Spatial Mapping of Heterogeneous Strain Patterns Using GIS

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Overview

• Introduction
• Background
• Data
• Methodology
• Results and Discussion
• Conclusion
Introduction

- Strain and stress on a rock
- Strain like pages to part of a story of the rock
- Finite strain analysis
- Problems with conventional finite strain methods
- Need for more thorough methods
Objectives

1) To assess the nature and cause for the degree of spatial heterogeneity of strain in deformed oolites at different scales.

2) To compare the results of this method with the Fry method, its enhancements, and the Rf/φ method in order to show limitations with using those conventional methods as oppose to this one.
Background

- Strain Analysis
- GIS in microscopic analysis
- Conventional Methods
  - Fry Method
  - Rf/phi
  - Assumptions
    - Prefer dispersed data
    - Strain homogeneity
  - Spatial Statistics
Data

- Variables
- Orientation
- Strain Magnitude (Major/Minor Axes)
- Synthetics (Adobe Illustrator)
- Natural: Ordovician Beekmantown Dolomite
Methodology

- Exploratory Statistics
- Distribution analysis (Global Moran’s I)
- Cluster analysis
  - Gi* Statistic (Hot Spot)
  - Local Moran’s I
- Create Map Composite
- T and F tests between cluster and whole data
- Measuring heterogeneity using semivariograms
- Comparison of method with Fry and Rf/phi methods
Results

- Histograms and box and whisker plots
  - Overlook on data
  - Means
- Distribution
  - Some dispersed and clustered
  - Mostly random
- Omnidirectional semivariograms
- Directional semivariograms show anisotropy
- Maps were created
- T and F tests
  - Orientation (Pass) T 41/44 F 39/44
  - Strain magnitude (Pass) T 5/43 F 28/43
- Fry and Rf/phi plots were created
Shear
Subset 40
Further Discussion

- Further Use for method
- Highlighting clusters
- Showing direction and magnitude
Conclusion

- Strain analysis
- Thorough GIS based method
- Explore statistics of data
- Use of spatial statistics
- Compiling clusters and mapping
- Measuring heterogeneity
- Statistical testing
- Comparing with conventional methods
¿Preguntas?

Questions?