DEEP-FOCUS EARTHQUAKES IN THE MEDITERRANEAN REGION

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Summary — In Table I the authors give a list of known deep-focus earthquakes in the eastern Mediterranean. Fig. 1 shows that their epicenters generally lie in the zones of active volcanoes, as in the regions surrounding the Pacific Ocean; however, their coincidence with positive gravity anomalies is less evident.

Zusammenfassung — In Tabelle I geben die Verf. eine Liste der ihnen bekannten Tiefenbeben im östlichen Mittelmeer. Fig. 1 zeigt, dass deren Herde im Allgemeinen in den Zonen der tätigen Vulkane liegen, ähnlich wie in der Umgebung des Pazifischen Ozeans. Dagegen ist deren Zusammenfallen mit positiven Schweranomalien weniger deutlich.

Riassunto — Gli AA. hanno raccolto nella Tab. I l'elenco dei terremoti profondi a loro noti del bacino mediterraneo orientale. La Fig. 1 mostra che in generale gli epicentri relativi sono distribuiti nelle zone dei vulcani attivi, analogamente a quanto accade nelle regioni dell'Oceano Pacifico. Per contro, la connessione con le anomalie gravimetriche positive risulta meno evidente.

Certain of the larger earthquakes in the Levant are so abnormal in their effects that these were noticed and correctly interpreted by JULIUS SCHMIDT as early as 1881. He concluded that these shocks must have a focal depth greater than that of ordinary earthquakes, and associated their occurrence in this region with the volcanic activity of Santorin and the Cyclades. Some of these intermediate shocks are the largest earthquakes in Europe. That of Aug. 11, 1903, in southern Greece was an intermediate shock of magnitude about 8. A very large shock of this group (magnitude 7.9) occurred in 1926. It was investigated on the ground by SIEBERG, who published a special study of the group (SIEBERG, 1932), which he termed *Levantinische Riesenbeben*; he did not consider the possibility of intermediate focal depth, but attempted an explanation in terms

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Fig. 1

of abnormal conduction of seismic energy along extended hypothetical lines of faulting. SIEBERG's figures show the enormous shaken area of some of these shocks, several of which were felt in Egypt, Cyrenaica, Asia Minor and far up the Adriatic.

Shocks at intermediate depth from 1903 to the present have now been

TABLE I - Chronological list of deep-focus earthquakes in the Mediterranean region

Date	Time	Location	Depth in km	Magnitude
1908, May 1/	12 : 30.9	35 N. 24 E.	100 ±	6 3/4
1910, February 18	05 : 09.3	36 N. 24 1/2 E.	150 ±	7
1910, August 1	10 : 40.4	39 N. 15 E.	200 ±	6 1/2
1910, August 21	16 : 11.5	34 N. 27 E.	170 ±	6 1/2
1911, April 4	15 : 43.9	36 1/2 N. 25 1/2 E.	140 ±	7
1911, April 5	15 : 28.2	40 N. 15 1/2 E.	200 ±	5 3/4
1911, April 30	20 : 42.5	36 N. 30 E.	180	6 1/4
1915, July 7	16 : 42.9	40 N. 15 E.	300 ±	6
1918, July 16	20 : 03 : 46	35 1/2 N. 25 1/2 E.	150 ±	6 1/2
1923, August 1	08 : 16 : 38	35 N. 25 E.	150	6.7
1925, July 6	12 : 15 : 55	38 1/4 N. 21 3/4 E.	120	6 1/2
1926, June 26	19 : 46 : 34	36 1/2 N. 27 1/2 E.	100	7.9
1926, July 5	09 : 21 : 54	36 1/2 N. 27 E.	150 ±	5 1/2 ±
1926, August 30	11 : 38 : 12	36 3/4 N. 23 1/4 E.	100	7.0
1926, August 17	01 : 42 : 53	39 N. 14 3/4 E.	100 ±	5 3/4 ±
1926, September 19	01 : 03 : 57	36 N. 22 E.	80	6 1/4
1927, June 5	02 : 24 : 58	36 N. 31 E.	120	6 1/4
1927, July 1	08 : 19 : 04	36 3/4 N. 22 3/4 E.	120	6.9

