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## REFERENCES

Abou Karaki, N. (1994). Reevaluating the seismicity of the Jordan Dead Sea Transform, paper presented to the 5<sup>th</sup> Jordanian Geological Conference, Amman, Jordan.

Abou Karaki, N. (1987). Synthese et carte seismotectonique des pays de la bordure orientate de la Mediterranee: Sismicite du system de failles du Jourdain-MerMorte. Ph.D. Thesis , IPGS, Univ. Strasborg I. (In French).

Abou Karaki, N. (2001). The Gulf of Aqaba earthquake activity of 1995: Geodynamic context, analysis of the location of the main event ( $M_w = 7.2$ ). *Dirasat*, **28** (1), 115-132 (In Arabic).

Al-Amri, A. M., Necioglu, A. and Mokhtar, T. (1996). An investigation of crustal and upper mantle structure beneath the Riyadh region from spectral analysis of long period P-wave amplitude ratios, Final project no. 13-46. King Abdul Aziz City for science and Technology.

Al-Qaryouti, M. (2002). Earthquake strong motion data analysis of the Gulf of Aqaba activity for 1993-2001 and engineering seismology implications in Aqaba area, Jordan. Ph.D thesis, University of Jordan.

Al-Sa'adani, A. (Edit) (1971). *As-Soyuti, Galal-Aldin: Kashf as Salsalah an'wast azzalalah*. Ministry of Cultural and Educational Affairs. Morocco. In Arabic.

Al-Tarazi, E. (1992). Investigation and Assessment of seismic hazard in Jordan and its vicinity. Ph.D Thesis, Ruhr-University. Bochum, Germany.

Al-Tarazi, E. (2000). The major Gulf of Aqaba earthquake, 22-November 1995. Maximum intensity distribution. *Nat. Hazards*, **22**, 17-27.

Al-Zoubi, A. and Ben-Avraham, Z. (2002). Structure of the Earth's crust in Jordan from potential field data. *Tectonophysics*, **346**, 45-59.

Ambraseys, N, Melville, R. and Adams, R. (1994). The seismicity of Egypt, Arabia and the Red Sea. A historical Review. Cambridge Univ. Press. 181 pp.

Amiran, D. H. K., Arieh, E. and Turcotte, T. (1994). Earthquake in Israel and adjacent areas: macroseismic observation since 100 B.C.E., *Israel Explor. J.* **44**, 260-305.

Ammon, C. J. (1991). The isolation of receiver effects from teleseismic P waveforms, *Bull. Seism. Soc. Am.* **81**, 2504-2510.

Arieh, E. Artzi, D. Benedik, N., Shapira, A. Issakow, R. and Reich, B. Revised and updated catalog of earthquakes in Israel and adjacent areas, 1900-1980. Inst. Petrol. Res. Geophys. Holon.

Barazangi, M. (1983). A summary of the seismotectonics of the Arab region. In: K. Cidlinsky and M. Rouhban (Edits), A ssesment and mitigation of earthquake risk in the Arab region. UNESCO.

Barberi, F., Ferrara, C., Santa Croce, R. and Varet, J. (1975). Structural evolution of the Afar triple junction, in Pilger, A. and Rosler, A. (Edits) Afar depression of Ethiopia, Schweitzerbart, Stuttgart, 1, 38-54.

Bartov, Y., Avni, Y., Calvo, R. and Frieslandar, U. (1998). The Zofar Fault – A major intra-rift feature in the Arava rift valley, *Geological Society of Israel, current research*, **11**, 27-32.

Bartov, Y. Steinitz, G. Eyal, M. and Eyal, Y. (1980). Sinistral movement along the Gulf of Aqaba, its age and relation to the opening of the Red Sea. *Nature*, **285**, 220-222.

Ben-Avraham, Z, Garfunkel, A., Makris, J. and Eppelbaum, L. (2002). Crustal structure of the Levant basin, eastern Mediterranean, *Tectonophysics*, **346**, 23-43.

Bender, F. (1974). *Geology of Jordan*. (Borntraeger, Berlin).

Bender, F. (1975). *Geology of the Arabian Peninsula, Jordan*.

Ben-Menahem, A. (1991). Four thousands years of seismicity along the Dead Sea Rift. *J. Geophys. Res.* **96**, 20,195-20,216.

Ben-Menahem, A. Nur, A. and Vered, M. (1976). Tectonics seismicity and structure of the Afro-Eurasian-Junction the breaking of an incoherent. Plate. *Phys. Earth Planet. Int.* **12**, 1-50.

Blanchenhorn, M. (1896). *Entstehung and Geschichte des Toten Meeres-Zeitschr. Deutsch. Palestina Vereins la, Leipzig*.

