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Seismic signature of crustal magma and fluid from deep seismic sounding data across Tengchong volcanic area

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The weakened lithosphere around eastern syntax of Tibet plateau has been revealed by the Average Pn and Sn velocities, the 3D upper mantle velocity variations of P wave and S wave, and the iimaging results of magnetotelluric data. Tengchong volcanic area is neighboring to core of eastern syntax and famous for its springs, volcanic-geothermal activities and remarkable seismicity in mainland China. To probe the deep environment for the Tengchong volcanic-geothermal activity a deep seismic sounding (DSS) project was carried out across the this area in 1999. In this paper the seismic signature of crustal magma and fluid is explored from the DSS data with the seismic attribute fusion (SAF) technique, hence four possible positions for magma generation together with some locations for porous and fractured fluid beneath the Tengchong volcanic area were disclosed from the final fusion image of multi seismic attributes. The adopted attributes include the Vp, Vs and Vp/Vs results derived from a new inversion method based on the No-Ray-Tomography technique, and the migrated instantaneous attributes of central frequency, bandwidth and high frequency energy of pressure wave. Moreover, the back-projected ones which are mainly consisted by the attenuation factor Q_p , the delay-time of shear wave splitting, and the amplitude ratio between S wave and P wave + S wave were also considered in this fusion process. Our fusion image indicates such a mechanism for the surface springs: a large amount of heat and the fluid released by the crystallization of magma were transmitted upward into the fluid-filled rock, and the fluid upwells along some pipeline since the high pressure in deep, thus the widespread springs of Tengchong volcanic area were developed. Moreover, the fusion image, regional volcanic and geothermal activities, and the seismicity suggest that the main risk of volcanic eruption was concentrated to the south of Tengchong city, especially around the shot point (SP) Tuantian. There are typical tectonic and deep origin mechanisms for the moderate-strong earthquakes nearby SP Tuantian, and precaution should be added on this area in case of the potential earthquake. Our fusion image also clearly revealed that there exist two remarkable positions on the Moho discontinuity through which the heat from the upper mantle was transmitted upward, and this is attributed to the widely distributed hot material within the crust and upper mantle.

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Key Words: Seismic Signature, Magma, Tengchong Volcanic Area, Deep Seismic Sounding, Seismic Attribute Fusion

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