victoria 4120 Ottawa (7500) La Paz 16850 Stonyhurst 5320 Harvard (8500) Sydney 5750
1155 Feb. 11	No Location					La Paz (3550) Balboa (460) Harvard (4945)

LOCATION OF EPICENTRES, 1921

Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1156 Feb. 14	Manila..... Sydney..... Batavia.....	0-59-17 1-00-46 1-00-43	2150 4780 2400	$\varphi = 1^{\circ} \cdot 5$ S $\lambda = 125^{\circ}$ E O = 1-00-15 Location approximate only	Batavia and Manila give Mindanao.	La Paz (9000)
1157 Feb. 19	Sydney..... Batavia..... La Paz.....	14-33-46 14-33-37 14-33-55	4060 3020 16670	$\varphi = 10^{\circ}$ N $\lambda = 129^{\circ}$ E O = 14-33-46 Location approximate only		Victoria 6600 Chicago (8800) Uccle (8800)
1158 Feb. 19	Victoria..... Chicago..... Stonyhurst..... Wien..... Coimbra..... Lemberg..... Uccle..... Budapest.....	18-29-23 18-24-14 18-23-1 (18-20-58) (18-22-31) 18-20-4 18-22-53 18-20-37	5740 7900 9020 (9310) (12020) 8800 8600 10340	$\varphi = 44^{\circ}$ N $\lambda = 161^{\circ}$ E O = 18-23 ca. Location doubtful.		Strasbourg 6700 La Paz 15600 Tokio 100 Wellington 5000 Sydney 3590
1159 Feb. 21	No Location					Victoria 650
1160 Feb. 21	No Location					Strasbourg (10320) Victoria 1510 Berkeley (1540)
1161 Feb. 21	No Location					No data.
1162 Feb. 27	Ottawa..... Ithaca..... Strasbourg..... Cartuja..... Georgetown..... Algiers..... Athens..... Wien..... Harvard..... Coimbra..... Uccle..... Besançon..... Tucson..... Perth..... Manila..... Tokio..... Wellington..... Sydney..... Batavia..... Lick.....	18-29-56 18-30-27 (18-30-29) 18-29-13 18-30-39 18-31-01 (18-29-07) (18-30-25) 18-30-55 18-30-17 18-31-08 (18-30-25) 18-23-39 18-22-26 18-23-31 18-23-33 18-23-6 18-23-37 18-23-47 18-23-38	8780 8280 9780 11760 7080 9230 (10940) (9860) 8420 9600 8920 (10000) 8680 7750 8220 7950 2600 3680 8650 8260	$\varphi = 47^{\circ} \cdot 5$ N $\lambda = 167^{\circ}$ E O = 18-30-20 Location doubtful. $\varphi = 19^{\circ} \cdot 5$ S $\lambda = 172^{\circ}$ W O = 18-23-28	Tokio gives near Samoa Is.	Denver (4220) Firenze 2340 Budapest 7650 Victoria 6820 La Paz 9520 Washington 9950 Chicago 9500 Honolulu 4120 Naples 9300 Paris 13000

LOCATION OF EPICENTRES, 1921

Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1163 Mar. 3	Strasbourg Tokio Besançon Uccle Naples Paris Königsberg	3-02-27 (3-02-43) 3-02-28 3-02-58 3-02-14 (3-01-15)	9280 194 (9250) 9200 8800 9740 (9660)	$\varphi = 37^\circ \text{ N}$ $\lambda = 137^\circ \text{ E}$ $O = 3-02-21$	Tokio reports quake felt at north part of Iwaki.	Cartuja 10100 La Paz 15750 Algiers 9250 Sydney 7270 Chicago (6920) Batavia 8520
1164 Mar. 3	Perth Sydney Melbourne	8-20-22 8-20-32 8-20-8	3110 5560 5100	$\varphi = 6^\circ \text{ S}$ $\lambda = 105^\circ .5 \text{ E}$ $O = 8-20-30$ Location approximate.		La Paz 16150 Harvard (11420)
1165 Mar. 5	La Paz Manila Zi-ka-wei	(6-25-06) 6-23-37 6-24-17	(16100) 3480 3670	$\varphi = 15^\circ \text{ N}$ $\lambda = 152^\circ \text{ E}$ $O = 6-24-3$ Location doubtful.		
1166 Mar. 6	Ottawa Toronto Harvard Washington Chicago St. Louis Fordham Georgetown Uccle Berkeley La Paz	7-24-52 7-25-26 7-24-50 7-24-28 7-24-58 7-23-46 7-24-50 (7-25-09) 7-24-38 7-25-09	3740 3150 4000 3350 2720 2500 3200 3420 9350 1950 6650	$\varphi = 24^\circ \text{ N}$ $\lambda = 119^\circ \text{ W}$ $O = 7-24-49$		Victoria 2170
1167 Mar. 10	Perth Sydney	(20-04-46) 20-05-14	(3520) 2690	$\varphi = 11^\circ .5 \text{ S}$ $\lambda = 125^\circ \text{ E}$ $O = 20-05$ Location approximate.		
1168 Mar. 12	Ottawa La Paz Chicago Balboa	(10-29-08) 10-30-24 10-30-44	(4830) 3020 3550 (555)	$\varphi = 7^\circ \text{ N}$ $\lambda = 85^\circ .5 \text{ W}$ $O = 10-30-2$ Location approximate.		
1169 Mar. 16	No Location					Sydney 2560