Date	Time	Location	Depth in km	Magnitude
1928, March 7	10 : 55 : 12	38 3/4 N. 16 E.	120	6
1929, March 27	07 : 41 : 46	36 3/4 N. 26 1/2 E.	120 ±	5 3/4 ±
1930, February 14	18 : 38 : 20	35 3/4 N. 24 3/4 E.	130	6 3/4
1930, March 6	08 : 21 : 42	34 1/2 N. 26 E.	130	5 3/4
1930, March 6	09 : 18 : 32	35 N. 24 1/2 E.	100	6
1931, June 30	10 : 23 : 56	36 1/2 N. 23 E.	100 ±	5 1/2 ±
1932, August 15	04 : 34 : 40	39 1/4 N. 22 E.	100	5 1/2 ±
1933, July 19	20 : 07 : 08	38 1/4 N. 29 3/4 E.	100	6
1934, November 9	13 : 40 : 56	36 3/4 N. 25 3/4 E.	140	6 1/4
1935, February 25	02 : 51 : 37	35 3/4 N. 25 E.	80	6 3/4
1935, March 18	08 : 40 : 41	35 1/2 N. 27 E.	130	6 1/4
1936, April 28	23 : 15 : 26	36 3/4 N. 26 3/4 E.	170	5 3/4 ±
1937, December 16	17 : 35 : 30	35 N. 23 1/2 E.	100	6 1/2
1938, April 13	02 : 45 : 46	39.2 N. 15.2 E.	270	6 3/4
1938, June 3	16 : 58 : 03	34 1/2 N. 26 1/2 E.	120	5 3/4
1938, September 18	03 : 50 : 38	38 N. 22 1/2 E.	100	6 1/2
1939, September 20	00 : 19 : 31	38 N. 20 1/2 E.	80	6 1/2
1940, July 24	22 : 15 : 27	34 1/2 N. 34 E.	80	5 3/4 ±
1941, January 20	03 : 37 : 07	35 N. 34 E ± 2	100 ± 50	6 1/2
1941, March 16	16 : 35 : 15	38 1/2 N. 11 1/2 E.	100	6 1/2 ±
1941, March 16	18 : 48 : 21	38 1/2 N. 11 1/2 E.	100	5 3/4 ±
1941, December 13	06 : 16 : 05	37 N. 28 E.	100	6 ±
1942, May 9	04 : 37 : 07	35 1/2 N. 26 E.	100	5 3/4
1942, May 21	03 : 42 : 41	37 1/2 N. 20 1/2 E.	150	5 1/2 ±
1942, June 21	04 : 38 : 43	36 1/2 N. 27 E.	130	6 1/4
1943, January 7	11 : 14 : 45	38 1/2 N. 20 1/2 E.	100	5 1/2 ±
1943, June 27	10 : 05 : 37	35 N. 26 E.	100	5 3/4 ±
1943, September 17	03 : 39 : 20	39 1/2 N. 15 1/2 E.	270 ±	5 1/2 ±
1943, October 16	13 : 08 : 53	36 1/2 N. 27 1/2 E.	110	6 1/4 ±
1944, May 27	23 : 52 : 30	36 N. 27 1/2 E.	100	6 1/4 ±
1944, August 9	17 : 36 : 37	36 1/2 N. 27 1/2 E.	100	5 1/2 ±
1945, September 2	11 : 53 : 57	33 3/4 N. 28 1/2 E.	80	6 1/2 ±
1947, July 31	07 : 54 : 52	39 1/4 N. 15 1/4 E.	290	5 1/2 ±
1947, September 1	22 : 18 : 54	39 1/4 N. 15 1/4 E.	250 ±	5 1/2 ±

identified. These were previously frequently overlooked, as most of the stations are at such distances that the usual evidence of depth is not available. Investigation of amplitudes of *P*, *S*, and surface waves has discriminated many of these shocks from the shallow earthquakes of the region.

Off the west coast of Italy several shocks are now known at depths approaching 300 km, which makes them the deepest shocks identified outside the Pacific area. Shocks at depths of about 100 km off Sicily have been studied by DI FILIPPO (1941).

Table I is a chronological list of all deep-focus shocks in the region for which data available to the writers suffice to determine epicenter and depth. These are plotted as triangles on Figure 1, which also shows gravity anomalies and active volcanoes. As in most regions, the epicenters of

deepfocus earthquakes fall within the belts of contemporary volcanism, while shallow earthquakes (mapped as crosses and stars) generally fall outside these belts. Correlation of deep shocks and active volcanoes with positive gravity anomalies is much less definite than in the Pacific region.

Elsewhere in Europe deep shocks are known only in Rumania.

Further details, and correlation between seismicity and other phenomena for the world, will be found in a forthcoming publication (GUTENBERG and RICHTER, 1948) from which the material of the present article is taken.

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