GPR 3D High-resolution Imaging of Burrows Attributes
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The concept of enhancing storage and flow capacities in sedimentary strata through burrowing activity is well-established in sedimentary geology. This study explores the utilization of ground-penetrating radar (GPR) to capture and analyze burrow attributes in large rock samples, aiming to build a high-resolution 3D image that evaluates the impact of burrows on porosity and permeability. Using a shielded 2.7 GHz antenna, a GPR 3D dataset is acquired from an upper Cretaceous rock sample measuring 0.6 x 0.3 x 0.3 m³. The study focuses on mapping burrows within the rock sample by recording 88 profiles, each 0.3 m in length, with profile intervals of 0.67 cm. Data processing involves filtering techniques such as DEWOW, bandpass, gain, and moving average filters to enhance the recorded profiles, enabling the generation of a 3D block displaying burrow attributes like percentage, direction, and diameter. The processed GPR profiles are used to create a detailed 3D block illustrating the attributes of burrows within the rock sample. Furthermore, the study extends its analysis by scanning two 1 x 1 m² in situ locations within the same rock to assess the technique's field applicability. A comparative analysis against computed tomography (CT) scans shows the GPR's effectiveness in detecting complex burrow networks and capturing variations in burrow attributes that other methods may not fully capture. This research highlights GPR's potential as a valuable tool for characterizing small features in large rock samples or field acquisition, providing detailed 3D representations of subsurface structures, and offering insights into the porosity and permeability values.