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Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1170 Mar. 21	La Paz..... Ithaca..... Balboa..... Uccle.....	4-06-20 4-06-33 4-06-49	2680 4220 450 9160	$\varphi = 4^{\circ}.5$ N $\lambda = 79^{\circ} 33'$ W O = 4-06-34		Chicago 3170
1171 Mar. 21	No Location					La Paz 2690
1172 Mar. 24	No Location					La Paz 12300 Sydney 3240 Melbourne 3250
1173 Mar. 24	No Location					No data.
1174 Mar. 24	Ottawa..... Algiers..... Ithaca..... Coimbra..... Washington..... St. Louis..... De Bilt..... Georgetown..... Zi-ka-wei..... Uccle..... Sydney..... Barcelona..... Naples..... Paris.....	14-41-58 14-41-50 (14-41-44) 14-41-27 14-40-52 (14-42-11) 14-41-38 14-41-54 14-41-54 14-41-54 14-41-23 (14-42-33) 14-41-58 (14-40-51)	8040 9600 (8360) 9900 8700 (7850) 8440 8650 3520 8400 9600 9050 8800 (9950)	$\varphi = 51^{\circ}$ N $\lambda = 156^{\circ}.5$ E O = 14-41-43		La Paz 15730 Strasbourg 3700 Chicago 6820 Tokio (1190) Belgrade 4150 Melbourne 9020 Budapest 11680 Besançon (3180)
1175 Mar. 25	No Location					Victoria 1100 Harvard (7590) Coimbra (4210)
1176 Mar. 25	No Location					No data.

LOCATION OF EPICENTRES, 1921

Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1177 Mar. 28	Ottawa.....	7-49-17	3600	$\varphi = 13^\circ \text{ N}$ $\lambda = 86^\circ.5 \text{ W}$ $O = 7-49-18$	Victoria gives Nicaragua.	Athens 8880
	Saskatoon.....	7-49-42	4650			Naples 8800
	Cartuja.....	7-49-36	8500			Firenze 10480
	La Paz.....	7-49-12	3730			Wellington 9280
	Georgetown.....	7-49-12	3020			Melbourne (11920)
	Stonyhurst.....	7-49-5	8320			
	Strasbourg.....	7-49-34	9060			
	Ithaca.....	7-48-58	3360			
	Algiers.....	7-49-31	9020			
	Paris.....	7-49-29	8780			
	Victoria.....	7-48-59	5300			
	Toronto.....	7-48-38	3810			
	Hamburg.....	7-49-35	9000			
	Wien.....	7-49-31	9440			
	Honolulu.....	7-49-26	7500			
	Porto Rico.....	7-49-12	2460			
	Besançon.....	7-49-30	9050			
	Cheltenham.....	7-48-28	3250			
	Tucson.....	7-49-38	2930			
	Harvard.....	7-49-16	3480			
	Barcelona.....	7-49-24	8920			
	Coimbra.....	7-49-30	8060			
	Washington.....	(7-48-10)	(3040)			
	Chicago.....	7-48-00	4000			
	Lick.....	7-49-25	4180			
	St. Louis.....	7-49-21	2780			
	Berkeley.....	7-49-22	4260			
	Fordham.....	7-49-09	3330			
	Northfield.....	7-50-10	3450			
	Balboa.....	7-49-32	920			
De Bilt.....	7-49-34	8850				
Uccle.....	7-49-30	8850				
Belgrade.....	7-48-49	10140				
Apia.....	7-49-35	9500				
Lemberg.....	7-49-31	9700				
1178 Mar. 29	Osaka.....	2-11-35	2035	$\varphi = 48^\circ \text{ N}$ $\lambda = 148^\circ.5 \text{ E}$ $O = 2-11-48$ Location approximate.		Wien (12260)
	Zi-ka-wei.....	2-11-59	2820			Sydney (11460)
	Uccle.....	(2-11-51)	(8800)			

