

### THE EUROPLANET METEORITES VIRTUAL MICROSCOPE COLLECTION.

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**Abstract:** The Europlanet Meteorite Virtual Microscope (VM) Collection is an Open Educational Resource (OER) which allows users to investigate the optical mineralogy and petrology of 24 varied meteorites [1]. It uses software that duplicates many of the functions of a petrological microscope. The VM's may be viewed at:

<https://www.virtualmicroscope.org/content/europlanet-meteorites>

**Introduction:** When The Open University (OU), one of the world's largest Distance Learning Higher Education Establishment, faced the problem of how to supply thousands of undergraduate students with an interactive petrological microscope and a personal set of thin sections, they decided to develop a software tool called the Virtual Microscope (Figure 1). The Virtual Microscope allows users to view an entire thin section in plane polarized light, between crossed polars and also in reflected light.



Figure 1: An early version of the Virtual Microscope produced for Open University students.

2018 celebrates 25 years of virtual microscope work at the Open University. During this time we have created many OER collections based on terrestrial rock samples - Charles Darwin's Beagle Collection, UK Virtual Microscope Collection, Irish University Rock Collection, St Austell Granite Collection, Greenland Collection. We have also built a Cornish Mineral Heritage Collection based on mineral specimens in the Rashleigh Collection at the Royal Cornwall Museum in Truro, Cornwall.

Our work is not however, Earth-bound and we have five VM collections of samples that are extraterrestrial in origin. The Europlanet Meteorites Collection was the catalyst and the first one of these collections. We have since created

a British and Irish Meteorites Collection:

<https://www.virtualmicroscope.org/content/british-irish-meteorites>

a Martian Meteorite Collection:

<https://www.virtualmicroscope.org/content/martian-meteorites>

a Lunar Meteorite Collection:

<https://www.virtualmicroscope.org/content/lunar-meteorites>

and most recently we are working with NASA to create an Apollo Moon Rock collection:

<https://www.virtualmicroscope.org/collections/apollo>

**Method:** Production of a virtual microscope dedicated to a particular theme divides into four main parts - photography, image processing, building and assembly of virtual microscope components, and publication on a website. The method used to produce the VM images has been described earlier [2-5] and involves two automated Leica research microscopes (Figure 2).

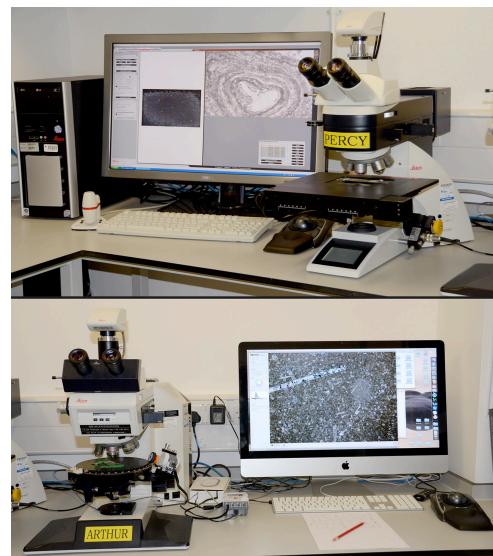
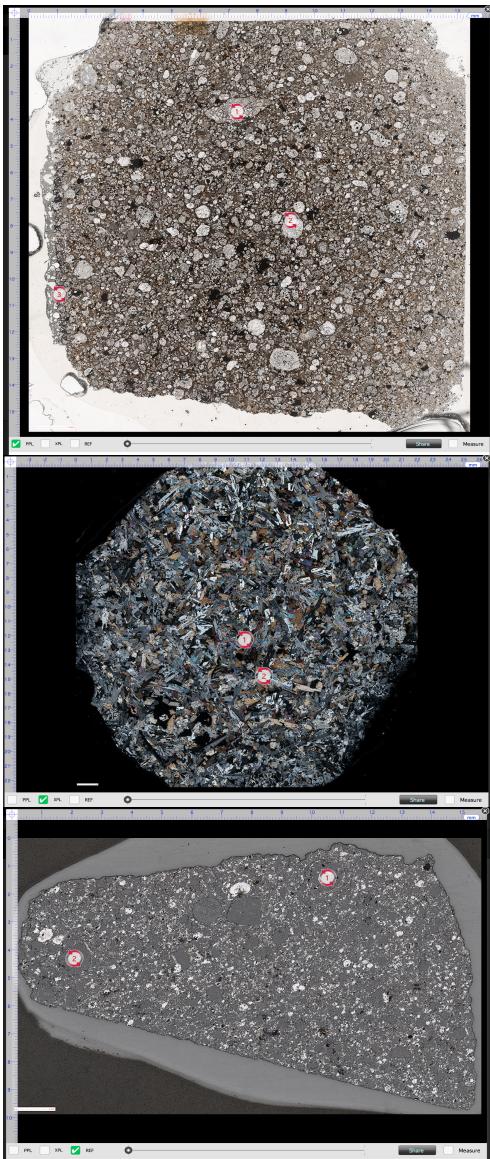
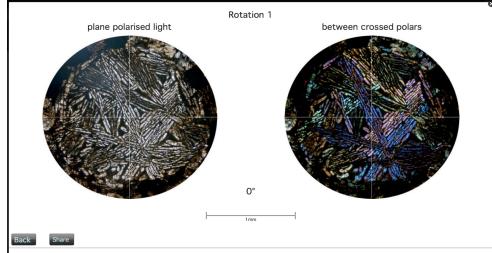