Blank, H. R. (1977). Aeromagnetic and geology study of the Tertiary dikes and related structures on the Arabian margin of Red Sea. *Saudi Arabian Dir. Gen. Miner. Resources. Bull.* **22**, G1-G18.

Bostock, M. G. (1996a). Ps conversions from the upper mantle transition zone beneath the Canadian landmass. *J. Geophys. Res.* **101**, 8393-9402.

Bostock, M. G. (1996b). A seismic image of the upper mantle beneath the north American craton. *Geophys. Res. Lett.* **23**, 1593-1596.

Bostock, M. G. (1997). Anisotropic upper mantle stratigraphy and architecture of the Slave craton. *Nature* **390**, 392-395.

Burdick, L. J. and Langston, C. A. (1977). Modeling crust-structure through the use of converted phases in teleseismic body-waveforms. *Bull. Seism. Soc. Am.* **67**, 677-691.

Choubert, G. (1968). International Geological Map of Africa, 1:5,000,000. UNESCO. Paris.

Civetta, L., La Volpe, L. and Liber, L. (1978). K-Ar ages of the Yemen Plateau. *J. Volcanol. Geotherm. Res.*, **4**, 307-314.

Clayton, R. W. and Wiggins, R. A. (1976). Source shape estimation and deconvolution of teleseismic body waves. *Geophys. J. R. Astr. Soc.* **47**, 151-177.

Coleman, R. G., Fleck, R. J., Hedge, C. E. and Ghent, E. D. (1977). The volcanic rocks of the south west Saudi Arabia and the opening of the Red Sea. *Saudi Arabia, Dir. Gen. Miner. Resour., Bull.*, **22**, D1-D30.

DESERT Group. (2003). The crustal structure of the Dead Sea Transform. *Geophys. J. Int.* submitted.

DESERT Team (2000). Multinational geoscientific effort kicks off in the Middle East, *EOS*, **81**, 609, 616-617.

Dueker, K. G. and Sheehan, A. F. (1998). Mantle discontinuity structure beneath the Colorado Rocky Mountains and High Plains. *J. Geophys. Res.* **103**, 7153-7169.

El-Isa, Z. H., Mechie, J., and Prodehl, C. (1987b). Shear velocity structure of Jordan from explosion seismic data. *Geophys. J. R. Astr. Soc.* **90**, 265-281.

El-Isa, Z. H., Mechie, J., Prodehl, C., Makris, J. and Khim, R. (1987a). A crustal structure study of Jordan derived from seismic refraction data. *Tectonophysics.* **138**, 235-253.

El-Isa, Z. H., Merghelani, M. and Barazangi, M. (1984). The Gulf of Aqaba swarms of 1983 January-April. *Geophys. J. R. Astr. Soc.* **90**, 265-281.

El-Isa, Z. H. (1981). Earthquakes studies of some archeological sites in Jordan, Oxford. *Conf. On Archeology of Jordan*. V.2, 5381-5388.

El-Isa, Z. H. (1983). The Jordan University Seismological Station (UNJ). In: Abed, A. and Khalid, H. (Edits). *Geology of Jordan and adjacent areas*. Jord. Geol. Assoc., Amman, 542-564.

El-Isa, Z. H. (1990). Lithospheric structure of the Jordan Dead Sea Transform from earthquake data. *Tectonophysics*. **180**, 29-36.

El-Isa, Z. H. (1992). Seismicity of Wadi Araba-Dead Sea region. *Proc. 1<sup>st</sup> Arab. Geol. Conf. Ja.*, Cairo University.

El-Isa, Z. H. and Hasweh, N. K (1988). Seismicity of the southern Jordan-Dead Sea Transform. In: A. Al-Far'aa (Edit), *Proc. 3<sup>rd</sup>. Arab Symp. On Earthq. Seismo.*, 8-10 March, King Saud University, Riyadh, pp. 47-85.

Freund, R. Garfunkel, Z. Zak, I, Goldberg, M. Derin, B. and Weissbrod, T. (1970). The shear along the Dead Sea Rift. *Philos. Trans. R. Soc. London. Ser. A.*, **267**, 107-130.

Gao, S. S., Silver, P. G., Liu, K. H., and the Kaapvaal Seismic Group. (2002). Mantle discontinuities beneath southern Africa. *Geophys. Res. Lett.*, 10.1029/2001GL013834, May 31.

Garfunkel, Z. (1981). Internal structure of the Dead Sea Leaky Transform (rift) in relation to plate Kinematics. In R. Freund and Z. Garfunkel (Edits). *The Dead Sea rift*. *Tectonophysics*, **80**, 81-108.