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Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1179 Mar. 30	Osaka.....	15-02-19	4380	$\varphi = 3^{\circ} S$		Ottawa 13000+
	Honolulu.....	15-02-19	8360	$\lambda = 125^{\circ} \cdot 5 E$		La Paz 16200
	Manila.....	15-03-12	1860	O = 15-02-23		Chicago 5150
	Tokio.....	15-01-45	4750	Location		Georgetown (2170)
	Zi-ka-wei.....	15-02-46	3550	approximate.		Sydney 3360
	Melbourne.....	15-02-2	3520			
	Batavia.....	15-02-07	2230			
	Strasbourg.....	15-05-29	1530	$\varphi = 38^{\circ} N$		
	Algiers.....	15-05-54	1660	$\lambda = 21^{\circ} \cdot 5 E$		
	Wien.....	15-05-22	1130	O = 15-05-36		
	Coimbra.....	15-05-56	2480			
	Belgrade.....	15-05-57	430			
	Naples.....	15-06-17	440			
	Firenze.....	15-05-14	1270			
	Athens.....	15-06-04	500			
	Paris.....	15-05-10	2120			
	Besançon.....	(15-04-38)	(2000)			
1180 April 1	Strasbourg.....	(4-06-35)	(9780)	$\varphi = 2^{\circ} \cdot 5 N$	Batavia reports destructive quake at Tapanuli, Sumatra.	La Paz 15850
	Wien.....	4-06-41	9250	$\lambda = 98^{\circ} E$		Osaka 8200
	Algiers.....	4-06-57	9680	O = 4-06-58		Tokio 11120
	Hamburg.....	4-07-42	9020			Chicago (9560)
	De Bilt.....	(4-07-3)	(9400)			Zi-ka-wei 2690
	Uccle.....	4-06-55	9850			Melbourne 4340
	Batavia.....	4-06-29	1390			Athens 9780
	Manila.....	4-06-34	2820			Ebro 9440
	Naples.....	4-07-14	8800			
	Budapest.....	4-07-02	9230			
	Paris.....	4-07-14	9560			
1181 April 1	Osaka.....	12-00-41	5920	$\varphi = 12^{\circ} \cdot 5 S$		La Paz 11800
	Melbourne.....	(12-00-3)	3420	$\lambda = 162^{\circ} \cdot 5 E$		Tokio 3800
	Sydney.....	12-00-56	2590	O = 12-00-24		Chicago (8440)
	Apia.....	(11-59-40)	(3100)			Uccle 9210
						Ebro (8440)
1182 April 2	Strasbourg.....	9-36-51	9800	$\varphi = 25^{\circ} N$	Tokio gives Ishigaki I.	La Paz 15900
	Osaka.....	9-35-42	2410	$\lambda = 125^{\circ} E$		Coimbra 8800
	Wien.....	9-37-02	9120	O = 9-37-03		Chicago (4040)
	Marseilles.....	(9-37-47)	(9200)			Belgrade 3230
	Algiers.....	9-36-53	10140			Melbourne 6220
	Hamburg.....	9-36-53	9370			Naples 8480
	Tokio.....	9-37-59	1390			Ebro (9660)
	De Bilt.....	9-37-40	9060			Barcelona (7300)
	Zi-ka-wei.....	9-36-31	1080			
	Uccle.....	9-37-11	9420			
	Lemberg.....	9-36-8	8800			
	Sydney.....	9-36-45	7040			
	Batavia.....	9-36-50	3620			
	Manila.....	9-36-32	1150			
	Budapest.....	9-37-09	9280			
	Paris.....	9-37-27	9380			
Besançon.....	(9-37-54)	(9350)				

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Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1183 April 5	No Location					No data.
1184 April 10	Ottawa..... Strasbourg..... Algiers..... Georgetown..... De Bilt..... Chicago..... Uccle..... La Paz..... Ebro..... Paris.....	13-40-05 13-40-02 13-40-26 (13-38-39) 13-40-08 13-39-08 13-40-10 13-40-38 13-40-15 13-40-08	4100 8400 9230 (5040) 7900 4400 7960 9680 8780 8150	$\varphi = 50^{\circ}.5$ N $\lambda = 131^{\circ}.5$ W O = 13-40-00	La Paz gives $\varphi = 49^{\circ}.5$ N $\lambda = 130^{\circ}$ W Victoria reports quake felt at northern part of Queen Charlotte islands.	St. Louis (830)
1185 April 10	No Location					No data.
1186 April 12	De Bilt..... Paris.....	(7-29-24) 7-29-25	(7650) 7950	$\varphi = 52^{\circ}$ N $\lambda = 133^{\circ}.5$ W O = 7-29-25 Location approximate only	Victoria reports quake near Queen Charlotte islands.	St. Louis 710
1187 April 20	No Location					Uccle 4650 La Paz 5750
1188 April 22	No Location					La Paz 9380 Melbourne 4560 Sydney 2920 Ebro (8800) Paris 15000+
1189 April 25	No Location					Strasbourg 7380 Belgrade 890 Melbourne 2300 Perth 4450 Sydney 2820
1190 April 27	No Location					No data.

