8th International Conference on Seismology & Earthquake Engineering
11-13 Nov. 2019, Tehran, Iran

CRUSTAL STRUCTURE OF IRAQ FROM TELESISMIC DATA

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Keywords: Mesopotamia plain, Receiver functions, Surface wave dispersion, Joint inversion, Velocity models

The whole Iraq is located within the northeastern part of the Arabian plate except a very small area in the extreme northeastern part of the country called Shalair Terrane, which is part of the Sanandaj-Sirjan Zone of the Eurasian (Iranian) Plate. Iraq is divided into two main tectonic units (Fouad, 2010); the Outer and Inner Arabian Platforms. The Outer Platform is unstable and consists of the Zagros Fold-Thrust Belt and the Mesopotamia Foredeep, while the Inner Platform is stable and covers the western desert of Iraq.

From May 2014, Universities of Basrah, Summar, Sulaymaniyah, and Duhok installed a regional network in eastern part of Iraq, mostly in the Mesopotamia Plain, in collaboration with University of Arkansas at Little Rock (UALR) and Lawrence Livermore National Laboratories (LLNL). Broadband seismic stations were installed in Basra (BSR1 and 2), Amarah (AMR1 and 2), Nasiria (NSR1, 2, and 3), Karbala (KIR1), Sulaymaniyah (SLY1), and Duhok (DHK1) cites (Figure 1). SLY1 and DHK1 are located at the northern portion of the Zagros orogeny while the others are located inside the Mesopotamian Plain. The instruments are three-component Güralp Systems with 24-bit digitizers. Two seismic stations are located within the Zagros Fold-Thrust Belt and eight within the Mesopotamia Plain of the Iraq.

Crustal structure of Iraq from these 10 broadband seismic stations was calculated using joint inversion of P-wave receiver functions and Rayleigh wave dispersion data. Two data sets were prepared to do a joint inversion modeling beneath each seismic station. Among the teleseismic waveforms recorded by the stations, we selected 495 teleseismic events with an epicentral distance between 20^{o} and 140^{o} and magnitude greater than 5.4. For each waveform, the theoretical P or Pdiff onset were calculated using the IASP91 standard velocity model (Kennett et al., 1995). The theoretical P/Pdiff onset was then used to extract the teleseismic P window started from 50 s before and 100 s after the time. The three component waveforms were band-pass filtered between 0.05 Hz to 2 Hz and rotated from ZNE into ZRT coordinate system. Using the iterative deconvolution method of Ligorria and Ammon (1999), the Z component was deconvolved from R and T components and a Gaussian filter with a Gaussian width of 3.0 was applied onto each RF. We then make a move out correction using standard velocity model of IASP91 and stack them by averaging the individual RFs. Thus, we present one high quality stacked receiver function for each station. Rayleigh-wave group velocity dispersion data were extracted from the expanded tomographic study of Acton et al. (2010) (Priestley, personal communication). The group velocities were measured for the region in the period range 10–70 s. We interpolated the group velocity maps to obtain a site-specific dispersion curve. The program *joint96* was employed to invert data to S-wave velocity model. The program is available in the software package 'Computer Programs in Seismology' (Herrmann, 2013).

Results of the crustal structures from other studies within and surrounding Iraq were collected and combined with the results of this study in order to have wide and better view of the nature of sedimentary and crustal thickness in the northeastern part of the Arabian Plate (Figure 1). The crust is thin beneath DHK1 at the border of the Zagros Mountains north of Iraq and thick beneath SLY1, which is located inside the Zagros mountain region. The crustal thickness variation beneath stations located in the Mesopotamia Plain is variable. The crustal thickness beneath KAR1 and NSR3 is ~45 km, increasing beneath NSR1, NSR2, BSR1 and BSR2 to ~50 km, and finally beneath AMR1 and AMR2 to ~54 km. Assuming a profile from SW to NE, it is observed that the crustal thickness is increasing from SW to NE direction, which

is the direction from stable region toward the Zagros collision zone. Our S velocity models show thick sedimentary basin (average ~ 14 km) and thick crustal thickness (average ~ 50 km) beneath the plain dipping gently from stable Arabian shield toward the active Zagros collision zone.

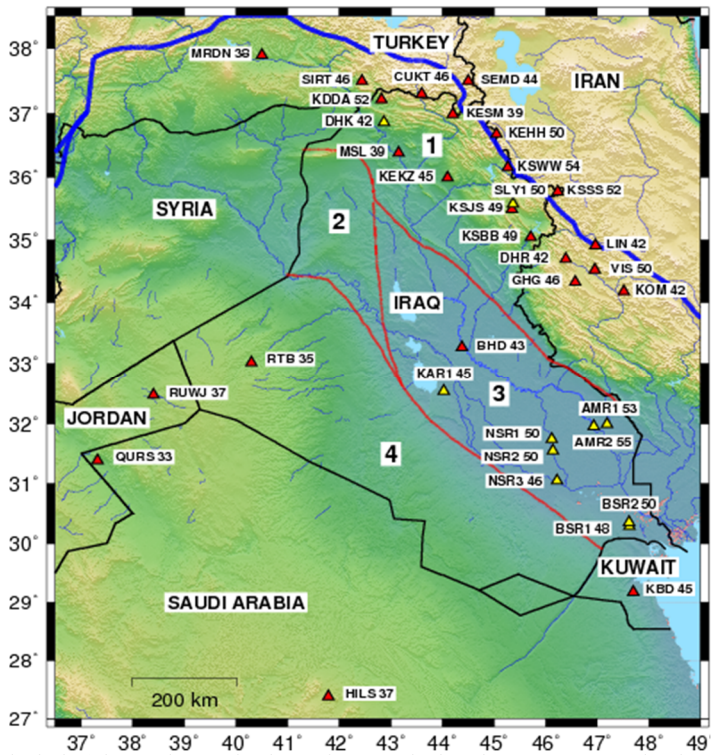

Figure 1. Crustal thickness (Moho depths in km) beneath 35 seismic stations. Red triangles represent Moho depths from previous studies and yellow triangles are from this study. Blue line is the suture line between the Eurasian and Arabian Plates. Red lines depict the tectonic divisions of Iraq according to Fouad (2010). 1 Zagros Fold-Thrust Belt; 2 Al-Jazira Plain; 3 Mesopotamia Plain; 2 and 3 Mesopotamia Foredeep; 1, 2, and 3 Outer Platform of the Arabian Platform; 4 Inner Platform of the Arabian Plate.

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