5.2.2. TECTONICS OF ADRIA INFERRED FROM GPS MEASURMENTS

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5.2.2.1. Introduction

Tectonic evolution of the central Mediterranean and central Europe was mainly influenced by the movement of Adria (Channel, Horváth, 1976). Geological studies indicate that in the past Adria moved as a part of the Africa plate (Argand, 1924, Andersen, Jackson 1987, Jackson, McKenzie, 1988). In the late Miocene, the westward movement of the Anatolian-Aegean-Balkan system caused Adria to decouple from the Africa plate (Babucci et al., 2004, Mantovani et al., 2005).

According to the earthquake epicentres recorded in the Adriatic region seismic activity in Adria is concentrated mostly in the on-shore areas. In the off-shore area, the area between the Gargano zone and the central Dinarides also subject to significant seismic activities (Westaway, 1990, Favali et al., 1993, Oldow et al., 2002, Mantovani et al., 2005).

To study of present-day tectonics of Adria a GPS network of twenty stations located in Croatia, Italy, and Slovenia was established in 1994. In 1996, the network was extended to include new stations distributed over Albania, Bosnia and Herzegovina, Croatia, and Italy. Using an identical sets of Trimble receivers as well as of antennas, three GPS campaign were conducted within the network in 1994, 1996, and 1998 (Colic et al., 1996, Miškovic, Altıner, 1997, Altıner et al., 2006a, Altıner et al., 2006b).

5.2.2.2. Velocities estimated

Data processing was carried out at BKG using the GPS software developed at the University of Bern (Hugentobler et al., 2001). For data processing, the final orbits of the International GNSS Service (IGS) in the ITRF96 were used (Boucher et al., 1998; McCarthy, 1996). Annual horizontal and vertical velocities of stations in ITRF96 (epoch 1996.56) were determined through a combination of reaching ionosphere-free daily solutions, and fixing the coordinates and velocity of the permanent station GRAZ (Altıner et al., 2006). The horizontal station velocities were significant at the 0.95 confidence level for all stations with the exception of Malija (724), Split (4), (Trebacnik (525), Terracina (103), and VENE (Fig. 5.2.2.1.). Additionally, we assumed that the station Bakar (2) subject to the local movement due to an unstable pillar.

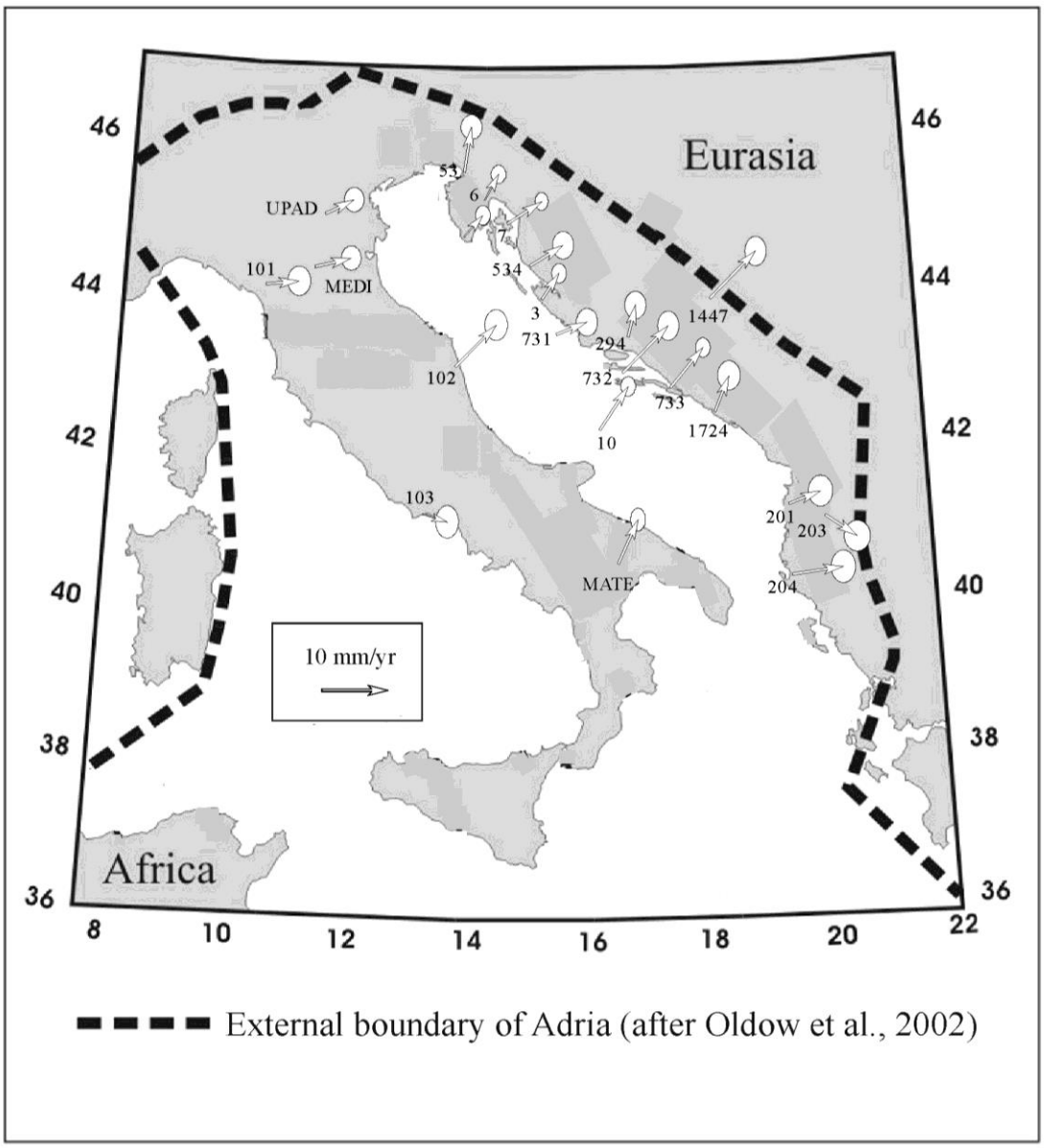

Fig. 5.2.2.1. Horizontal velocities of stations and their confidence ellipses with a probability of 95 % (confidence level 1-α=0.95) for normal distribution of observations (Modified from Altıner et al., 2006)