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Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1191 May 1	Ottawa.....	5-38-43	3980	$\varphi = 20^\circ \text{ N}$ $\lambda = 102^\circ \text{ W}$ $O = 5-39-10$	La Paz gives $\varphi = 20^\circ.5 \text{ N}$ $\lambda = 102^\circ \text{ W}$	
	Saskatoon.....	(5-38-40)	3740			
	Halifax.....	(5-38-43)	4750			
	Chicago.....	5-38-37	3140			
	La Paz.....	5-38-54	5650			
	St. Louis.....	5-38-55	2620			
	Strasbourg.....	(5-39-40)	(9230)			
	Hamburg.....	(5-39-21)	(9480)			
	Tucson.....	5-39-10	1620			
	Wien.....	5-39-46	9600			
	Coimbra.....	5-38-54	9480			
	Algiers.....	5-39-36	9500			
	De Bilt.....	(5-39-23)	(9420)			
	Georgetown.....	5-40-38	2820			
	Ithaca.....	5-40-39	2780			
	Washington.....	5-39-51	3070			
	Uccle.....	5-39-12	9510			
Stonyhurst.....	5-38-6	9900				
Ebro.....	5-39-26	9400				
Barcelona.....	5-39-22	9480				
Paris.....	5-39-23	9320				
1192 May 12	Honolulu.....	3-40-17	5950	$\varphi = 7^\circ.5 \text{ S}$ $\lambda = 155^\circ \text{ E}$ $O = 3-40-17$		Victoria 4660
	Perth.....	3-40-09	4880			
	Sydney.....	3-40-15	2960			
	Wellington.....	3-40-26	4220			
1193 May 14	Perth.....	11-25-16	1950	$\varphi = 24^\circ.5 \text{ S}$ $\lambda = 97^\circ.5 \text{ E}$ $O = 11-17 \text{ ca.}$ Location and O doubtful.		La Paz (9520) Paris 11000
	Sydney.....	11-17-29	5250			
	Batavia.....	11-15-53	2260			
1194 May 14	Honolulu.....	20-17-42	6110	$\varphi = 7^\circ.5 \text{ S}$ $\lambda = 154^\circ \text{ E}$ $O = 20-18-0$ Location doubtful.		Algiers (10020) Perth 6710 La Paz 12350 Paris 13500
	Sydney.....	20-18-20	2960			
1195 May 14	No Location					No data.
1196 May 14	Cheltenham.....	22-10-28	3100	$\varphi = 20^\circ.5 \text{ N}$ $\lambda = 101^\circ.5 \text{ W}$ $O = 22-09-50$		
	Chicago.....	22-09-32	2800			
	La Paz.....	22-09-34	5530			
1197 May 16	No Location					La Paz 580 Sydney 2850

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Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1198 May 20	Strasbourg.....	0-43-15	4830	$\varphi = 37^\circ \text{ N}$	De Bilt gives $\varphi = 37^\circ.9 \text{ N}$ $\lambda = 67^\circ.4 \text{ E}$ Uccle gives $\varphi = 37^\circ.5 \text{ N}$ $\lambda = 67^\circ.3 \text{ E}$ Naples gives South Turkestan	Chicago 9000
	Coimbra.....	0-43-19	6370	$\lambda = 66^\circ.5 \text{ E}$		Wien (950)
	Algiers.....	0-43-14	5560	O = 0-43-12		Stonhyurst 3250
	Dyce.....	0-43-12	5380			La Paz (12300)
	De Bilt.....	0-43-14	4980			Batavia (5100)
	Uccle.....	0-43-12	5070			
	Athens.....	0-43-18	3720			
	Ebro.....	0-43-16	5600			
	Naples.....	0-43-17	4400			
	Budapest.....	0-42-40	3960			
	Barcelona.....	0-43-18	5440			
	Paris.....	0-43-13	5240			
	Besançon.....	(0-43-03)	(5150)			
1199 May 21	Strasbourg.....	8-43-12	9450	$\varphi = 14^\circ.5 \text{ N}$	Tokio and De Bilt give off east coast of Manira I. Manila reports quake northeast of Samar I.	Coimbra 10680
	Osaka.....	8-42-13	2520	$\lambda = 121^\circ.5 \text{ E}$		Chicago 8420
	Hamburg.....	8-42-54	9500	O = 8-42-29 ca.		Uccle (5850)
	Honolulu.....	8-42-25	8100	Location approximate.		Naples 2270
	Tokio.....	8-41-16	3550			
	Zi-ka-wei.....	8-42-16	2010			
	Wien.....	8-43-16	8940			
	Lemberg.....	8-42-6	9280			
	La Paz.....		18000			
	De Bilt.....	8-43-4	9380			
	Melbourne.....	8-41-8	6220			
	Sydney.....	8-41-44	6050			
	Budapest.....	8-42-46	9250			
1200 May 21	No Location					Uccle 2680 Paris (2180)
1201 May 21	Strasbourg.....	(22-26-04)	(8640)	$\varphi = 47^\circ.5 \text{ N}$	Tokio and De Bilt report quake in Kurile Is.	Victoria (4660)
	Osaka.....	22-25-35	2440	$\lambda = 155^\circ.5 \text{ E}$		Honolulu 2150
	Hamburg.....	22-25-51	8360	O = 22-25-51		Coimbra 12400
	Tokio.....	22-25-54	1950			Belgrade (7650)
	Zi-ka-wei.....	22-26-02	3200			
	Chicago.....	22-25-46	8250			
	Lemberg.....	22-25-7	8320			
	Wien.....	22-25-47	8800			
	Uccle.....	22-25-53	8720			
	De Bilt.....	22-25-53	8580			
	Batavia.....	22-25-57	7820			
	Budapest.....	22-25-21	9080			
	Paris.....	22-25-59	8880			
Ebro.....	22-26-06	9440				
1202 May 28	St. Louis.....	20-53-43	3150	$\varphi = 51^\circ \text{ N}$	Victoria reports quake felt at Estevan, Nootka and Quatsino.	
	Victoria.....		300	$\lambda = 126^\circ \text{ W}$		
	Chicago.....	20-54-14	2920	O = 20-53-58		

