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Stress-Strain Evolution During Peak-Ring Formation: A Case Study of the Chicxulub Impact Structure

Auriol S. P. Rae[1,2], Gareth S. Collins[1], Michael Poelchau[2], Ulrich Riller[3], Thomas M. Davison[1], Richard A. F. Grieve[4], Gordon R. Osinski[4], Joanna V. Morgan[1], and IODP-ICDP Expedition 364 Scientists

[1]Department of Earth Science and Engineering, Imperial College London, London, UK, [2]Institut für Geo- und Umweltnaturwissenschaften, Albert-Ludwigs-Universität Freiburg, Geologie, Freiburg, Germany, [3]Institut für Geologie, Universität Hamburg, Hamburg, Germany, [4]Department of Earth Sciences/Centre for Planetary Science and Exploration, Western University, London, Ontario, Canada

Key Points:
- Numerical impact simulations are used to track stress and strain during complex crater formation
- Stress and strain predictions allow time, orientation, and magnitude constraints on the deformational history of paraautochthonous rocks
- Predicted strains are consistent with the deformation observed within rocks of the Chicxulub peak ring

Supporting Information:
- Supporting Information S1

Correspondence to:
A. S. P. Rae,
auriol.rae@geologie.uni-freiburg.de

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Abstract Deformation is a ubiquitous process that occurs to rocks during impact cratering; thus, quantifying the deformation of those rocks can provide first-order constraints on the process of impact cratering. Until now, specific quantification of the conditions of stress and strain within models of impact cratering has not been compared to structural observations. This paper describes a methodology to analyze stress and strain within numerical impact models. This method is then used to predict deformation and its cause during peak-ring formation: a complex process that is not fully understood, requiring remarkable transient weakening and causing a significant redistribution of crustal rocks. The presented results are timely due to the recent Joint International Ocean Discovery Program and International Continental Scientific Drilling Program drilling of the peak ring within the Chicxulub crater, permitting direct comparison between the deformation history within numerical models and the structural history of rocks from a peak ring. The modeled results are remarkably consistent with observed deformation within the Chicxulub peak ring, constraining the following: (1) the orientation of rocks relative to their preimpact