

GIGAPIXEL OPTICAL MICROSCOPY FOR METEORITE CHARACTERIZATION

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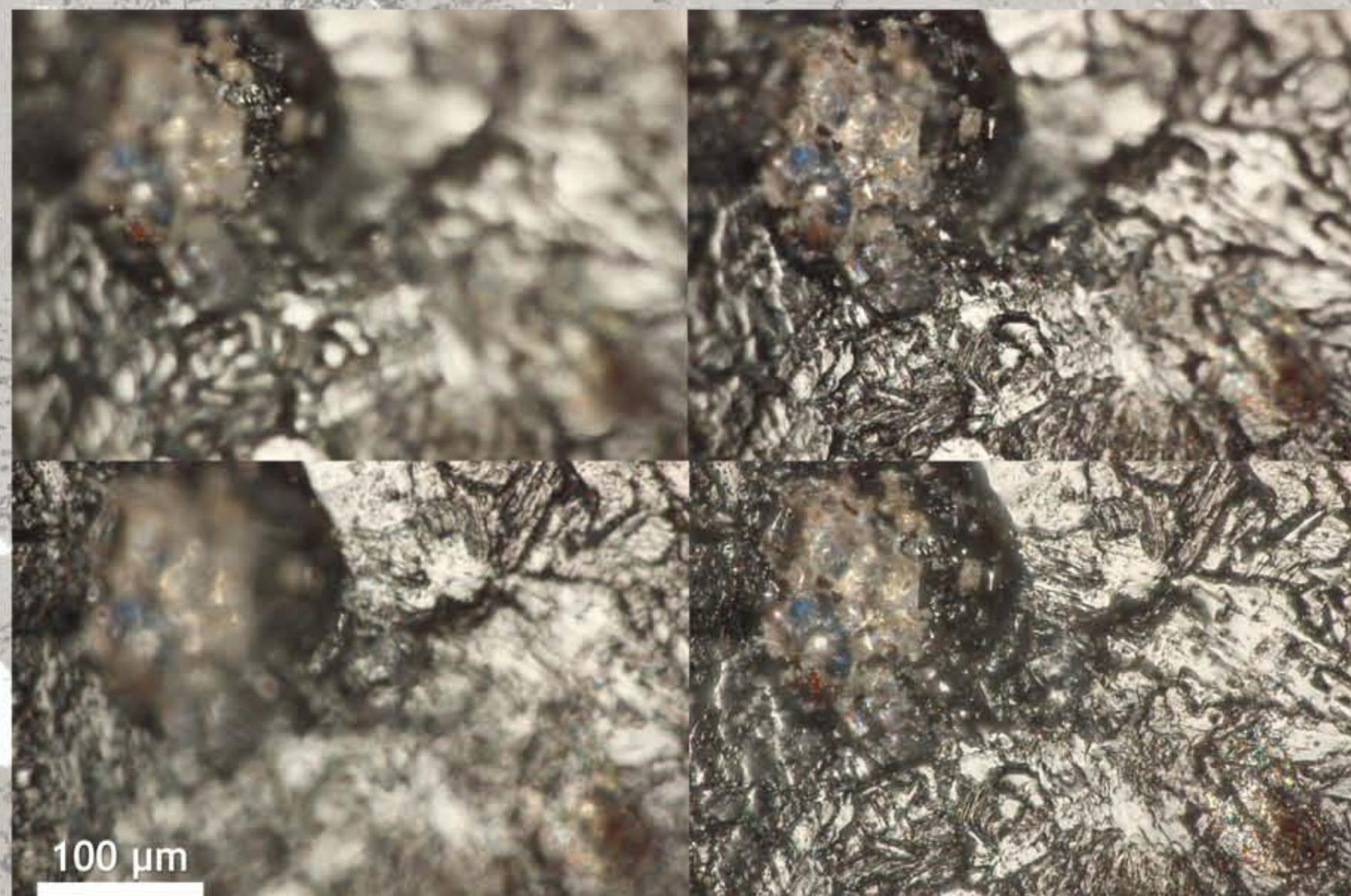
Introduction: We describe an automated microscopy setup for the acquisition, creation, and display of optical micrographs at ~385 nm/pixel for typical meteorite thin sections up to a few cm in size, resulting in a total image size of up to a few billion pixels. Our system employs focus stacking and exposure fusion to properly image variable-height and high-contrast samples. Using free software available for Windows and Macintosh, these images can be shared and viewed easily in a web browser, allowing for smooth zooming and panning. The result is a "virtual microscope" in which the static optical characteristics of the meteorite thin section can be examined without the operator having to sit in front of the microscope with the sample in hand. The software for our system is entirely open source and can be improved upon and adapted for a wide range of applications. The system we describe is entirely automated and can be set up on any optical microscope with a computer-controlled stage and modern consumer-grade digital camera.

