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岫岩陨石撞击坑结构高精度地震探测研究

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High-resolution seismic exploration of Xiuyan impact crater structures

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摘要

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摘要 我国的岫岩陨石撞击坑位于辽东半岛北部低山丘陵地区, 直径1.8 km, 保存完好, 已被多方面的证据证实为陨石撞击坑. 陨石的撞击和此后的沉积作用在坑内形成了特殊的地球物理场, 使坑内与坑外的介质在速度、密度等方面存在差异. 本次通过采用反射和折射地震相结合的探测方法, 利用陨石撞击所形成的岩石的地震波速度和波阻抗差异, 获得了陨石坑的速度结构、地层结构和整体形态. 根据地层反射特征, 直接撞击形成的区域为直径约1.8 km、深度800 m左右的坑体; 受撞击影响的深度约1.4 km. 撞击坑的结构分为慢速沉积区、快速沉积区和影响区三部分. 根据撞击坑的地震波速度特征, 在撞击坑的中心约800 m深度地震波的速度已达到7.0 km/s, 且速度7.0 km/s的等值线与坑体形态一致, 坑的边缘在500~600 m深度地震波的速度已达到7.0 km/s. 坑体的结构和岩石的这些物性参数都进一步证实了岫岩陨石坑的陨石撞击起源.

关键词: 陨石撞击坑 地球物理场 岫岩 波阻抗差异 反射和折射地震探测

Abstract: The Xiuyan impact crater with a rim-rim diameter of 1.8 km is located at northern hills in the Liaodong peninsula, Liaoning province, China. It is reserved well and confirmed to be a meteorite impact crater. A special geophysical field resulted from the meteorite impact and subsequent deposit at the crater makes different medium velocity and density between inside and outside of the crater. In the project, velocity structures, stratum structures and whole configuration of the crater are gotten using the differences of seismic velocity and wave impedance from the combined exploration of reflection and refraction. Based on the reflection features, the crater body formed by the direct impact has a diameter about 1.8 km, and a depth about 800 m, and the depth affected by the impact is about 1.4 km. The crater structure is divided into 3 parts, slow deposit area, rapid deposit area and affected area. According to the seismic velocity features, the velocity at the crater center where the depth is 800 m reaches 7.0 km/s, the isoline of 7.0 km/s is consistent with the crater configuration, but the velocity reached 7.0 km/s at the depth of 500~600 m in the edge of the crater. The structure of the crater body and the physical property of rocks confirm further the Xiuyan crater origin from meteorite impact.

Keywords: Meteorite impact crater Geophysical field Xiuyan Wave impedance difference Reflection and refraction exploration

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