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Correlation analysis of fracture arrangement in space

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- Fracture spacing does not effectively characterize overall pattern arrangement
- New analyses includes positional information for better pattern description
- New analyses employ Fourier periodograms and correlation integral
- Approaches can include fracture size
- Software measures statistical significance spatial correlation and allows rigorous pattern classification

Graphic abstract: Figure 12
Variation of spatial correlation with length scale, and interpretation of some patterns (a-h). x-axis is linear in a through d, logarithmic in e through h. (a) A flat-line pattern of spatial correlation (slope = 0; correlation = 1) indicates no statistically significant organization. (c, d, h) Periodic peaks and troughs (best appreciated with linear graduations of length scale) indicate regular spacing, another form of self organization. Combinations of any or all of these patterns can occur, with different patterns characterizing different ranges of length scale. (b) Individually anti-clustered but not regularly spaced. (f-h) Power-law variation of spatial correlation with length scale (slope $\neq 0$; best appreciated with logarithmic graduations of length scale) indicates fractal clustering, one form of self organization. (e) A plateau-and-basin pattern of spatial correlation (slope = 0; correlation $\neq 1$) indicates statistically significant clustering, due to some process other than self organization such as inherited or externally imposed control. Column colors mark linear and log scales.