Microscopy Setup:

Nikon AZ100 Multizoom Research Microscope System
0.5x, 1x, and 4x objective lenses
Transmitted, reflected, plane-polarized, cross-polarized light
Prior Optiscan II stage
1 micron step size in x and y, 0.1 micron in z
Canon T2i digital SLR camera
Capture live video feed (1056x704 pixels = 385nm/pixel at max zoom)

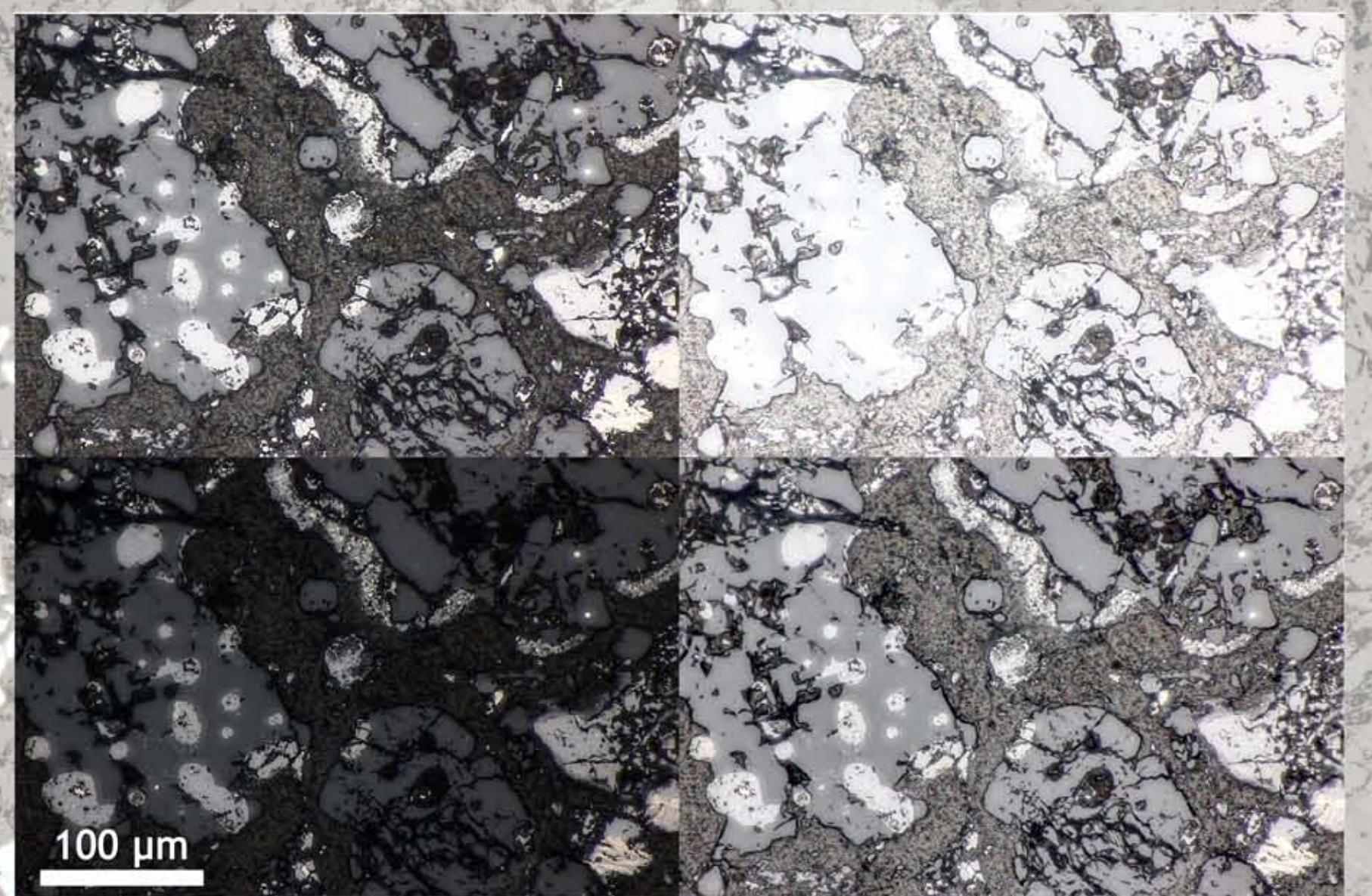
Computer Control
Stage through serial port and minicom
Camera through USB and libgphoto2
Fedora Linux OS and tcl/expect scripting
8-core AMD, 16 GB RAM (required for blending gigapixel images)
Mosaic tile capture
User defines corners of region to be imaged
Matlab script writes a tcl/expect script
Mosaic stitching
Automated using Hugin scripts
Mosaic viewing
Microsoft HDView