Garfunkel, Z. Zakm I. And Freund, R. (1981). Active faulting along the Dead Sea Rift. In: R. Freund and Z. Garfunkel (Edits). The Dead Sea Rift. Tectonophysics, **80**, 1-26.

Gilber, H. J., Sheehan, A. F., Wiens, D. A., Dueker, K. G., Dorman, L. M., Hildebrand, J. and Webb, S. (2001). Upper mantle discontinuity structure in the region of the Tonga Subduction Zone. Geophys. Res. Lett. **28**, 1855-1858.

Ginat, H., Enzel, Y. and Avni, Y. (1998). Translocated Plio-Pleistocene drainage systems along the Arava fault of the Dead Sea transform. Tectonophysics. **284**, 151-160.

Ginzburg, A. and Folkman, Y. (1980). The crustal structure between the Dead Sea rift and the Mediterranean Sea. Earth Planet. Sci. Lett. **51**, 181-188.

Ginzburg, A. Makris, Fuchs, K. and Prodehl, C. (1981). The structure of the crust and upper mantle in the Dead Sea rift. In: R.Freund and Z. Garfunkel (Edits), The Dead Sea Rift. Tectonophysics, **80**, 109-120.

Ginzburg, A. Makris, J. fuchs, K. Prodehl, C. Kaminski, W and Amitia, U. (1979a). A seismic study of the crust and the upper mantle of the Jordan dead Sea rift and their transition toward the Mediterranean Sea. J. Geophys. Res. **84**, 1569-1582.

Girdler, R. W. (1990). The Dead Sea Transform Fault System. Proc. Conf. Geol. And Tectonic process of the Dead Sea rift Zone. Standford, Calif., 7-8 Sept. Tecton- physics. **180**, 1-13.

Gossler, J. and Kind, R. (1996). Seismic evidence for very deep roots of continents. Earth Planet. Sci. Let. **138**, 1-13.

Gurrola, H, Minster, J. B. and Owens, T. (1994). The use of velocity spectrum for stacking receiver functions and imaging upper mantle discontinuities. *Geophys. J. Int.* **117**, 427-440.

Gutenberg, B. and Carrega, J. (1958). Attenuation of seismic waves in the earth's mantle. *Bull. Seism. Soc. Am.* **58**, 711-741.

Gutenberg, B. (1913). Über die Konstitution des Erdinneren, erschlossen aus Erdbebenbeobachtungen. *Physikalische Zeitschrift* **14**, 1217-1218.

Haskell, N. A. (1953). The dispersion of surface waves on multilayered media. *Bull. Seism. Soc. Am.* **43**, 17-34.

Haskell, N. A. (1962). Crustal reflections of plane P and SV waves. *J. Geophys. Res.* **67**, 4751-4767.

Helfrich, G. (2000). Topography of the transition zone seismic discontinuities. *Rev. Geophys.* **38**, 141-158.

Ibrahim, K. (1993). The geology of the Wadi Gharandal area. Map sheet 3050 II. Natural Resources Authority, Amman, Jordan.

Ibrahim, K. M. and McCourt, W. J. (1995). Neoproterozoic granitic magmatism and tectonic evolution of the northern Arabian Shield: Evidence from southwest Jordan, *Journal of African Earth Sciences*, **20**, 103-118.

IPRG, 1983-1990. Earthquakes in and around Israel. Bulletin of the Institute for Petroleum Research and Geophysics.

Jarrar, G. H., Baumann, A. and Wachendorf, H. (1983). Age determinations in the Precambrian basement of the Wadi Araba, southwest Jordan. *Earth and Planetary Science Letters*, Vol. **63**, 292-304.

Jarrar, G. H. (1985). Late Proterozoic evolution of the Arabian-Nubian Shield in the Wadi Araba area, southwest Jordan. *Geologisches Jahrbuch Reihe*. **B61**, 3-87.

Jestin, E, Huchon, P. and Gaulier, J. M. (1994). The Somalia plate and the Eastern Africa Rift System: present-day kinematics. *Geophys. J. Int.* **116**, 637-654.

JSO, 1984-2000. Earthquakes in Jordan and adjacent areas. Bulletin of Jordan Seismological Observatory, NRA, Amman, Jordan

Kashia, E. L. and Croker, P. F. (1987). Structural geology and evolution of the Dead Sea - Jordan rift system as deduced from new subsurface data. *Tectonophysics*. **141**, 33-60.

Kennett, B. L. N., and Engdahl, E. R. (1991). Travel times for global earthquake location and phase identification. *J. Geophys. Res.* **99**, 24323-24339.

Kind, R., Kosarev, G. L. and Peterson, N. V. (1995). Receiver functions at the stations of the German Regional Seismic Network (GRSN). *Geophys. J. Int.* **121**, 191-202.

