

# MACROSCOPIC SOLUTIONS

*Inspiring Discovery*

Macroscopic Solutions, LLC  
Tolland, CT  
[www.macroscopicsolutions.com](http://www.macroscopicsolutions.com)

Macroscopic Solutions  
1 Technology Dr.  
Tolland, CT 06084  
Descriptive Literature

## *Background*

Macroscopic Solutions, LLC is the developer and sole source provider of the Macropod imaging system technology. This technology comprises a series of professional digital imaging systems that perform a variety of functions including high resolution macro/micro imaging, 3D scanning/modeling and 1080P/high speed (60fps) video in both lab and field-based settings.

Macropod imaging systems are fully portable and automated devices capable of capturing detailed, high resolution images for samples ranging from 1 micron to infinity ( $\infty$ ).

## *Photographic Capabilities*

The primary function of a Macropod as a photographic apparatus is to create focus stacked (z-stack) images of a specimen. The apparatus includes a rigid longitudinal member having a longitudinal axis and includes translational and rotational stages that are designed to move the specimen relative to the camera mount. The translational device allows for precise positioning and panoramic style imaging. The rotational device allows for the specimen to be rotated 360° around a first axis that is perpendicular to the longitudinal axis to generate 3D movies and point clouds that can be used for 3D printing, volumetric analyses and as visual aids for research and educational purposes. Macropod systems achieve all this while maintaining a compact, rigid and reliable platform that can be easily transported and carried into the field using only the provided backpack.

Macropod systems are available in a variety of configurations for imaging a diverse range of scientific, industrial and material specimens. Each system includes all necessary hardware and software for immediate use.

The 1-5x stereoscopic lens is best used for pinned insects, rocks, fossils, minerals, metals, plants and slides that are smaller, but not limited to, 4 cm in size (Fig 1).

The added capability of long working distance (LWD) objectives resolve details 0.4 microns in size (Fig 2). Note\*\*\* 100x would be the equivalent to 1000x on a compound microscope as those manufacturers multiply the 10x eyepiece by the microscope optic. 100mm, 70-200mm, and 24-105mm lenses are also offered for imaging subjects greater than 4 cm in size.

