Correlative Study On Microstructure And Mechanical Behavior Of Chondrite Meteorite

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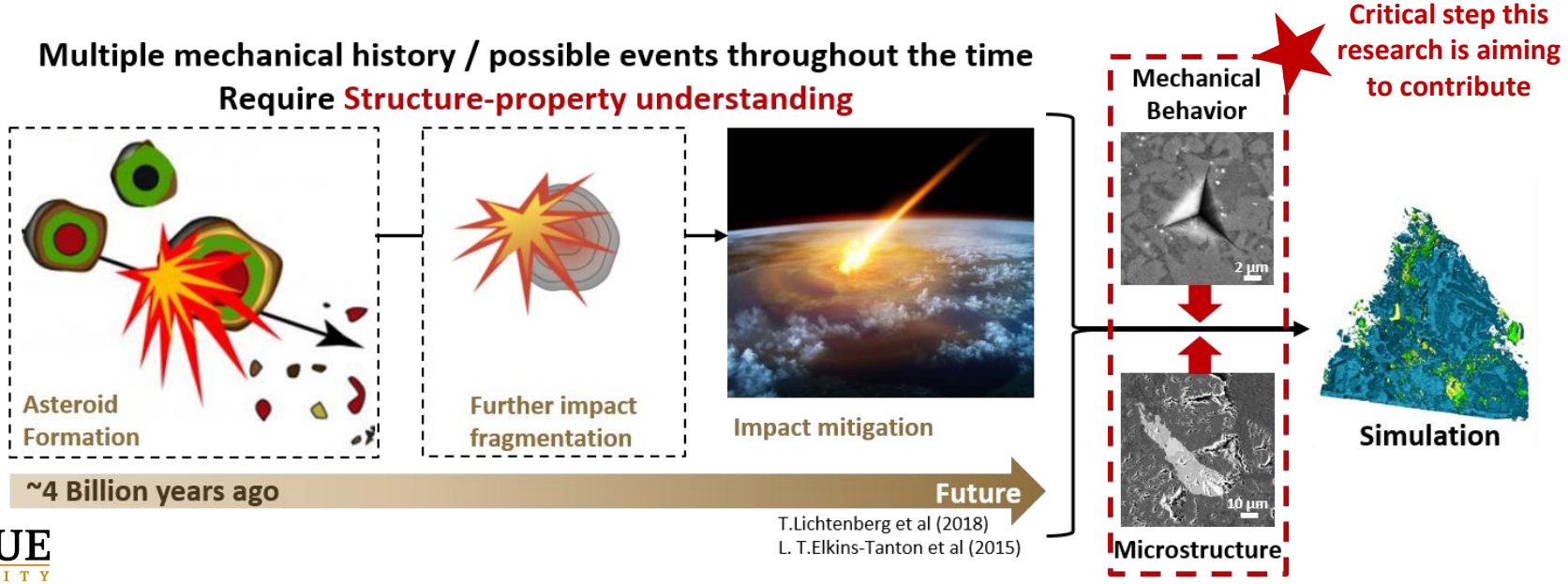
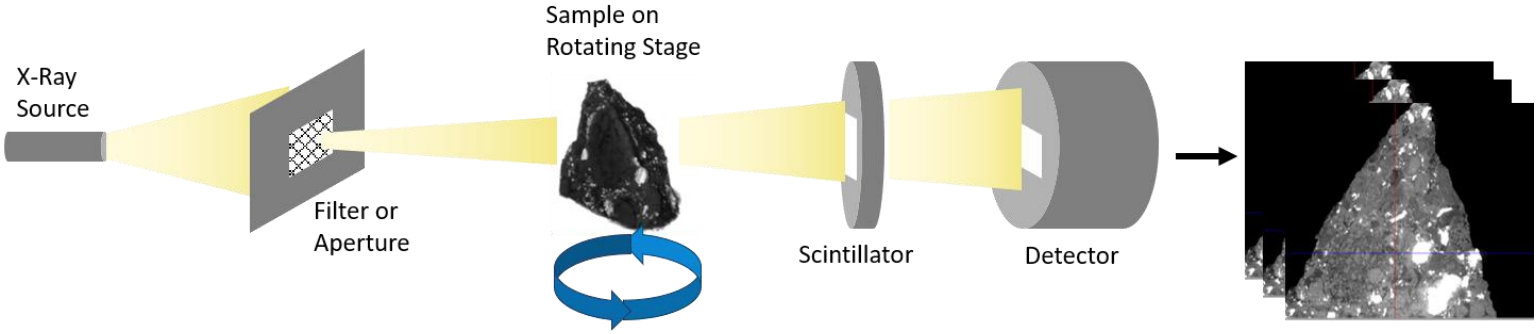
Motivation and Objectives