Kind, R and Vinnik, L. P. (1988). The upper mantle discontinuities underneath the GRF array from P-to-S converted phases. *J. Geophys.* **62**, 138-147.

Klinger, Y., Avouac, J. P., Dorbath, L., Abou Karaki, N. and Tisserat, N. (2002). Seismic behaviour of the Dead Sea fault along Araba Valley, Jordan. *Geophysical Journal International*, **142**, 769-782.

Klinger, Y., Rivera, L, Haessler, H. and Maurin, J. C. (1999). Active faulting in the Gulf of Aqaba: new knowledge from the Mw 7.3 earthquake of 22 November 1995. *Bull. Seismol. Soc. Am.* **89**, 1025-1036.

Kosarev, G. L., Makeyeva, L. I. And Vinnik, L. P. (1987). Inversion of teleseismic P-waves particle motions for crustal structure in Fennoscandia. *Phys. Earth planet. Inter.*

47, 11-24.

Kosarev, G. L., Petersen, N. V., Vinnik, L. P. and Roecker, S. W. (1993). Receiver function for the Tien Shan analog broadband network: contrast in the evolution of structure across the Talasso-Fargana fault. *J. Geophys. Res.* **98**, 4437-4448.

Kroner, A., Eyal, M. and Eyal, Y. (1990). Early Pan-African evolution of the basement around Elat, Israel and the Sinai Peninsula by single-zircon evaporation dating and implications for crustal accretion rates. *Geology*. Vol. **18**, 545-548.

Langston, C. A. (1979). Structure under Mount Rainer, Washington, inferred from teleseismic body waves. *J. Geophys. Res.* **84**, 4749-4762.

Lartet, L. M. (1869). Essai Sur la Geologie da la palestina-Ann. Sc. Geol. 1.Pt. 1-116a. 149-329.

Li, X., Kind, R., Yuan, X., Sobolev, S. V., Hanka, W., Ramesh, D. S., Gi. Y. and Dziewonski, A. M. (2003). Seismic observation of narrow plumes in the oceanic upper mantle. *Geophys. Res. Lett.* **30**. No. 6, 10.1029/2002GL015411.

Makris, J., Ben-Avraham, Z., Behle, A., Ginzberg, A., Giese, P., Steinmetz, L., Whitmarsch, R. B. and Eleftheriou, S. (1983). Seismic refraction profiles between Cyprus and Israel and their interpretation. *Geophys. J. R. Astr. Soc.* **75**, 575-591.

McCourt, J. and Ibrahim, K. (1990). The geology, geochemistry and tectonic setting of the granitic and associated rocks in the Aqaba and Araba complexes of southwest Jordan. *Bulletin* **10**. Geology Directorate. Natural resources Authority. Amman. Jordan.

Meneisy, M. Y. and Kreuzer, H. (1974). Potassium-argon ages of Egyptian basaltic rocks. *Geol. Jahrb.*, D9, 21-31.

Milne, J. (1895). Suggestion for a systematic observation in the northern hemisphere of earth waves and vibrations travelling great distances. Tokyo, 31, January.

Oldham, R. (1906). The constitution of the interior of the earth, as revealed by earthquakes. Quarterly Journal of the Geological Society of London, **62**, 456-473.

Owens, T. J., Zandt, G. and Taylor, S. R. (1984). Seismic evidence for an ancient rift beneath the Cumberland Plateau, Tennessee: A detailed analysis of broadband teleseismic P waveforms. J. Geophys. Res. **89**, 7783-7795.

Paulssen, H. (1988). Evidence for a sharp 670-km discontinuity as inferred from P-to-S converted waves. J. Geophys. Res. **93**, 10489-10500.

Petersen, N., Vinnik, L., Kosarev, G., Kind, R., Oreshin, S. and Stammer, K. (1993). Sharpness of the mantle discontinuities. Geophys. Res. Lett. **9**, 859-862.

Petersen, N. V. and Vinnik, L. P. (1991). Detection of waves converted from P to SV in the crust by multichannel deconvolution. Akad. Nauk SSSR Fiz. Zemli. **4**, 37-44.

Phinney, R. A. (1964). Structure of the Earth's crust from spectral behaviour of long-period body waves. J. Geophys. Res. **69**, 2997-3107.

Piorrier, J. P. and Taher, M. A. (1980). Historical seismicity in the Near and Middle East. North Africa and Spain from Arabic documents (VII-XVII century), Bull. Seism. Soc. Am. **70**, 2185-2202.

Quennel, A. M. (1956). The geological map of the Kingdom of Trans-Jordan, Scale 1:250,000.

