Science - Earth Science; Data from University of Texas Austin Provide New Insights into Earth Science
(Mechanisms for the Generation of Complex Fracture Networks: Observations From Slant Core, Analog Models, and Outcrop)

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2022 APR 15 (NewsRx) -- By a News Reporter-Staff News Editor at Science Letter -- Research findings on earth science are discussed in a new report. According to news originating from Austin, Texas, by NewsRx editors, the research stated, "We use observations of hydraulic fractures in core, outcrop attributes of natural hydraulic fractures, and analogue models, to address how hydraulic fracture networks evolve. A slant core from the Wolfcamp Formation-an unconventional shale hydrocarbon reservoir in the Permian Basin of West Texas-collected within 18 m and 30 m of two hydraulically stimulated horizontal wells, provided an opportunity to examine hydraulic fractures directly."

The news editors obtained a quote from the research from University of Texas Austin: "In approximately 183 m of core, 309 calcite-sealed natural opening-mode fractures and 375 hydraulic fractures were identified. Many hydraulic fractures in the core show complex morphology, including twist-hackle segmentation, diversion, and bifurcation; these structures most commonly develop at lithological bed boundaries and mechanical heterogeneities such as natural fractures and concretions. An outcrop of bed-parallel pavements in the Cretaceous Boquillas Formation in West Texas contains opening-mode fractures that likely formed by natural hydraulic fracturing. Fracture traces provide evidence of twist-hackle segmentation, and are typically associated with bed boundaries and preexisting bed-parallel stylolites. A laboratory study of hydraulic fracturing of 33 synthetic blocks of gypsum and hydrostone revealed fracture steps, diversions, twist hackles, and multiple overlapping fractures together with information on fracture growth directions. These complexities in the fracture network were dominantly nucleated at inclusions used to simulate pre-existing fractures, and as a result of mechanical heterogeneity introduced by the wellbore and perforations. Collectively, our results show that complex

fracture networks are produced in hydraulic fracturing of self-sourced reservoir strata. Mechanical stratigraphic
boundaries and other heterogeneities are likely to enhance fracture network complexity through the processes of
segmentation, diversion, and bifurcation."
According to the news editors, the research concluded: "These processes create multiple fracture strands,
resulting in an increased number of hydraulic fractures over those initiated, thereby increasing total fracture
surface area. Our study provides insight into hydraulic fracture network propagation, and has applications for
evaluation, completion, production, and fracture modeling of unconventional reservoirs."
For more information on this research see: Mechanisms for the Generation of Complex Fracture Networks:
Observations From Slant Core, Analog Models, and Outcrop. Frontiers in Earth Science, 2022,10. (Frontiers in
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Our news journalists report that additional information may be obtained by contacting Bethany Rysak, Bureau of
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