

## **Bioturbation Effects on Fracture Characterization in Carbonate Rocks: Insights from the Aruma Formation, Central Saudi Arabia**

**Nabil A. Saraih<sup>1</sup>, Hassan Eltom<sup>1</sup>, Robert H Goldstein<sup>2</sup>, Ammar El-Husseiny<sup>1</sup>, Sherif Hanafy<sup>1</sup>, Scott A. Whattam<sup>1</sup>, John Humphrey<sup>1</sup>, Moaz Salih<sup>1</sup>**

<sup>1</sup>King Fahd University of Petroleum and Minerals

<sup>2</sup>University of Kansas

### **Abstract**

Previous studies have investigated the relationship among bioturbation, porosity, and permeability in carbonate reservoir rocks. However, the influence of bioturbation on natural fractures within these rocks remains relatively unexplored, despite its importance for efficient subsurface resource management. This research focuses on examining the relationship between bioturbation attributes (such as burrow percentage, diameter, and morphology) and fracture characteristics in a well-exposed outcrop: the Upper Cretaceous Khanasir Member of the Aruma Formation in central Saudi Arabia. To achieve the objective of this study, a comprehensive approach was adopted, encompassing field investigation, petrography, imaging analysis, and CT scanning. The results quantify the relationship between burrow attributes and fracture characteristics across different scales, from thin sections to outcrop scale. At the outcrop scale, the Khanasir Member reveals three distinct units distinguished by their fracture and burrow attributes. In these units, two primary categories of fractures are evident: (1) burrow-related fractures, influenced and controlled by bioturbation; and (2) non-burrow-related fractures, unaffected by bioturbation. Fracture characteristics within these units are influenced by various factors, including burrow percentage, shape, whether they are open or filled, the composition of fillings, mineralogy and texture of the host rock matrix. Additionally, the absence of burrows also plays a role in shaping these fracture characteristics. The interaction of these factors has a direct impact on fracture characteristics such as density, length, and spacing, all of which influence fluid flow behavior in subsurface reservoirs.