Coastal uplift, sea level changes and active tectonics of the southeastern Black Sea: Evidences from Quaternary marine terraces, Trabzon coast, NE Turkey

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The data obtained from landsat imagery, airphotos, geological and geophysical records show that there are three distinctive lineaments in the vicinity of Trabzon, trending northeast-southwest (NE-SW), northwest-southeast (NW-SE) and east-west (E-W), anologous to North Anatolian Fault (NAF) and Northeast Anatolian Fault (NEAF) systems. According to current seismic data, the faults, which have three distinctive directions, show active properties. As a result of these Boztepe, Erdogdu, Fatih (NE-SW directions), Yenimahalle and Faroz faults (NW-SW directions), forming the fault system of the Trabzon coast section, cut and raised the Quaternary marine terraces to the surface. In order to be able to reveal the motion rates and activity of these faults, field surveying, geomorphological studying, airphoto interpretation and geochronological measurements of seven different marine terraces on the Trabzon coast of the southeastern part of Black Sea was carried out. According to available data, the Holocene and Pleistocene marine terraces, at elevations ranging from 1-3 m to 4-300 m, are the result of the interaction between regional scale uplift and subsidence, interglacial sea level changes, and local fault movement**.** The mollusca shells, collected from these terraces at elevations ranging between 1-3 m (H), 4-14 m (T-1), 22-34 m (T-2), 60-80 m (T-3), were dated by ESR method. The ESR results showed that the ages of H, T-1, T-2 and, T-3 are 5.141 ± 0.294 ka, 124.8±26.0 ka, 292.5±49.8 ka and 407.998 ± 67.475 ka, respectively. The terraces were correlated to the OIS 1, 5e, 9, 11, which correspond to the 5.141 ka, 124.8 ka, 292.5 ka and 407.9 ka highstands of the paleosea-level curve. Considering the new ESR results, subsidence rate of the East Black Sea Basin and the abrupt drowning of the Black Sea self at 7150 years ago, mean uplift rates of the Holocene and Pleistocene marine terraces are ranging from 0.5 to 1.4 mm/year. The average motion rates of the faults, forming the fault system of the Trabzon coast section, are 0.5-1.4 mm/year while this rate is 16-25 mm/year for NAF and 9 mm / year for NEAF. This indicates that the motion rates of the faults decrease towards the plate. As a result of these mean uplift rates, the recurrent of the maximum earthquake (M=7) is predicted to be a few thousands years.

^{236}U Inventories, ^{236}U/^{238}U, and ^{236}U/^{239}Pu: The Stratospheric Fallout Signature

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^{236}U ($T_{1/2}$ = 23.4 Ma) is formed as a result of thermal neutron capture processes in Nature as well as artificial reactors. ^{236}U/^{238}U atom ratios in the natural Earth's crust, are expected to be on the order of 10^{-14}; reactor-irradiated U exhibits high ^{236}U/^{238}U atom ratios approaching 10^{-2}. The presence of very small quantities of reactor-irradiated U significantly enhances the "background" ^{236}U/^{238}U, and detection of ^{236}U is highly relevant in nuclear forensics. However, the post-nuclear ^{236}U signature remains undefined, although the signatures and inventories of Np and Pu from stratospheric fallout (SF) are well-known (Kelley *et al.*, 1999). Our objective is to characterize ^{236}U/^{238}U, ^{236}U/^{239}Pu, and ^{236}U inventories from SF in Northern Hemisphere surface environments.

We use sector ICPMS for ^{236}U/^{238}U and ^{239}Pu measurements; ^{236}U/^{238}U $\geq 10^{-7}$ can be determined by this technique (Ketterer *et al*., 2003). Sample ^{236}U/^{238}U atom ratios are influenced by two independent factors: ^{236}U concentration is determined from SF content (with ^{239}Pu as a proxy) and ^{238}U concentration is a function of background geology. Locations with high ^{239}Pu and low ^{238}U concentrations, such as ombrotrophic peat, low-U soils, and sediments from low-U watersheds are optimal.

We have studied soils from Minnesota and Washington (USA), along with lake sediment and peat cores from the Pechora Region (Russia). ^{236}U/^{238}U approaches 10^{-4} in some high-^{239}Pu, low ^{238}U samples. ^{236}U/^{239}Pu ratios range from 0.05-0.50 for samples containing Pu of purely SF origin; evidently, fallout ^{236}U is more mobile than Pu in the surface environment. Based upon these results and Kelley *et al*.'s ^{239}Pu inventory data, the mid-latitude ^{236}U inventories are on the order of 10^{12}-10^{13} atoms/m^2. Caution in using ^{236}U as a tracer of reactor U, and more detailed studies of ^{236}U are in order.

References

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