Quennell, A. M. (1958). The structural and geomorphic evolution of the Dead Sea Rift, the geological society of London CXIV: 1-24, London.

Quennell, A. M. (1959). Tectonic of the Dead Sea Rift. Cong. Geol. Int. Mexico. 22<sup>nd</sup> session, 385-405.

Quennell, A. M. (1983). Evolution of the Dead Sea Rift. A review In. Abed and Khaled (Edits). Proc. 1<sup>st</sup> Jord. Geol. Conf. Sept, 1982, Amman, 460-482.

Quennell, A. M. (1984). The western Arabian Rift System. In. Dixon, J. and Roberston, A. (Edits). The geological evolution of the eastern Mediterranean. Geol. Soc. London, Sep. Pub. **17**, 775-788.

Quennell, A. M. (1985). The geology and mineral resources of (former) Trans. Jordan. Colon. Geol. **9**, Resource, 2 No. 2.

Ramesh, D. S., Kind, R. and Yuan, X. (2002). Receiver function analysis of the North American crust and upper mantle. Geophys. J. Int. **150**, 91-108.

Hofstetter, R. and Bock, G. (2003). Shear-wave velocity structure of the sinai sub-plate from receiver function analysis. Geophys. J. Int., submitted.

Rodgers, A., Walter, W, Mellors, R., Al-Amri, A. and Zhang, Y. (1999). Lithospheric structure of the Arabian shield and platform from complete regional waveform modeling and surface wave group velocities. Geophys. J. Int. **138**, 871-878.

Rümpker, G., Ryberg, T., Bock, G. and DESERT Group (2003). Evidence for boundary-layer mantle flow beneath the Dead Sea Transform from seismic anisotropy, Nature, **425**, 497-501.

Sandvol, A., Seber, D., Barazangi, M., Veron, F., Mellors, R. and Al-Amri, A. (1998a). Lithospheric seismic velocity beneath the Arabian shield. Geophys. Res. Lett. **25**, 2873-2876.

Sandvol, E., Seber, D., Calvert, A. and Barazangi, M. (1998). Grid search modeling of receiver functions: Implications for crustal structure in the Middle East and North

Africa. *J. Geophys. Res.* **103**. 26899-26917.

Sieberg, A. *Erdbebengeographie in Handbuch der Geophysik*, ed. B. Gutenberg, 688-877, Gebrüder Bornträger.

Sneh, A., Bartov, Y., Weissbrod, T. and Rosensaft, M. (1998). *Geological Map of Israel 1:200,000*, sheets 3 and 4: Geological survey of Israel, Jerusalem.

Sobolev, S. V., Babeyko, A. Yu., Garfunkel, Z. and DESERT Group (2003). *Thermo-mechanical model for the Dead Sea Transform*, submitted to *EPSL*.

Stammler, K., Kind, R., Petersen, N., Kosarev, G., Vinnik, L. and Liu, Q. (1992). The upper mantle discontinuities: correlated or anticorrelated?. *Geophys. Res. Lett.* **19**, 1563-1566.

Steinitz, Y., Bartov, Y. and Hunziker, J. C. (1978). K-Ar age determinations of some Pliocene-Miocene basalts in Israel: their significance to the tectonics of the rift valley. *Geol. Mag.* **115**, 329-340

Thomson, W. T. (1950). Transmission of elastic waves through a stratified medium. *J. appl. Phys.* **21**, 89-93.

Vinnik, L. P. (1977). Detection of waves converted from P to SV in the mantle, *Phys. Earth Planet. Int.* **15**, 39-45.

Vinnik, L. P. and Kosarev, G. L. (1981). Determination of crustal parameters from observations of teleseismic body waves. *Proc. Acad. Sci. USSR*, **261**, 1091-1095. (in Russian).

von Rebeur-Paschwitz, E. A. (1889). The earthquake in Tokyo, April 18. *Nature* **40**, 294-295.

Walley, C. D. (1988). A bridged strike-slip model for the northern continuation of the Dead Sea fault and its implications for Levantine tectonics. *Tectonophysics*. **145**, 63-72.

Yuan, X., Ni, J., Kind, R., Mechie, J. and Sandolev, E. (1997). Lithospheric and upper mantle structure of southern Tibet from a seismological passive source experiment. *J. Geophys. Res.* **102**, 27491-27500.

Yuval, Z. and Rotstein, Y. (1987). Deep Crustal Survey in Central Israel. *Journal of Geodynamics*, **8**, 17-31.

Zak, I. and Freund, R. (1966). Recent strike-slip movement along the Dead Sea Rift. *Isr. J. Earth. Sci.* **15**, 33-37.

Zhu, H. and Kanamori, H. (2000). Moho depth variation in southern California from teleseismic receiver functions. *J. Geophys. Res.* **105**, 2969-2980.