Figure 2: Research microscopes used for Virtual Microscope production at the Open University.



**Figure 3:** Screen shots from the Lancé carbonaceous chondrite (top), D'Orbigny angrite (middle) and Indarch enstatite chondrite (bottom). In plane polarised light, between crossed polars and in reflected light respectively. Red circles show positions of rotation points.



**Figure 4:** Screen shots of a rotation point from the Chandakapur L5 chondrite meteorite.

**The Europlanet VM Collection:** This virtual microscope collection of rare and usually inaccessible extraterrestrial meteorite samples was funded by a EUROPLANET public engagement award and is a collaboration between The Open University, The Natural History Museum, London, The Natural History Museum, Vienna and NASA's Meteorite Working Group (MWG). The collection includes carbonaceous chondrites (CO3, CO3.5 and CV3), ordinary chondrites (H3.7, H3.9, H4, H6, L3.6, L4, L4-7, L5, L6, LL3.6 and LL/L3.2), an enstatite chondrite and an olivine-hypersthene chondrite. There are also examples of angrite, aubrite, ureilite, eucrite meteorites and two Martian meteorites. Over the past 5 years the EUROPLANET VM has been showcased at various public engagement events, too numerous to list here, but suffice to mention that it continues to receive a favourable response from a wide spectrum of non-specialists from primary school children to adults and other mature learners.

**The Future:** We hope to expand the collection to include further examples of the existing classes of meteorites and to extend the collection to include examples of all meteorite types, as and when we secure additional funding.

**References:** [1] Anand, M., Pearson, V.K., Tindle, A.G., Kelley S.P., Koelberl, C., Smith, C.L. and Whalley, P.C. (2012), In LPSC XLIII, ABSTRACT #2187. [2] Anand, M., Kelley S.P. and Tindle, A.G. (2010), In LPSC XLI, ABSTRACT #2409. [3] Gibson, E.K., Tindle, A.G., Kelley S.P. and Pillinger J.M. (2016), In LPSC XLVII, ABSTRACT #1199. [4] Gibson, E.K., Tindle, A.G., Kelley S.P. and Pillinger J.M. (2017), In LPSC XLVIII, ABSTRACT #1181. [5] Gibson, E.K., Tindle, A.G., Schwenzer, S.P., Kelley S.P., Morgan, G.H., Anand, M. and Pillinger J.M. (2018), In LPSC XLIX, ABSTRACT #1087.

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