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Generating volumetric composition maps from particle based computational geodynamic simulations.

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The advent of using large scale, high resolution three-dimensional hybrid particle-grid based methods to study geodynamics processes is upon us. Visualizing and interpreting the three-dimensional geometry of the material configuration after severe deformation has occurred is a challenging task when adopting such a point based representation.

In two-dimensions, the material configuration is readily visualized by creating a simple (x,y) scatter plot, using the particles position vector and coloring the points according to the lithology which each particle represents. Using only colored points (which do not need to be rendered as spheres), this approach unambiguous fills the 2D model domain with information defining the current material configuration.

Along with an increased volume (i.e. MBytes) of output data generated by three-dimensional simulations, the higher dimensionality introduces additional complexities for visualization. The geometry of the deformed material in three-space will become topologically more complex than its two-dimensional counterpart. Secondly, the scatter plot approach used in 2D to represent the material configuration simply does not extend to three-dimensions as technique is unable to provide any sense of depth.

To address some of the visualization challenges posed by such methods, we describe how an Approximate Voronoi Diagram (AVD) can be used to produce a volumetric representation of point based data. The AVD approach allows us to efficiently construct a volumetric partitioning of any subset of the model domain amongst a set points. From this representation, we can efficiently generate a representation of the material configuration which can be volume rendered, contoured, or from which cross sections can be extracted.

The type of volumetric representations possible, and the performance characteristics of the AVD algorithm were demonstrated by applying the technique to simulation results from models of continental collision and salt tectonics.