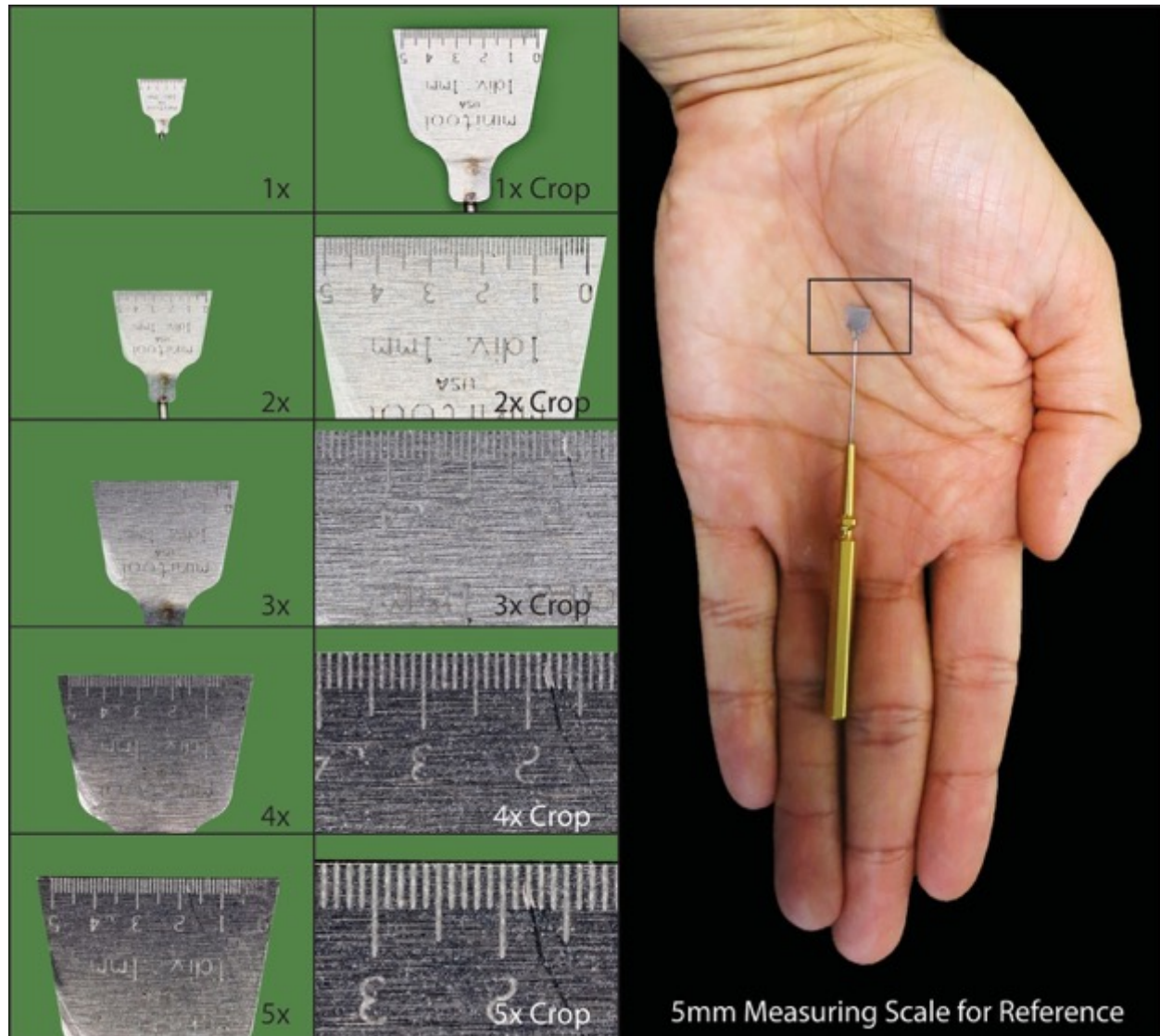


Figure 1.

### *3D Modeling Capabilities*

The secondary function of a Macropod is to create 3D models of 1) small specimens ranging from >100 microns to 2) broad landscapes/terrain/outcrops in the field ( $\infty$ ). Imagery acquired is processed using photogrammetry in order to create an accurate 3D representation of the subject being photographed (Fig 3).

### *Ergonomics*

Macropod imaging systems are designed to be ergonomically beneficial. The microscope/camera live view is transferred to a computer screen which eliminates eye and back strain commonly experienced when looking through microscope binoculars. The motorization/automation of the system naturally lends itself to ergonomics and work flow. Light intensity and other camera settings are adjusted through a user-friendly interface on the computer.

### *Infrastructure*

No special infrastructure is needed for a Macropod setup other than any solid surface (i.e. table). It may run plugged into standard 120V electrical outlets or can be completely battery-operated.