LOCATION OF EPICENTRES, 1921

Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1203 June 4	No Location					No data.
1204 June 15	No Location					No data.
1205 June 17	No Location					Tucson 360
1206 June 17	No Location					No data.
1207 June 25	No Location					Chicago 3580 Honolulu 2160 Victoria 840
1208 June 28	Victoria..... Chicago..... Algiers..... Coimbra..... Perth..... Sydney..... Batavia.....	14-06-13. 14-06-39 (14-07-07) 14-07-30 13-59-06 13-58-39 13-58-53	6860 8740 (8480) 9900 5100 2340 7650	$\phi = 46^\circ$ N $\lambda = 141^\circ.5$ E O = 14-06-50 Location and O approximate. $\phi = 40^\circ$ S $\lambda = 176^\circ$ E O = 13-58-52	Sydney reports quake felt in New Zealand at Hawkes Bay. $\phi = 39^\circ.8$ S $\lambda = 177^\circ.4$ E	Ebro (10700) Naples 4220 Melbourne (3070) La Paz 9340 Manila 3810
1209 June 30	Ottawa..... Strasbourg..... Toronto..... Chicago..... Uccle..... De Bilt..... Coimbra..... Paris..... Besançon..... Ebro.....	2-10-08 (2-09-58) 2-09-51 (2-10-22) 2-10-01 2-10-09 2-10-10 2-10-01 2-10-21 2-10-15	3190 (2970) 3070 (4020) 2580 2540 2660 2640 2800 2960	$\phi = 57^\circ$ N $\lambda = 35^\circ$ W O = 2-10-08	De Bilt reports quake in north Atlantic.	Wien (2620)
1210 July 4	Strasbourg..... Wien..... Sydney..... Zi-ka-wei..... De Bilt..... Tokio..... Manila..... Batavia..... Budapest.....	(14-19-11) 14-19-42 14-18-06 14-18-14 (14-18-18) 14-18-16 14-19-08 14-17-48 14-18-00	(9050) 8550 6460 1940 (9510) 1030 1780 4740 9350	$\phi = 30^\circ$ N $\lambda = 127^\circ$ E O = 14-18-30 Location and O approximate only.	De Bilt gives Pacific ocean near Japan. Tokio reports quake near Vladivostok and felt at Hakodate, Fukusima and Mito. Manila reports quake felt at West Luzon.	Chicago 5780 Belgrade 1420 Coimbra 12580

LOCATION OF EPICENTRES, 1921

Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1211 July 7	No Location					Honolulu 1320 La Paz 3500 Melbourne 3420 Uccle (8800) Sydney 2750 Paris 11650
1212 July 8	No Location					Chicago (2560) La Paz (7400)
1213 July 9	No Location					No data.
1214 July 10	No Location					No data.
1215 July 12	No Location					No data.
1216 July 13	Uccle..... Coimbra..... La Paz.....	10-16-0 10-18-53 (10-18-11)	9900 9150 (4580)	$\varphi = 11^{\circ} 5' N$ $\lambda = 99^{\circ} W$ O = (10-18-30)		Chicago (3880)
1217 July 24	No Location				Manila reports quake felt at SE. Luzon and NE. Samar.	Ottawa (3700) Zi-ka-wei 2035
1218 July 25	No Location					Manila 1550 Zi-ka-wei 810
1219 July 25	No Location					No data.
1220 July 31	No Location					Victoria 4660 Honolulu 2590 Sydney 2620
1221 Aug. 14	Rocca di Papa... Strasbourg..... Algiers..... Uccle..... Wien..... Hamburg..... De Bilt..... Coimbra..... Belgrade..... Paris..... Besançon..... La Paz.....	13-15-18 13-15-24 13-15-25 13-15-23 13-15-19 13-15-18 13-15-29 13-14-43 13-14-26 13-15-21 13-15-26	3910 4620 4260 5000 4220 5000 4980 5480 3820 5050 4650 (12300)	$\varphi = 15^{\circ} N$ $\lambda = 39^{\circ} E$ O = 13-15-14	"Nature" of Aug. 25, 1921, and Strasbourg report quake in Eritrea, Abyssinia.	Stonyhurst 3520

