Science - Earth Sciences; University of Texas Austin Researchers Detail Research in Earth Sciences (Diagenesis is key to unlocking outcrop fracture data suitable for quantitative extrapolation to geothermal targets)

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2025 APR 18 (NewsRx) -- By a News Reporter-Staff News Editor at Science Letter -- New research on earth sciences is the subject of a new report. According to news reporting from Austin, Texas, by NewsRx journalists, research stated, "Exceptionally large, well-exposed sandstone outcrops in New York provide insights into folds, deformation bands, and fractures that could influence permeability, heat exchange, and stimulation outcomes of geothermal reservoir targets. Cambrian Potsdam Sandstone with <5% porosity contains decimeter-scale open, angular-limbed monoclines <0.5 km apart with associated low-porosity mm-wide cataclastic deformation bands."

The news correspondents obtained a quote from the research from University of Texas Austin: "Crossing and abutting relationships among sub-vertical opening-mode fractures show four chronological Sets A-D, striking NNW, NE, NW, and ENE, respectively. Fracture lengths and heights range from millimeters to tens of meters. Sets A and C macro-fractures, and possibly B and D, contain quartz deposits. All sets have abundant associated quartz cemented microfractures that also record set orientations and crosscutting relations. Quartz cement deposits-evidence of diagenesis-are the key to identifying attributes of outcrop fractures suitable for extrapolation to geothermal targets in sandstones because they show which fractures formed in the subsurface. Set A fluid inclusion homogenization temperatures (120°C-129°C) are compatible with fracture at >3 km depth. Fractures are stiff and those 0.05 mm (Set C) and 0.1 mm (Set A) are open and potentially conducive to flow. Sets A and D are abundant in outcrops with close fracture spacing-0.18 m and 0.68 m, respectively-and define a rectangular connectivity network dominated by crossing and abutting X and Y nodes. Set A aperture distributions follow a power law with slope -0.8 up to 0.15 mm; other sets have lognormal distributions. Set A and D microfractures are weakly clustered, while macro-fractures commonly have 1D anticlustered (regular or periodic) arrangements at shorter length scales (<0.2 m). Sub-horizontal fractures are barren and may have formed near the surface. Fracture heights, lengths, and spatial arrangements show good trace connectivity but low open connectivity."

According to the news reporters, the research concluded: "For geothermal applications, outcrop results predict low initial well-test permeabilities owing to quartz disconnecting open fractures, but stimulation of closely spaced microfractures and partly open macro-fractures could yield high surface area for heat exchange. Quantitative extrapolation of key fracture attributes like abundance, orientation, spatial arrangement, length, and open fracture connectivity is possible from outcrops to fractured reservoirs if differing thermal histories and diagenesis are accounted for."

For more information on this research see: Diagenesis is key to unlocking outcrop fracture data suitable for quantitative extrapolation to geothermal targets. Frontiers in Earth Science, 2025,13. (Frontiers in Earth Science - http://www.frontiersin.org/earth_science). The publisher for Frontiers in Earth Science is Frontiers Media S.A.

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Our news editors report that more information may be obtained by contacting S. J. Elliott, **Bureau of Economic Geology**, University of Texas Austin, Austin, TX, United States. Additional authors for this research include S. R. Forstner, Q. Wang, R. Correa, M. Shakiba, S. A. Fulcher, N. J. Hebel, B. T. Lee, S. T. Tirmizi, J. N. Hooker, A. Fall, J. E. Olson, S. E. Laubach.

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