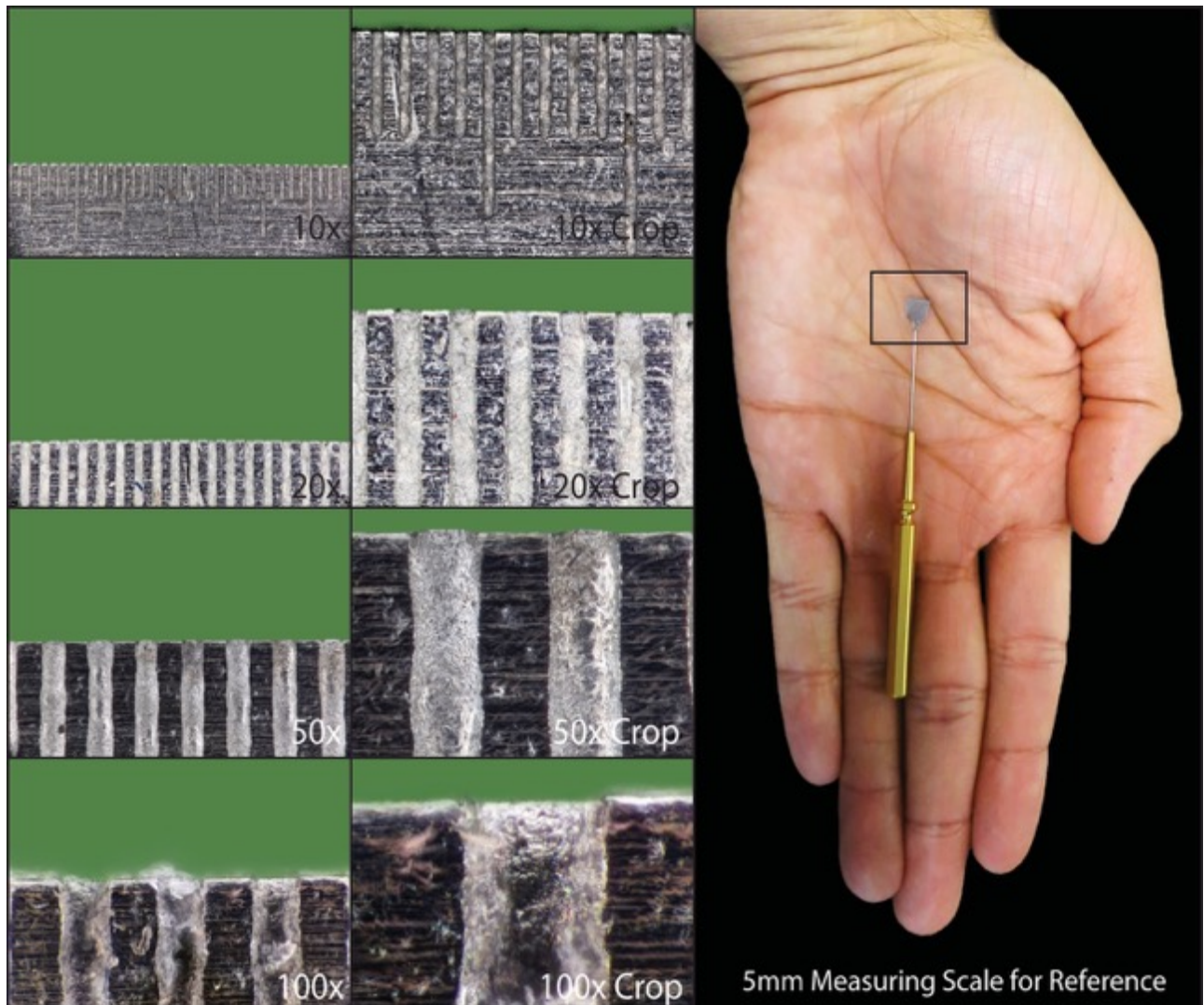


Figure 2.

### *Additional Capabilities and Advantages*

Macropod imaging systems utilize reflected, transmitted, fluorescent and cross-polarized light sources. The systems can be configured for each lighting technique while ensuring a smooth, even light distribution.

The camera body incorporates a GPS receiver so that images captured in the field can be georeferenced in a geospatial reference frame.

Sample preparation is not needed and imaging methods are non-destructive. The systems are capable of imaging dry specimens as well as specimens in solution.

Macroscopic Solutions' imaging systems are modular, meaning they are compatible with other Macropod products. Additional and future capabilities can be added without the need to purchase separate systems.