LOCATION OF EPICENTRES, 1921

Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1222 Aug. 16	No Location					No data.
1223 Aug. 17	No Location					La Paz (3140)
1224 Aug. 19	No Location					Chicago 1190
1225 Aug. 21	No Location					Uccle 5400
1226 Aug. 23	Ottawa..... Rocca di Papa... Strasbourg..... Toronto Algiers..... Marseilles..... Georgetown..... Washington..... Uccle..... Chicago..... Wien..... Hamburg..... De Bilt..... Dyce..... Coimbra..... Belgrade..... Paris..... Besançon.....	20-17-29 20-18-09 20-17-13 (20-17-30) 20-17-22 20-17-34 (20-17-14) (20-17-09) 20-17-21 20-17-45 20-17-17 20-17-33 20-17-16 20-17-17 20-16-45 3380 20-17-15 20-17-16	3910 2770 2620 (3600) 3520 2920 (4800) (4520) 2230 4370 2900 2090 2200 1430 3230 3380 2390 2690	$\varphi = 66^\circ \text{ N}$ $\lambda = 22^\circ \text{ W}$ O = 20-17-23	Uccle gives $\varphi = 65^\circ.6 \text{ N}$ $\lambda = 22^\circ.1 \text{ W}$ De Bilt and Coimbra report quake at or near Iceland.	Honolulu 6320
1227 Aug. 25	No Location					No data.
1228 Aug. 25	No Location				Manila reports quake felt at SE. Luzon.	No data.
1229 Aug. 27	No Location				Felt at Arnprior, Hawkesbury, Cornwall, Ontario; and at Montreal, Vaudreuil, Ste. Anne de Bellevue, Lachine, Joliette, Cartierville, Sorel, St. Jérôme, Ste. Thérèse, St. Faustin, St. Jovite, Labelle and Lac Supérieur, Quebec province.	Ottawa 220

LOCATION OF EPICENTRES, 1921

Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1230 Aug. 29	No Location					Chicago 315
1231 Sept. 5	Strasbourg..... Osaka..... Pola..... Uccle..... Wien..... Sydney..... Zi-ka-wei..... Washington..... Chicago..... Hamburg..... De Bilt..... Belgrade..... Batavia..... Budapest..... Barcelona..... Coimbra..... Paris..... La Paz..... Besançon.....	19-56-49 19-56-37 19-57-06 19-57-14 (19-57-48) (19-57-53) 19-56-50 19-57-03 19-56-07 19-57-01 19-57-05 19-56-57 19-56-52 (19-56-45) (9720) 19-57-46 19-57-15 19-56-58	9120 2140 9020 8520 (7720) (8500) 3070 9230 9500 8320 8520 8800 7450 (8680) (9720) 9320 8780 (14400) 9150	$\varphi = 46^{\circ}.5$ N $\lambda = 152^{\circ}.5$ E O = 19-57-04	De Bilt gives Kurile Is.	Honolulu 9560 Manila 2620
1232 Sept. 8	No Location					Victoria (650) Tucson 330 Chicago 2690
1233 Sept. 11	Lemberg..... Honolulu..... Osaka..... Pola..... Wien..... Sydney..... Zi-ka-wei..... Batavia..... Coimbra.....	4-02-6 4-02-02 4-01-55 4-02-44 4-02-24 4-01-28 4-02-40 (4-01-36) 4-01-32	9520 9980 5380 10050 9980 4680 3780 (750) 13200	$\varphi = 1^{\circ}$ S $\lambda = 108^{\circ}.5$ E O = 4-02-06 Location Rough approximation only.	Sydney gives $\varphi = 13^{\circ}$ S $\lambda = 111^{\circ}$ E Batavia gives $\varphi = 11^{\circ}$ S $\lambda = 111^{\circ}$ E Felt all over islands of Java, Madura, Bali and Lombok.	Ottawa (12340) Fordham 2480 Chicago 12460 St. Louis (3520) Victoria (4650) Marseilles (9650) Strasbourg (10260) Algiers 10140 Georgetown(10140) Dyce 4450 Rio de Janeiro 6000 Manila 3650 Belgrade 2480 Athens 11080 Budapest 8080 Barcelona 10140 Paris (9550) Naples 2560 La Paz 17500

