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Deterministic Chaos in Stretching Lineations from a Lesser Himalayan Shear Zone, Kumaun Lesser Himalaya

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A B S T R A C T

Time and again earth scientists are struck by the messiness of geological data and resort to make- do alternatives that go by more respectable adjectives like averaging, generalizations, satisfactory, tolerable etc. in the geological literature. Interestingly, there are a large variety of data types that may be better comprehended. A geometry rooted in geology (geomorphology) is likely the best to comprehend geological phenomenon. Admittedly, despite being observed at all length scales, viz. from the sub nuclear to the cosmological, turbulence is one of the least understood physical phenomena. Deterministic chaos addresses problems that defy accepted ways of working in science. We attempt to explore the deterministic chaos in the Basal Shear Zone of Almora Nappe in Kumaun Lesser Himalaya employing fractal geometry. The shear zone is characterized by stretching lineations (mineral lineations) formed during the evolution of the shear zone, which classical structural geologists would be tempted to plot on the stereo net and would uncritically 'determine' a generalized direction of tectonic transport for the shear zone, with little regard to the fact that in this case the lineation directions vary from WNW to East and their plunges vary a good 35 degrees within the shear zone. We present a geometrical model for the evolution of shear zones in three dimensions (+ time) and with the help of a program written for the equations of particle paths during the evolution of a shear zone demonstrate that mathematically chaos (turbulence) is expected and the latter manifests in field in the chaotic (deterministic) stretching lineations and other geological structures that likely owe their origin to turbulence.