Zilberman, E., Amit, R., Porat, N. and Avner, U. (1998). Relocation of the epicenter of the 1068 earthquake in the Avmona Playa, southern Dead Sea rift, using paleoseismic and archeoseismic evidence. Abstract 26<sup>th</sup>. General Assembly of the European Seismological Conference, August, 23-28.

APPENDIX A

LIST OF EVENTS

<i>No.</i>	<i>Year</i>	<i>Mon.</i>	<i>Day</i>	<i>Origin Time</i>	<i>Lat.(°)</i>	<i>Long.(°)</i>	<i>Dep. (km)</i>	<i>Mag.</i>
1	2000	06	03	03:54:45.70	51.946	158.969	76	5.7
2	2000	06	03	08:54:49.70	35.537	140.396	70	5.6
3	2000	06	04	16:28:25.80	-04.773	102.050	33	6.8
4	2000	06	05	03:00:26.30	-05.695	102.957	33	5.6
5	2000	06	06	09:58:06.60	-05.091	102.764	33	5.8
6	2000	06	06	14:56:58.70	29.443	131.413	10	5.8
7	2000	06	06	21:16:42.70	36.893	135.445	10	5.8
8	2000	06	07	21:46:55.80	26.837	97.223	33	6.3
9	2000	06	09	08:00:22.10	-05.616	102.645	33	6.0
10	2000	06	10	18:23:29.20	23.818	121.212	33	6.1
11	2000	06	14	01:44:28.00	17.280	120.240	59	5.6
12	2000	06	14	17:00:48.30	04.656	127.570	88	6.0
13	2000	06	15	11:10:50.20	29.492	132.044	33	6.0
14	2000	06	17	15:40:41.50	64.029	-20.396	10	5.7
15	2000	06	18	14:44:12.70	-13.962	97.473	10	6.8
16	2000	06	21	00:51:46.70	63.971	-20.699	10	6.1
17	2000	06	23	05:01:54.30	01.360	126.274	62	6.1
18	2000	06	25	06:34:43.30	31.311	131.152	10	5.8
19	2000	07	01	07:01:55.60	34.211	139.134	10	6.0
20	2000	07	07	15:46:49.00	51.464	179.994	69	6.4
21	2000	07	08	04:52:55.20	-05.465	102.703	33	5.6
22	2000	07	08	18:57:47.30	34.683	139.274	10	5.7
23	2000	07	10	09:58:19.90	46.860	145.403	358	6.2
24	2000	07	10	10:39:38.80	-04.472	103.800	103	5.8
25	2000	07	11	01:32:27.80	57.508	-154.335	53	6.3
26	2000	07	16	03:21:45.80	20.288	121.995	33	6.1
27	2000	07	17	22:53:46.90	36.239	70.986	142	6.0
28	2000	07	20	18:39:19.40	36.625	140.961	49	6.0
29	2000	07	22	20:56:12.20	-04.019	102.454	69	5.8

**Table (1.1):** The list of events recorded by DESERT seismic stations.

30	2000	07	30	12:25:46.00	33.952	139.440	10	6.0
31	2000	08	04	21:13:02.70	48.753	142.293	10	6.3
32	2000	08	06	07:27:12.60	28.829	139.497	394	6.2
33	2000	08	07	14:33:56.00	-06.968	123.468	649	6.4
34	2000	08	24	11:36:45.20	-06.045	102.749	33	5.7
35	2000	08	28	03:36:56.20	04.444	126.782	33	5.8
36	2000	08	28	15:05:47.90	-04.018	127.515	16	6.4
37	2000	08	08	01:34:41.50	-39.895	41.581	10	5.6
38	2000	09	10	08:54:45.80	23.958	121.436	33	5.7
39	2000	09	10	19:06:15.50	-01.116	129.374	33	5.9
40	2000	09	12	00:28:02.00	35.373	99.343	33	5.7
41	2000	09	12	16:27:24.60	-05.463	101.850	33	5.8
42	2000	09	22	18:22:02.80	-04.997	102.185	33	5.7
43	2000	09	25	04:00:39.70	-46.647	37.388	10	5.8
44	2000	09	26	16:49:33.70	-00.151	127.489	144	5.8
45	2000	10	02	02:25:27.50	-07.999	30.518	10	6.1
46	2000	10	06	04:30:18.90	35.389	133.119	10	5.9
47	2000	10	21	22:30:32.20	13.739	120.718	148	5.6
48	2000	10	25	09:32:24.00	-06.507	105.604	38	6.3
49	2000	10	27	00:08:50.30	54.701	95.037	10	5.7
50	2000	10	27	04:21:51.70	26.277	140.522	387	6.1
51	2000	10	29	22:03:56.60	47.703	155.689	50	5.7
52	2000	11	13	15:57:21.80	42.542	144.758	33	6.1
53	2000	12	22	10:13:00.80	44.833	147.157	137	5.9
54	2001	01	01	06:57:04.60	06.970	126.613	33	6.5
55	2001	01	02	07:30:03.70	06.747	126.781	33	5.8
56	2001	01	03	14:47:49.10	43.845	147.814	33	5.8
57	2001	01	04	04:18:23.40	37.070	138.560	33	5.6
58	2001	01	06	04:45:29.00	06.743	126.865	33	5.6
59	2001	01	07	12:55:46.70	-08.720	108.913	33	5.6
60	2001	01	10	16:02:43.40	57.019	-153.398	33	6.1
61	2001	01	15	05:52:15.50	-40.369	78.365	10	5.8