#### *Applications*

Macropod imaging systems are designed for interdisciplinary use in science and engineering. The following figures describe some ways in which the technology has been used. Please note the images shown are not full resolution but can be downloaded in max resolution on Flickr. To access additional information about the Macropod technology, its accessories and a database of images, please visit Macroscopic Solutions' website and Flickr page.

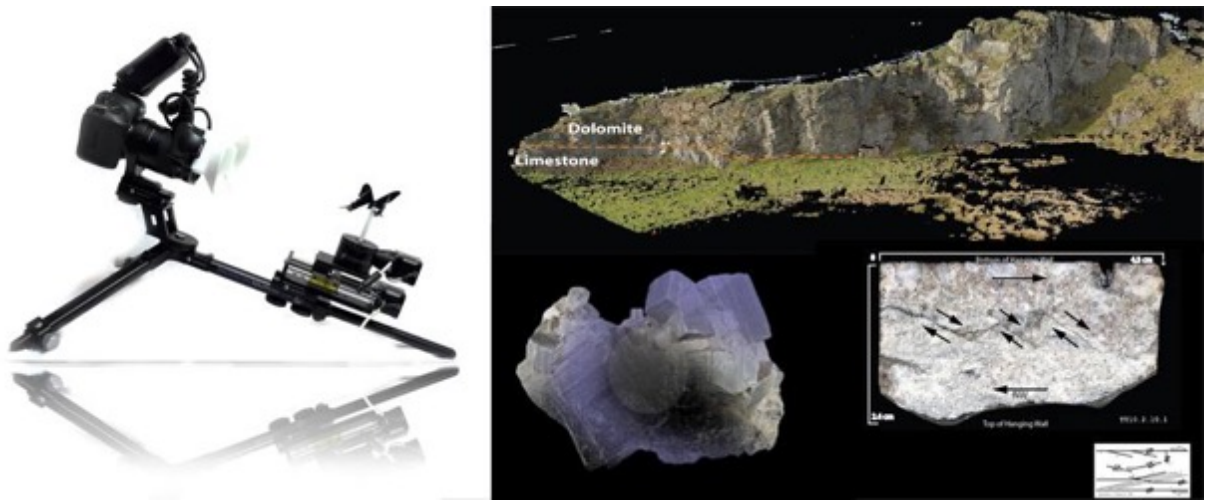


Figure 3. 3D Models of Pyrite, Micro Structures and Geological Outcrop



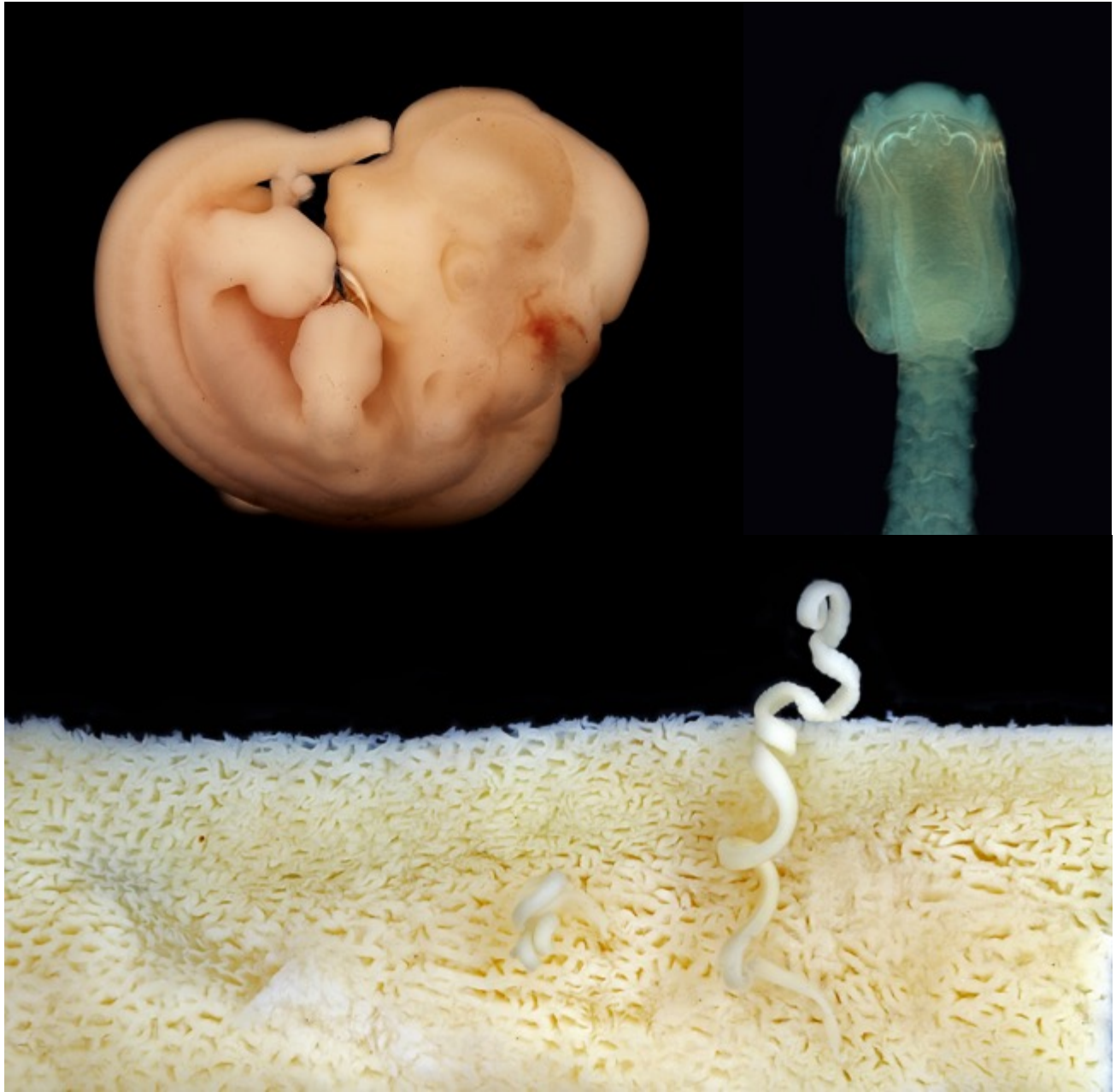


Figure 4. Mouse embryo in solution (bottom left), tapeworm (right), tapeworm in shark intestine (bottom).