- **Motivation**
  - **Meteorite** provides opportunity to **infer properties of parent body**
  - A through understanding of meteorite **structure-property relation** is required for:
    - **Formation / fragmentation study**
    - **Impact risk mitigation**
    - **Simulation model**
- **Research Objectives**
  - Establish **comprehensive understanding of Aba Panu (L3)**
  - Investigate relations through **correlative characterization techniques**
    - **Structural Characterization**
    - **Mechanical Behavior**

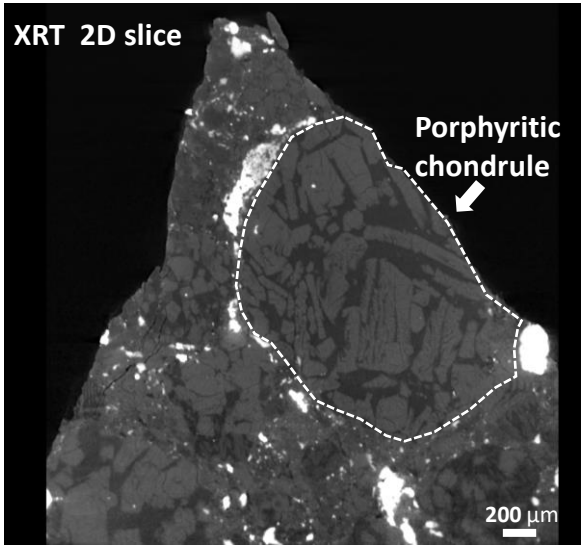


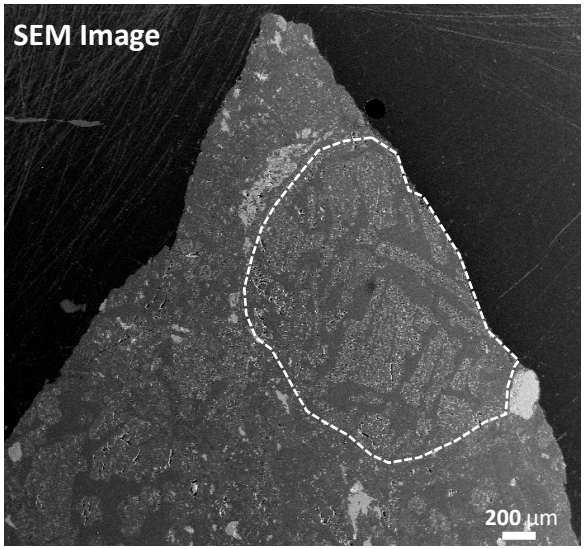
Structural Characterization

- **Correlate non-destructive 3D XRT analysis with detailed 2D examination**
  - XRT volume scan to non-destructively obtain 3D structural information