62	2001	01	16	13:25:01.10	-03.942	101.810	33	6.1
63	2001	01	16	16:49:55.00	-04.199	101.588	33	5.7
64	2001	01	26	03:16:40.70	23.326	70.317	23	6.9
65	2001	02	07	15:16:15.30	52.741	153.889	427	5.7
66	2001	02	08	05:41:42.40	24.330	125.100	33	5.6
67	2001	02	13	19:28:31.80	-04.618	102.937	36	6.2
68	2001	02	14	13:36:39.40	48.585	153.263	146	5.8
69	2001	02	16	05:59:09.20	-07.108	117.578	519	5.9
70	2001	02	21	15:22:20.40	-04.838	102.612	33	5.7
71	2001	02	23	00:09:23.30	29.521	101.141	33	5.7
72	2001	02	24	07:23:49.00	01.463	126.268	35	6.6
73	2001	02	24	16:33:44.20	01.594	126.335	33	5.8
74	2001	02	25	02:21:59.90	36.477	70.904	202	5.9
75	2001	02	26	05:58:22.20	46.831	144.517	390	5.8
76	2001	02	28	09:35:13.40	06.643	126.787	33	5.6
77	2001	03	08	21:11:24.40	-05.342	102.318	33	5.7
78	2001	03	13	20:04:58.00	18.818	121.206	33	5.6
79	2001	03	14	18:56:18.70	00.434	121.927	108	5.9
80	2001	03	15	01:22:42.00	08.679	94.009	24	5.6
81	2001	03	19	05:52:17.10	-03.914	127.965	40	6.1
82	2001	03	23	11:30:10.60	44.126	148.036	33	5.9
83	2001	03	24	06:27:51.70	34.066	132.531	33	6.4
84	2001	04	14	23:27:30.20	30.201	141.761	33	6.1
85	2001	04	17	21:54:02.70	51.354	-179.848	33	5.7
86	2001	04	25	14:40:06.60	32.818	132.052	37	5.9
87	2001	04	25	21:02:42.40	-09.038	106.523	33	5.6
88	2001	04	30	02:02:02.30	43.899	147.389	47	5.7
89	2001	05	03	04:31:57.10	00.448	126.365	33	5.7
90	2001	05	09	15:47:37.00	53.773	-164.249	40	5.7
91	2001	05	25	00:40:51.00	44.298	148.407	33	6.1
92	2001	05	25	05:05:57.60	-07.899	110.004	33	5.8

APPENDIX B  
STATIONS LIST  
&  
INSTRUMENTATION

<i>ID</i>	<i>Latitude(°)</i>	<i>Longitude(°)</i>	<i>Elevation(m)</i>	<i>Sensor</i>
ID01	31.20	34.54	165	MARK-L4
ID02	31.24	34.71	255	MARK-L4
ID03	31.14	34.78	305	MARK-L4
ID04	30.73	34.77	725	MARK-L4
ID05	30.87	34.79	505	MARK-L4
ID06	30.56	35.18	020	MARK-L4
ID07	30.79	34.77	580	Guralp-3T
ID08	30.60	34.79	870	Guralp-3T
ID10	31.36	34.49	150	Guralp-3T
ID11	31.29	34.45	135	MARK-L4
ID12	30.99	34.92	505	Guralp-3T
ID15	30.87	35.08	110	MARK-L4
ID16	30.92	35.02	400	MARK-L4
ID17	30.62	34.90	470	MARK-L4
ID18	30.93	35.39	-325	MARK-L4
ID19	30.77	35.28	135	MARK-L4
ID20	30.79	34.47	355	MARK-L4
ID21	30.33	34.95	290	MARK-L4
ID22	30.18	35.02	310	MARK-L4
ID23	30.05	35.04	445	MARK-L4
ID24	29.79	34.91	870	MARK-L4
ID26	30.97	34.69	365	STS2
ID27	30.66	35.24	065	STS2
ID28	30.36	35.16	130	STS2
ID30	31.17	35.44	-375	STS2
ID31	30.08	35.13	225	STS2
ID32	29.97	35.06	145	STS2
ID33	29.90	34.95	570	STS2
JD03	30.62	35.41	145	Guralp-40T
JD04	30.40	35.34	300	Guralp-40T
JD05	30.26	35.23	400	Guralp-40T