The magnitudes of the horizontal velocities relative to GRAZ increase from north to south and vary from 3 to 10 mm/yr. The greatest movement (8-10 mm/yr) occurs in central Adria between the Gargano zone and the central Dinarides. At the 0.95 confidence level, the vertical velocities for most of the stations are not significant, so that here we dispense with the illustration of vertical movements of stations. For a detailed explanation of the station velocities as well as of the results of the deformation analysis discussed in the following section, we recommend to the reader the relevant publication by Altıner et al., (2006).

5.2.2.3. Principal strain rates

Internal deformation measures (largest and smallest principal strain rates) for the Adriatic region were evaluated by means of analytical surface deformation theory (Altıner, 1996, 1999, 2001) considering ellipsoidal coordinates for a regular area-wide grid spanning 40.4° to 46.4° latitude and 12.8° to 20.4° longitude with a mesh spacing of 0.5° (Fig. 5.2.2.2.).

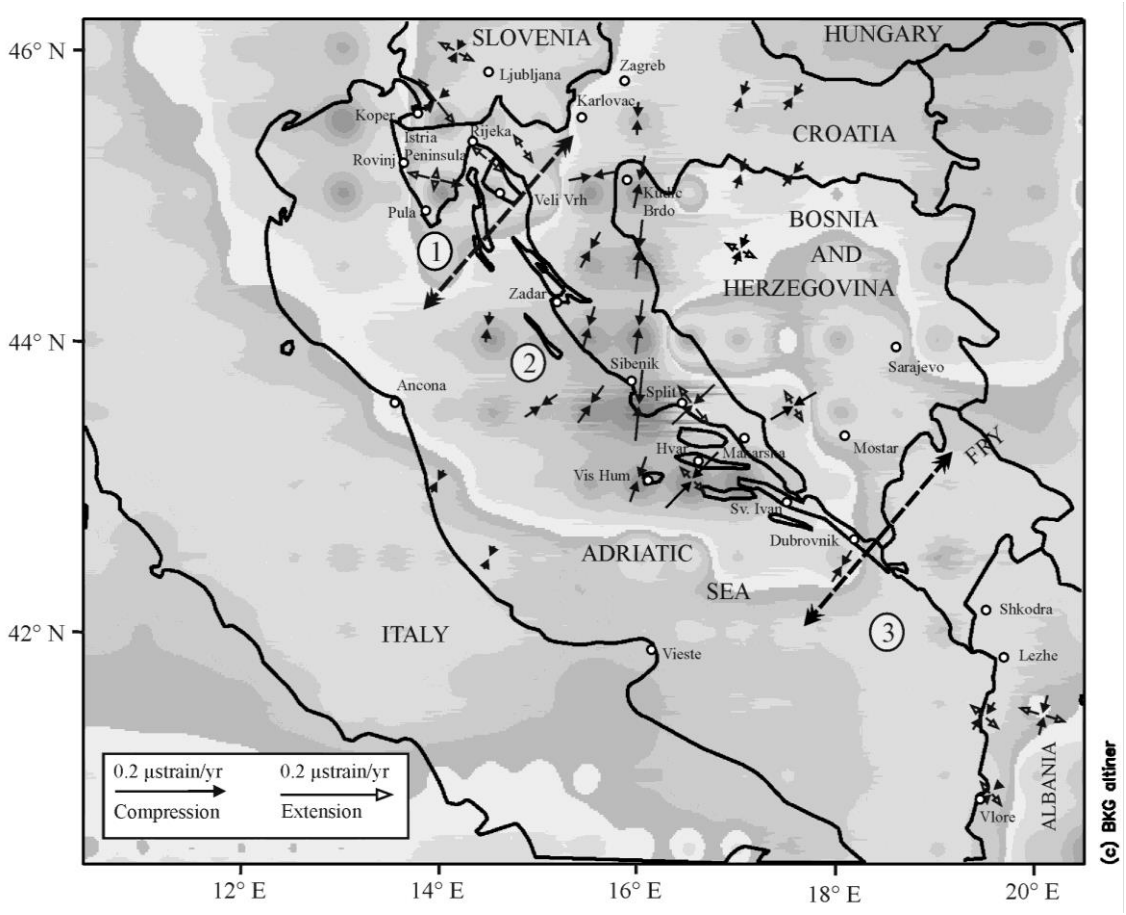

Fig. 5.2.2.2. Principal strain rates (Modified from Altıner et al., 2006). 1, 2, and 3 express the numbers of different deformation zones detected within the investigation area. Arrows directed outward indicate extensions, whereas those directed inward correspond to compression. FRY=Former Federal Republic of Yugoslavia (Modified from Altıner et al., 2006)

The results of deformation analysis are correlated with the outcomes of the geological studies in Adria given in Markusić et al., (1998) and Kuk et al., (2000) suggesting the existence of three different deformation zones within the northern Adriatic region. As conclusion of this study, we suggest that the Adria exists as an independent microplate, because the horizontal movements of the stations within the study area is generally northeast-oriented and differs from the northwest-oriented motion of the Africa plate relative to Eurasia.

5.2.2.4. References

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