Focus Stacking:

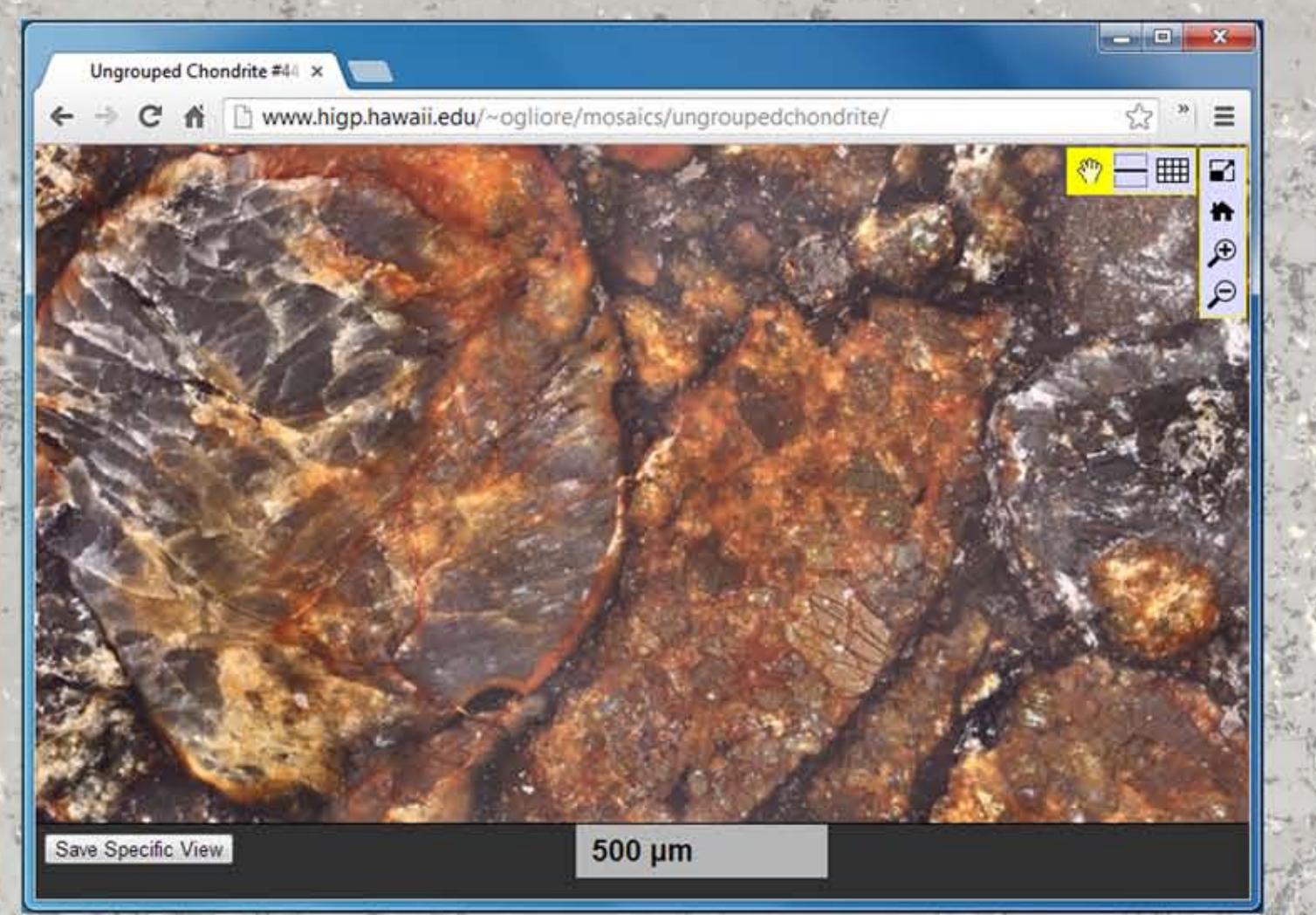


Sample mosaics are available to view at: <http://www.higp.hawaii.edu/~ogliore/mosaics/>
The software used to create and assemble these gigapixel mosaics is available as open source code (free to use, modify, and share) at:
<http://www.higp.hawaii.edu/~ogliore/mosaics/software/>
(Familiarity with Linux and scripting is recommended).

Exposure Fusion:



Viewing the gigapixel image:



HDView allows for smooth zooming and scrolling
Scale bar changes with image zoom

4 mm

The background of this poster is a crop (printed at 200 dpi, 42" x 42") of a 1.5 gigapixel mosaic of a thin section of Renazzo (CR2) in reflected light.