CHARACTERISTICS OF MICROCRACKS IN SAMPLES FROM THE DRILL HOLE NÖRDLINGEN 1973 IN THE RIES CRATER, GERMANY,
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Core samples from the drill hole Nördlingen 1973 within the inner Ries Crater, Germany [1,2] were studied with a petrographic microscope, a scanning electron microscope (SEM) with an energy dispersive x-ray (EDX) analyser, and differential strain analysis (DSA) [3] for the purpose of defining the types of cracks present, the characteristic DSA parameters of each rock type, the relationship between observed cracks and the DSA spectra, and the variation of these properties with respect to depth in the core. The specimens were representative samples from 623 meters (amphibolitic gneiss), 638 meters (amphibolite cut by breccia dikes), 790 meters (hornblende-chlorite gneiss with flaser structure), 972 meters (flaser gneiss with aploid schlieren of plagioclase and chlorite), and 1126 meters (aplitic pegmatite with feldspar phenocrysts).

Microscopic indicators of weak shock (stage 0-1) were observed in all but the deepest sample [4]. These indicators include diaplectic quartz and feldspar [5], planar deformation features in quartz, plagioclase, and amphibole [5,6,7], and shock-induced transgranular cracks [7]. These cracks are partially or completely healed or sealed with mineral debris, quartz, chlorite, oxide phases and/or glass as indicated by detailed SEM and EDX analyses. A notable feature of the partially sealed cracks in these samples is the direct correlation between short, bluntly terminated, partially healed intragranular cracks, and fluid inclusions or bubble planes in quartz and feldspar. Many cracks now healed or sealed resemble morphologically the open microcracks present in returned lunar samples-we infer they were produced by the shock event. Sample 1126 exhibits abundant partially to completely sealed transgranular cracks, but neither planar deformation features nor diaplectic glass were observed in silicate minerals. A distinct set of open microcracks with abundant straight segments which cut shock-induced features in all samples is probably due to stress relief on removal from the earth or to the drilling process.

Representative cumulative crack porosities of the shallowest (623) and deepest (1126) samples studied are plotted in Figure 1. The significance of these data is the closure of about half the open cracks at a pressure approximating the <u>in situ</u> pressure of 1421,623. These results are consistent with the interpretation that most open microcracks are the result of stress relief or drilling. The healing and sealing processes which probably are more efficient with increasing depth in rocks

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from beneath the Ries Crater have sealed chemically most of the microcracks that were produced by the naturally occurring shock event. The healed and sealed cracks in the Ries core, however, are valid analogues of the open shock-induced cracks of lunar rocks. Most importantly, the Ries healed and sealed cracks demonstrate unequivocally that open shock-induced cracks do form in rocks *in situ* at the time of the shock event.

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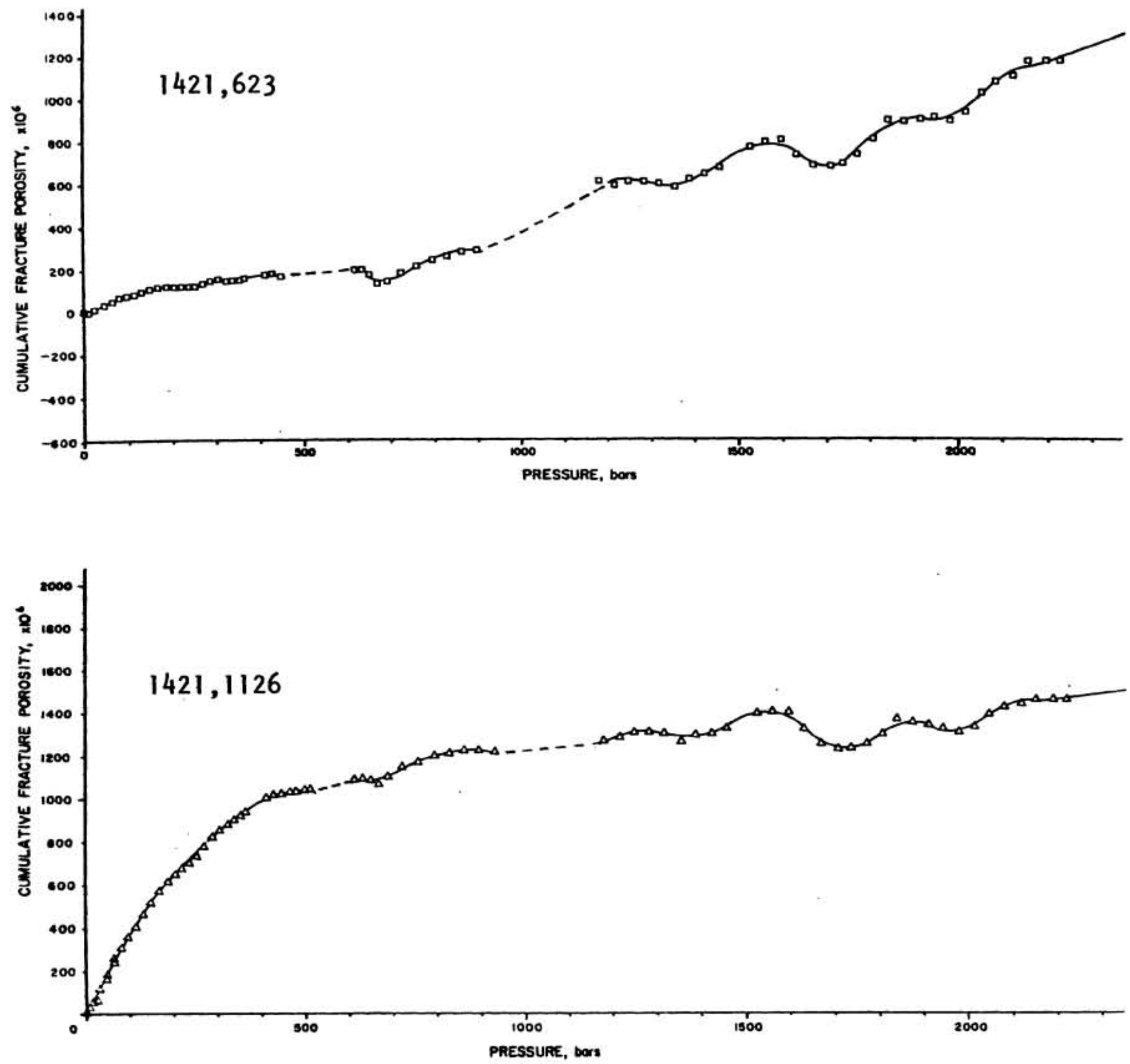

Figure 1. Cumulative crack porosity versus pressure. Note that the cumulative crack porosity for 1421,623 increases continuously to 2600 bars, while that for 1421,1126 becomes approximately constant at pressures above 500 bars. (Dashed where equipment malfunction necessitated curve smoothing.)