LOCATION OF EPICENTRES, 1921

Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1234 Sept. 13	Ottawa.....	2-48-00	4370	$\varphi = 54^\circ$ N $\lambda = 165^\circ$ W O = (2-45) Location and O only rough approximation.	Sydney gives Aleutian Is.	La Paz 5450
	Chicago.....	2-47-58	4320			Batavia (4150)
	Algiers.....	2-37-47	9480			Athens (4980)
	Pola.....	2-50-41	7850			Wien (11740)
	Sydney.....	2-37-38	9250			Rio de Janeiro 3150
	Hamburg.....	2-44-31	8500			
	Belgrade.....	2-44-28	7950			
Coimbra.....		(9500)				
1235 Sept. 19	No Location				De Bilt gives a doubtful location of N. Pacific ocean	No data.
1236 Sept. 19	Strasbourg.....		14200	$\varphi = 2^\circ$ N $\lambda = 159^\circ.5$ E O = (23-16.3) Location and O approximate only.	De Bilt gives origin as S. Pacific ocean.	Victoria 6860
	Honolulu.....	23-16-34	5050			Toronto (8080)
	Sydney.....	23-14-28	4060			Wien (7340)
	La Paz.....	23-17-53	14800			Chicago 7320 Belgrade 2010 Perth 6580
1237 Sept. 20	No Location					Belgrade 910
1238 Sept. 21	Strasbourg.....	11-01-41	4420	$\varphi = 15^\circ.5$ N $\lambda = 39^\circ$ E O = 11-01-27	Hamburg reports quake felt in Eritrea, Abyssinia.	
	Algiers.....	11-01-26	4300			
	Wien.....	(11-01-05)	(4480)			
	Hamburg.....	11-01-36	4860			
	Belgrade.....		3170			
1239 Oct. 1	No Location				De Bilt gives Central America (?)	La Paz 2930
1240 Oct. 15	Osaka.....	4-58-17	6300	$\varphi = 12^\circ$ S $\lambda = 167^\circ.5$ E O = 4-57-55	Sydney gives $\varphi = 11^\circ$ S $\lambda = 165^\circ$ E Near Solomon Is.	Ottawa (11000)
	Sydney.....	4-57-42	2920			
	Zi-ka-wei.....	4-58-17	6820			
	Batavia.....	4-57-22	7520			
	Wien.....	5-05-16	9060	$\varphi = 51^\circ$ N $\lambda = 160^\circ.5$ W O = 5-05-17		Toronto 7250
	Victoria.....	5-05-04	2760		Georgetown (6450)	
	Algiers.....	5-05-00	9940		Honolulu 2610	
	Chicago.....				Chicago 8200	
	Coimbra.....	5-05-49	9350		La Paz 10050	

LOCATION OF EPICENTRES, 1921.

Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1241 Oct. 20	Ottawa.....	(6-03-15)	(7140)	$\varphi = 19^\circ \text{ S}$ $\lambda = 70^\circ \cdot 5 \text{ W}$ O = 6-03-27	La Paz and De Bilt report quake at Iquique, Chile.	Chicago (6280)
	Algiers.....	6-03-35	9230			Strasbourg 9250
	Georgetown.....	6-03-13	6400			Victoria 2035
	Tucson.....	6-03-44	6700			Pola 9650
	Porto Rico.....	6-03-41	3720			Wien 5220
	Cheltenham.....	6-03-32	6240			Sydney 8320
	Washington.....	6-03-11	6450			Firenze 8700
	Balboa.....	6-02-59	3240			Stonyhurst 2220
	Barcelona.....	6-03-56	9060			Hamburg (9320)
	Coimbra.....	6-03-13	8950			Belgrade 6950
La Paz.....	6-03-33	315	Budapest 4740			
						Paris 8620
						Naples 6640
						Besançon (8700)
1242 Nov. 2	Chicago.....	3-37-31	3110	$\varphi = 15^\circ \text{ N}$ $\lambda = 115^\circ \text{ W}$ O = 3-37-36		
	Tucson.....	3-37-58	2160			
	La Paz.....	3-37-20	5580			
1243 Nov. 2	No Location				La Paz reports quake felt at Lima, Peru.	La Paz 1000 Chicago 5420
1244 Nov. 6	No Location					No data.
1245 Nov. 7	Honolulu.....	16-00-20	7820	$\varphi = 7^\circ \text{ N}$ $\lambda = 128^\circ \cdot 5 \text{ E}$ O = 15-59-45	Manila gives SE. of Mindanao.	Victoria 6320
	Zi-ka-wei.....	15-59-59	2590			Strasbourg (12820)
	Batavia.....	15-59-40	2640			Pola (10050)
	Manila.....	15-59-04	1390			Dyce 6450
						Perth 6150
						Belgrade 7900
						Paris (5800)
1246 Nov. 11	No Location					Chicago 6450
1247 Nov. 11	Strasbourg.....	18-36-10	11380	$\varphi = 5^\circ \cdot 5 \text{ N}$ $\lambda = 124^\circ \text{ E}$ O = 18-36-27	Manila gives SE. of Mindanao. Batavia gives Menado; tide waves at Great Sangi island.	Ottawa (8800)
	Wien.....	18-36-24	10450			St. Louis (1810)
	Osaka.....	18-35-38	3500			Toronto (7960)
	Pola.....	18-37-14	9880			Chicago 8450
	Honolulu.....	18-35-50	8500			Algiers 10180
	Lemberg.....	18-37-21	9650			Dyce 4400
	Zi-ka-wei.....	18-35-52	2750			Hamburg 9650
	Batavia.....	(18-36-56)	(2340)			Perth 2600
	Belgrade.....	18-37-12	9580			Athens 8920
	Budapest.....	18-37-03	9340			Barcelona 8260
	Manila.....	(18-35-17)	(1520)			Coimbra 8500
	Paris.....		12000			De Bilt (9600)
						Besançon (9060)
						Naples (7600)
1248 Nov. 13	Washington.....	8-39-25	4000	$\varphi = 4^\circ \text{ N}$ $\lambda = 88^\circ \text{ W}$ O = 8-40-0	De Bilt gives Nicaragua (?)	St. Louis 2900
	Chicago.....	8-39-22	4140			Strasbourg (330)
	Balboa.....	8-41-01	880			Cheltenham 2680
	La Paz.....	8-40-27	3190			

