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Triassic volcanic-sedimentary strata in the basement of Songliao Basin, discovered by International Continental Scientific Drilling Borehole, SK-2

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In the Songliao Basin, the existence of lower Mesozoic strata remains a debatable issue. Previous studies indicated the absence of Triassic to Lower and Middle Jurassic strata in northeastern China because of uplift and erosion events associated with the return of geo-synclinal folds and orogenic movement during the Late Permian–Early Jurassic. To date, geochronological studies of intrusive and metamorphic rocks in the basement of the Songliao Basin have also confirmed Carboniferous, Permian, and Late Jurassic ages for the basement formations in general. In the International Continental Scientific Drilling Project (ICDP) in the Songliao Basin, radiometric dating has been carried out for the entire drilling core of the SK-2 east borehole. As a result, we have discovered Triassic volcanic-sedimentary strata in the basement of the Songliao Basin. Laser-ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) U–Pb geochronology was used in this research. Errors in individual analyses by LA-ICP-MS are given at the 1σ level, whereas errors in pooled ages are given at the 95% (2σ) confidence level. Triassic volcanic-sedimentary strata revealed by the SK-2 east borehole consist of andesitic volcanic breccias at the bottom; andesites, sandstones, and conglomerates in the middle; and andesites at the top. The total thickness of these strata is over 500 m. The formation age of the andesite at the depth of 6,031.9 m is 242.4 ± 2.1 Ma (MSWD = 0.06, $n = 7$). The youngest peak age of the sandstone at the depth of 6,286.2 m is 242.2 Ma. The formation age of the andesite at the depth of 6,286.2 m is 242.6 ± 1.5 Ma (MSWD = 1.02, $n = 18$). This study demonstrates that in the Songliao Basin, there are not only Carboniferous and Permian strata, but also a Triassic volcanic-sedimentary succession in the basement of the basin. The SK-2 drilling core reveals that this volcanic-sedimentary sequence has great thickness. These Triassic volcanic-sedimentary strata provide new clues for the study of the origin and development of the Songliao Basin. As both volcanic and sedimentary rocks can be oil and gas reservoirs, this discovery also provides a new target for oil and gas exploration deep in the Songliao Basin.