X-ray Tomography





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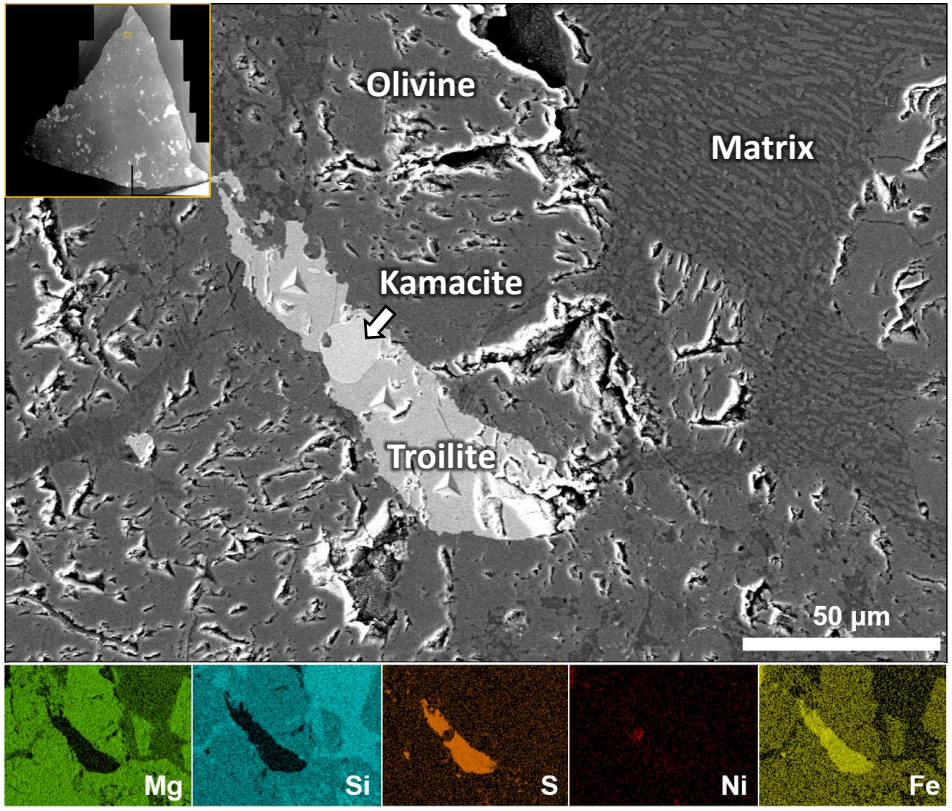
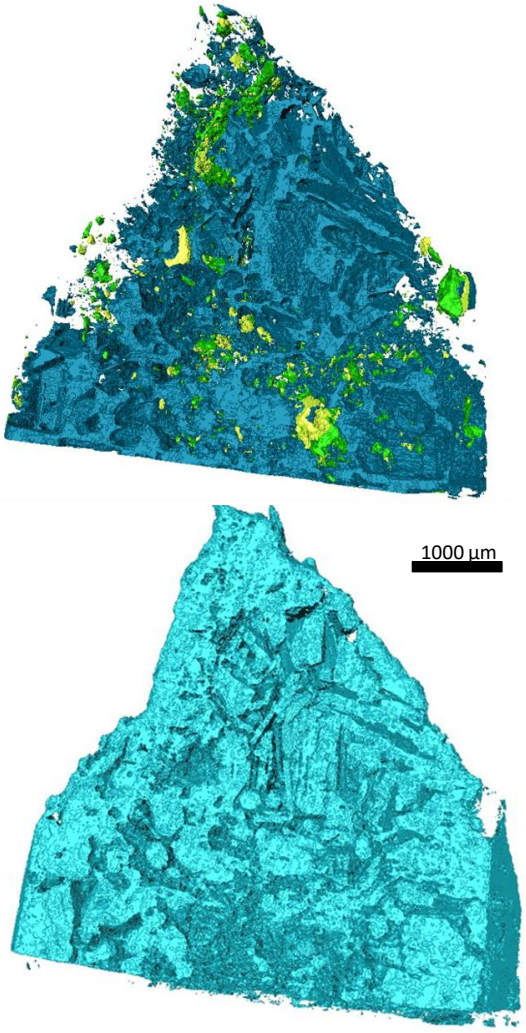
Structural Characterization

- **Correlate non-destructive 3D XRT analysis with detailed 2D examination**
  - Electron spectroscopy reveals local structural details and phase composition