LOCATION OF EPICENTRES, 1921

Date	Station	O	Δ	Epicentre	Other Locations	Other Data
1249 Nov. 15	Strasbourg.....	20-36-28	4880	$\varphi = 40^\circ \text{ N}$ $\lambda = 68^\circ \cdot 5 \text{ E}$ $O = 20-36-36$	Strasbourg gives region of Samarkanda. De Bilt gives South Turkestan.	St. Louis 6110 Victoria (7450) Osaka 6900 Tucson (3180) Honolulu 8880 Washington 7950 Zi-ka-wei 3810
	Algiers.....	20-36-34	5530			
	Pola.....	20-36-45	4370			
	Marseilles.....	20-36-44	5120			
	Firenze.....	20-36-33	4600			
	Hamburg.....	20-36-33	4620			
	Lemberg.....	20-36-33	3590			
	Belgrade.....	20-36-35	3900			
	Göttingen.....	20-36-34	4600			
	Höhenheim.....	20-36-39	4660			
	Königsberg.....	20-36-41	3810			
	München.....	20-36-32	4560			
	Barcelona.....	20-36-37	5440			
	Coimbra.....	20-36-26	6480			
	Paris.....	20-36-37	5160			
	Naples.....	29-36-47	4480			
	Besançon.....	20-36-33	4980			
	De Bilt.....	20-36-31	4980			
	Ottawa.....	20-37-17	9010	$\varphi = 50^\circ \text{ N}$ $\lambda = 74^\circ \text{ E}$	N.B.—Ottawa record has well-defined phases, so there can be no doubt of the values of O and Δ . Taking Ottawa, Chicago, Ithaca and Georgetown in con- junction with all the eastern stations listed on the left, the second location was determined.	
		Chicago.....	20-37-45			
Ithaca.....		20-37-1	9250			
Georgetown.....		20-37-44	9060			
1250 Dec. 18	Ottawa.....	15-29-27	4620	$\varphi = 5^\circ \text{ N}$ $\lambda = 67^\circ \cdot 5 \text{ W}$ $O = 15-29-26$		St. Louis (1780) Victoria 1710 Pola 8250 Porto Rico 2140 Rio de Janeiro 2900 Stonyhurst 2010 La Paz 1170 Honolulu 8280 Batavia 7600 Belgrade 8280 Manila 8200 Naples (10740)
	Strasbourg.....	15-29-21	8480			
	Fordham.....	15-29-28	4060			
	Toronto.....	15-29-20	5000			
	Dyce.....	15-29-33	8000			
	Georgetown.....	15-29-33	3850			
	Firenze.....	15-29-38	8420			
	Cheltenham.....	15-29-45	3720			
	Tucson.....	15-29-07	5050			
	Sitka.....	15-29-39	7680			
	Algiers.....	15-29-19	8000			
	Ithaca.....	15-29-47	4200			
	Marseilles.....	15-29-28	8200			
	Hamburg.....	15-29-38	8360			
	Washington.....	15-29-45	3720			
	Chicago.....	15-28-17	4450			
	Balboa.....	15-29-35	1430			
	Northfield.....	15-29-14	4600			
	Barcelona.....	15-29-21	8000			
	Coimbra.....	15-29-20	7220			
	Paris.....	15-29-21	8150			
	De Bilt.....	(15-29-33)	(8280)			
	Besançon.....	15-29-33	8160			