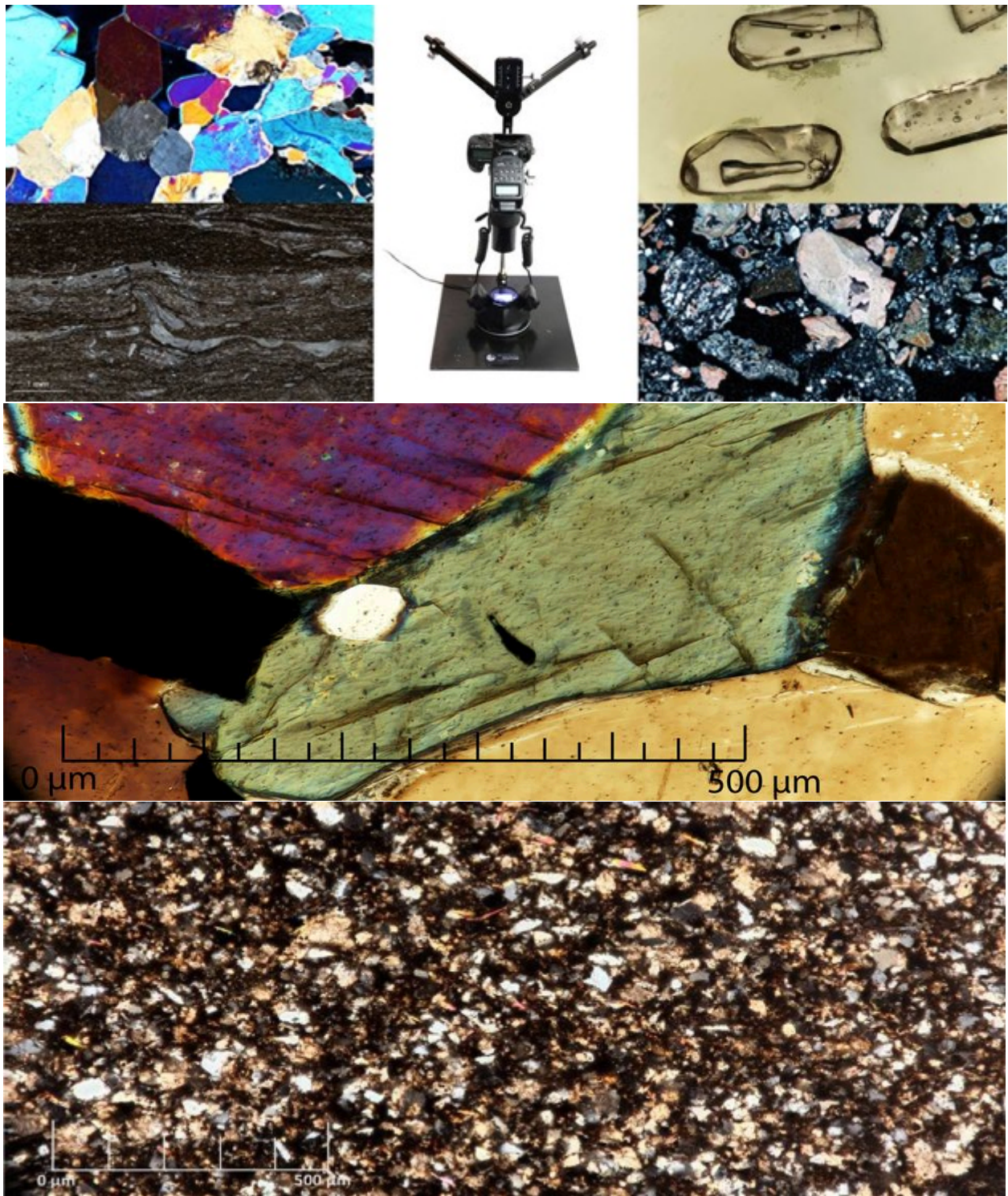


Figure 5. Macropod Petrographic and images of Zircons and Thin Sections (top), Hornblende-Plagioclase Gneiss magnified at 50x (middle), Montney Shale at 50x (bottom), polarized light.



