Electromagnetic studies in the Eastern Mediterranean Region with Special Reference to Major Transform (Strike-Slip) Faults

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SUMMARY

Even though extensively researched in the history of geosciences, human knowledge on the earthquake generation is still severely limited. This is primarily due to the complicated behavior of the medium, namely the seismogenic zone, where the earthquakes originate and variety of the numerous physical parameters used while acknowledging the earthquake phenomena. Leastways, our knowledge today reached to a certain level that allows us to affirm the fact that before, during and after earthquake processes are governed by the existence of sub-surface fluids (and/or geofluids) in and around the major fault zones. Depending mostly on fault's structural properties as well as its focal mechanism type, the geofluids present at the fault zone are held responsible for the occurrence of major and destructive earthquakes with their mechanical influence under various physicochemical conditions resulting in the weakening and lubricating effects. Thus, to comprehend the characteristics of the seismogenesis, imaging the geometry of fluid-sheltering fault structures, understanding the vivacity of the geofluids under varying stress conditions and determining the amounts of the geofluids have become indispensable apparatuses for the illumination of the earthquake related phenomena.

In this regard, together with some other fluid-sensitive geophysical and geological methods, the major fault zones worldwide are being examined with both time- and frequency-domain electromagnetic (EM) methods such as transient electromagnetics and magnetotellurics. Since 60s/70s when the earliest EM studies performed around the fault zones brought elementary results, there has been a tremendous amount of improvements in this field. However, the evolution of the equipment, the observation techniques and the modeling schemes brought further complexities. Particularly, the ongoing transition from the two-dimensional interpretation to the three-dimensional requires additional precautions and circumspections.

This narrative review attempts to shed some light on the pros and cons of utilizing some of these EM methods while investigating the structure and dynamic properties of the strike-slip fault zones in the Eastern Mediterranean region. The review begins with introducing the structural, rheological and electrical properties of the strike-slip faults in general. A historical perspective and global distribution of the EM studies on strike-slip faults will be given. Next, the tectonic, geodynamic and kinematic properties of the Eastern Mediterranean region will be presented. The remaining part of the review highlights several systematic studies performed at and around the major strike-slip faults of the Eastern Mediterranean Region, namely, the Dead Sea Transform Fault, the East Anatolian Fault and the North Anatolian Fault.

Keywords: Strike-slip Faults, Fluids, Eastern Mediterranean