SEM and EDS 2D analysis for microstructure and phase identification



Correlative result of 3D phase special distribution



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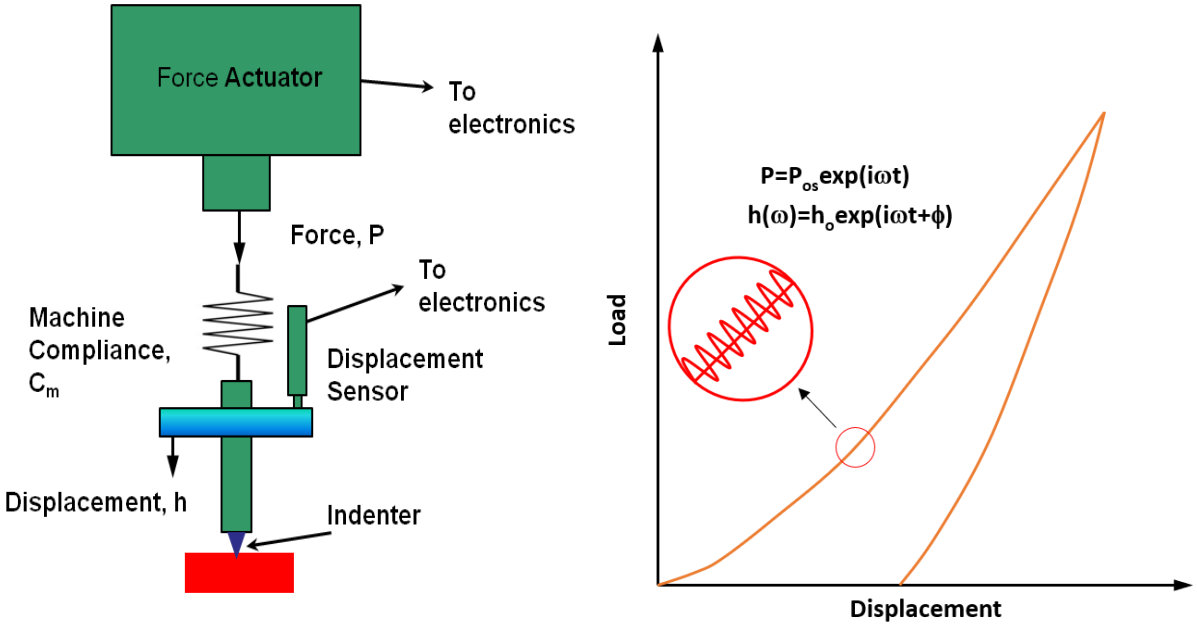
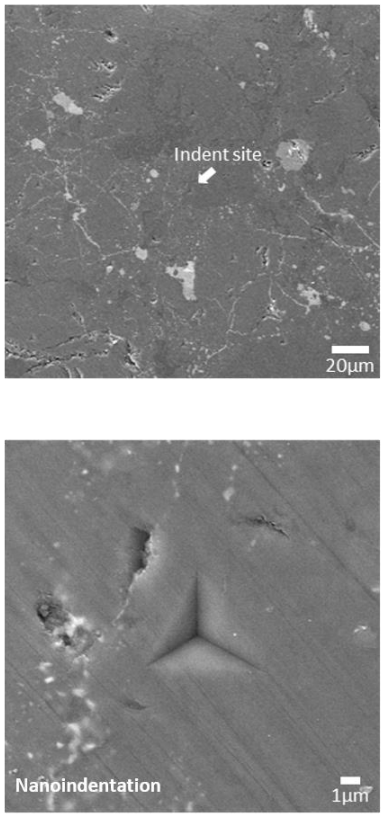
Mechanical Behavior

- **Mechanical Behavior of Individual Meteorite Phases**
  - Precise micro modulus and hardness via **Continuous Stiffness Measurement (CSM)** technique using **nanoindentation**
  - Combined mechanical response of lamellar matrix using **Vickers hardness test**

Basic Components of Instrumented Indentation Tester and load calculation



Individual phase modulus/hardness measurement



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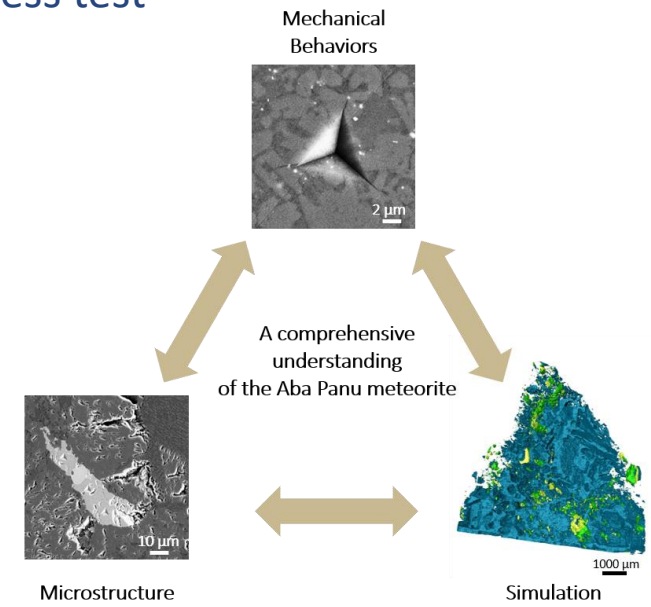
Summary and Future work

- **Summary**
  - **Structural Characterization**
    - **3D** Phase distribution via non-destructive **X-ray tomography**
    - **2D** composition analysis + detail structure observation
  - **Mechanical Behavior**
    - **Micro modulus/hardness** of individual phase via **Nanoindentation**
    - Combined response of matrix via Vickers Hardness test

	Metallic Phases			Mineral Solid solutions		Matrix
	Kamacite	**Troilite**	**Chromite**	**Olivine**	**Pyroxene**	**Matrix**
Modulus (GPa)	211.3	108.0	153.1	202.7	157.9	X
Hardness (GPa)	3.3	3.9	16.7	16.4	12.7	651.1 **MPa**



- **Future work**
  - **Scale dependent** structure-properties relations investigation
  - Expand research scope to **multiple meteorite types**
  - Provide solid results for **simulation model construction**

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Thank you for listening!

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