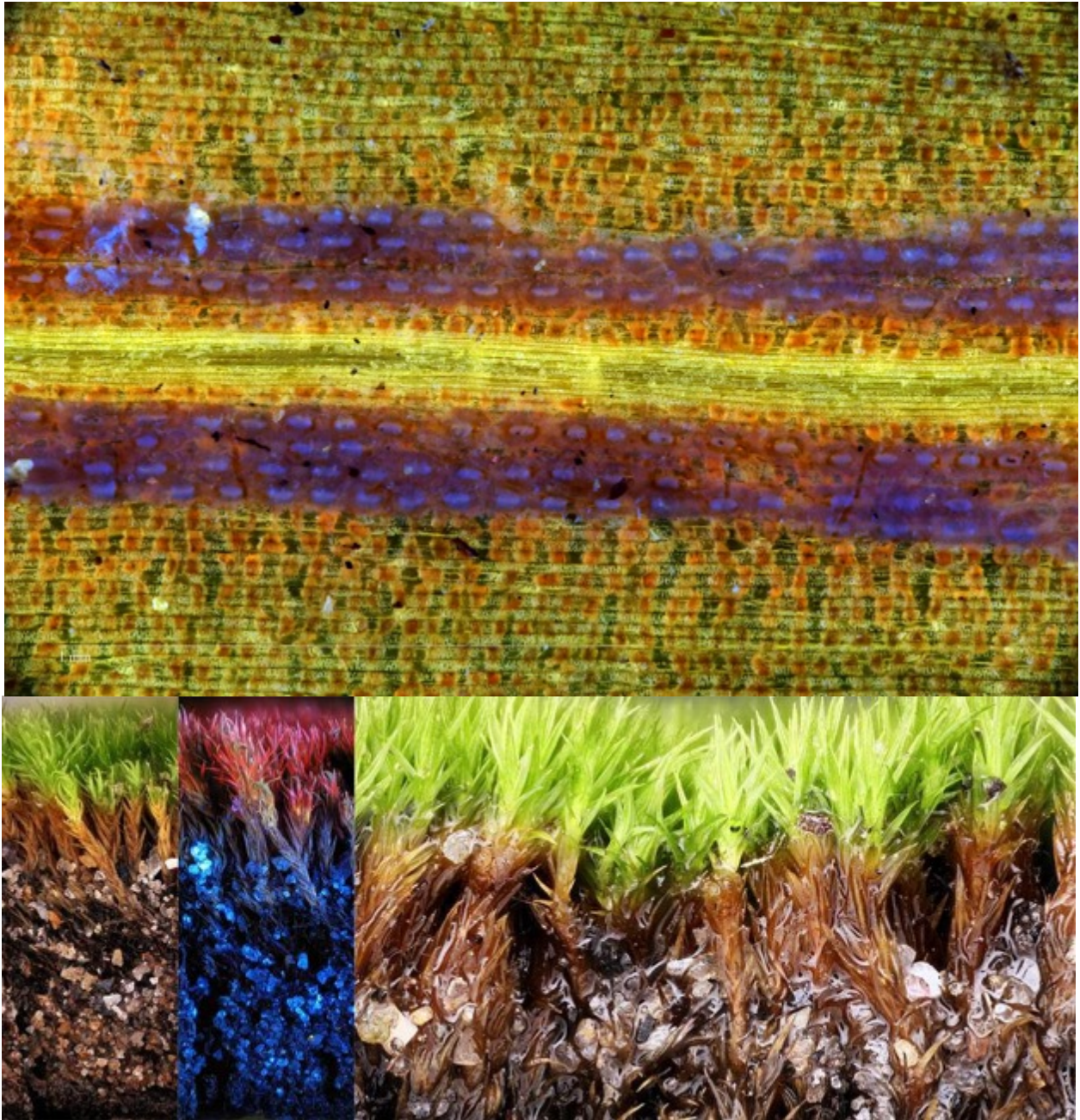


Figure 6. Pine needles fluorescence, magnified at 20x, organelles visible (top) and moss/soil cross section imaged using Macroscopic Solutions fluorescence adapters (bottom).





Figure 6. Conodont magnified at 50x (top), drill core system and accompanying imagery (middle) and drill core sample (bottom).



### *Training and Support*

Training is provided and arranged at the convenience of the institution and its personnel. Online/phone support is thereafter available during regular business hours.

### *Warranty*

Macroscopic Solutions provides warranties of 5 years for mechanical hardware, 2 years for stacking hardware and 1 year for electronic hardware, with all software updates included in perpetuity.

### *Conclusion*

Macroscopic Solutions' technology encompasses and exceeds capabilities offered by conventional optical/imaging systems. These include confocal, petrographic, optical, compound, and scanning electron microscopes. The technology has proven to be an innovative solution to the ever-expanding needs of modern day researchers.

I certify that the Macropod and the attributes referred to in this letter are true and that Macroscopic Solutions, LLC is the sole source provider of the Macropod technology.

Sincerely,

Chad E. Fagan  
Macroscopic Solutions, LLC