**Table (2.1):** List of DESERT temporary seismic stations

JD06	30.09	35.21	300	Guralp-40T
JD07	29.91	35.14	235	MARK-L4
JD08	29.72	35.05	225	Guralp-3T
JK01	30.78	35.61	1400	MARK-L4
JK02	30.57	35.56	1200	Guralp-40T
JK04	30.38	35.50	1800	MARK-L4
JK05	30.24	35.48	1680	MARK-L4
JK06	30.04	35.37	1140	MARK-L4
JW01	30.87	35.97	885	Guralp-40T
JW03	30.59	35.80	1098	MARK-L4
JW04	30.33	35.77	1100	MARK-L4
JW05	30.23	35.69	1200	MARK-L4
JW07	30.00	35.50	1650	Guralp-40T
JW09	29.68	35.32	835	Guralp-40T
JS02	30.29	36.24	880	Guralp-40T
JS03	29.94	36.14	935	Guralp-40T
JS05	29.44	35.82	930	Guralp-40T
JS06	29.53	35.60	820	MARK-L4
JS07	29.42	35.39	1130	Guralp-3T

APPENDIX C

LISTS OF DELAY TIMES OF

The

MOHO CONVERSIONS, MOHO MULTIPLES

&

LOWER CRUSTAL MULTIPLES

**Group A**

<i>ID</i>	<i>TT (Ps)s</i>	<i>TT (PpPs)s</i>	<i>TT (LCM)s</i>
ID02	4.05	13.79	
ID01	4.06	14.10	
ID03	3.95	14.13	
ID12	4.47	13.76	
ID26	4.26	14.40	
ID05	4.33	13.76	
ID15	4.10	13.72	
ID07	4.36	14.33	
ID04	4.16	14.13	
ID17	4.35	13.93	
ID08	4.36	13.86	
ID21	4.13	13.66	
JS02	4.10	14.10	

**Group B**

ID16	4.40	12.96	09.06
JW01	4.26	14.26	10.13
JK01	3.96	14.73	09.66
ID19	4.62	15.26	10.07
ID27	4.45	14.75	10.40
ID06	4.86	14.93	11.60
ID28	4.15	17.05	11.07
JK04	4.93	14.86	10.82
JD05	4.65	15.45	11.89
JK05	4.64	15.40	12.66
JW05	4.93	16.55	13.23
JD06	4.65	16.01	12.10
ID31	4.55	14.73	10.86
ID32	3.90	13.95	10.13
JS03	5.00	13.16	10.00
JW09	3.95	13.56	09.59
JS06	4.13	14.13	10.20
JS07	4.00	13.66	09.79

**Group C**

JD03	4.40
JK02	4.00
JD04	4.31
JW04	4.90
ID22	4.35
ID23	4.35
JK06	4.40
JW07	4.45
ID33	4.13
ID24	4.41
JD08	4.10
JS05	4.33
ID10	4.35
ID11	4.55
ID18	4.75
ID20	4.24
ID30	4.61
JD07	4.35
JW03	4.10

**Table (3.1):** List of delay times of Moho conversions, Moho multiples and LCM.

## Lebenslauf

Name: Mohsen  
 Vorname: Ayman  
 Geburtsdatum: 10. Dezember 1968  
 Geburtsort: Nablus, Palästina

### Schulbildung:

1975-1977 Grundschole in Al-Naqura, Palästina  
 1978-1986 Gymnasium in Al-Naqura und Sabastia, Palästina  
 1987 Abitur

### Hochschulbildung:

Sep. 1987-Feb. 1991 Studium an der Yermouk Universität in Jordanien  
 Studienfach: Geologie  
 Abschluss: Bachelor of Earth Science and Environment

Sep. 1992-Feb. 1995 Studium an der Jordan Universität in Jordanien  
 Studienfach: Geophysik  
 Abschluss: Master in Geology and Geophysics

### Berufstätigkeit:

Aug. 1996-Feb. 2000 Wissenschaftlicher Mitarbeiter der Palastinian Water Authority, Ramallah, Palästina  
 seit April. 2000 Wissenschaftlicher Mitarbeiter (Doktorand) am GeoForschungsZentrum, Potsdam