Imperial College London

Royal School of Mines
Earth Science & Engineering
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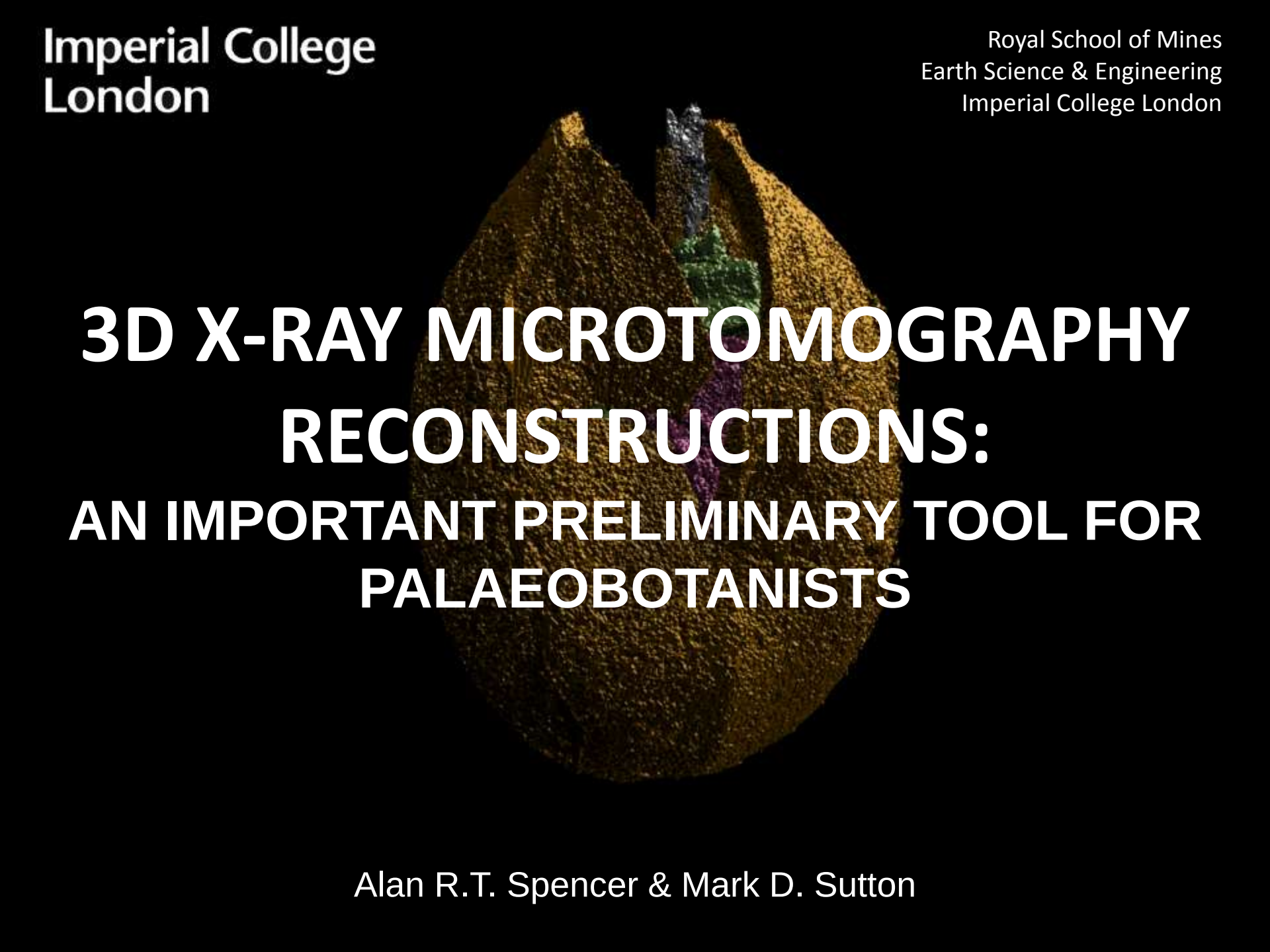

3D X-RAY MICROTOMOGRAPHY RECONSTRUCTIONS:

AN IMPORTANT PRELIMINARY TOOL FOR PALAEOBOTANISTS

Alan R.T. Spencer & Mark D. Sutton

CT/CAT Scanning History (in brief):

1967

EMI

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+

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1967-1971

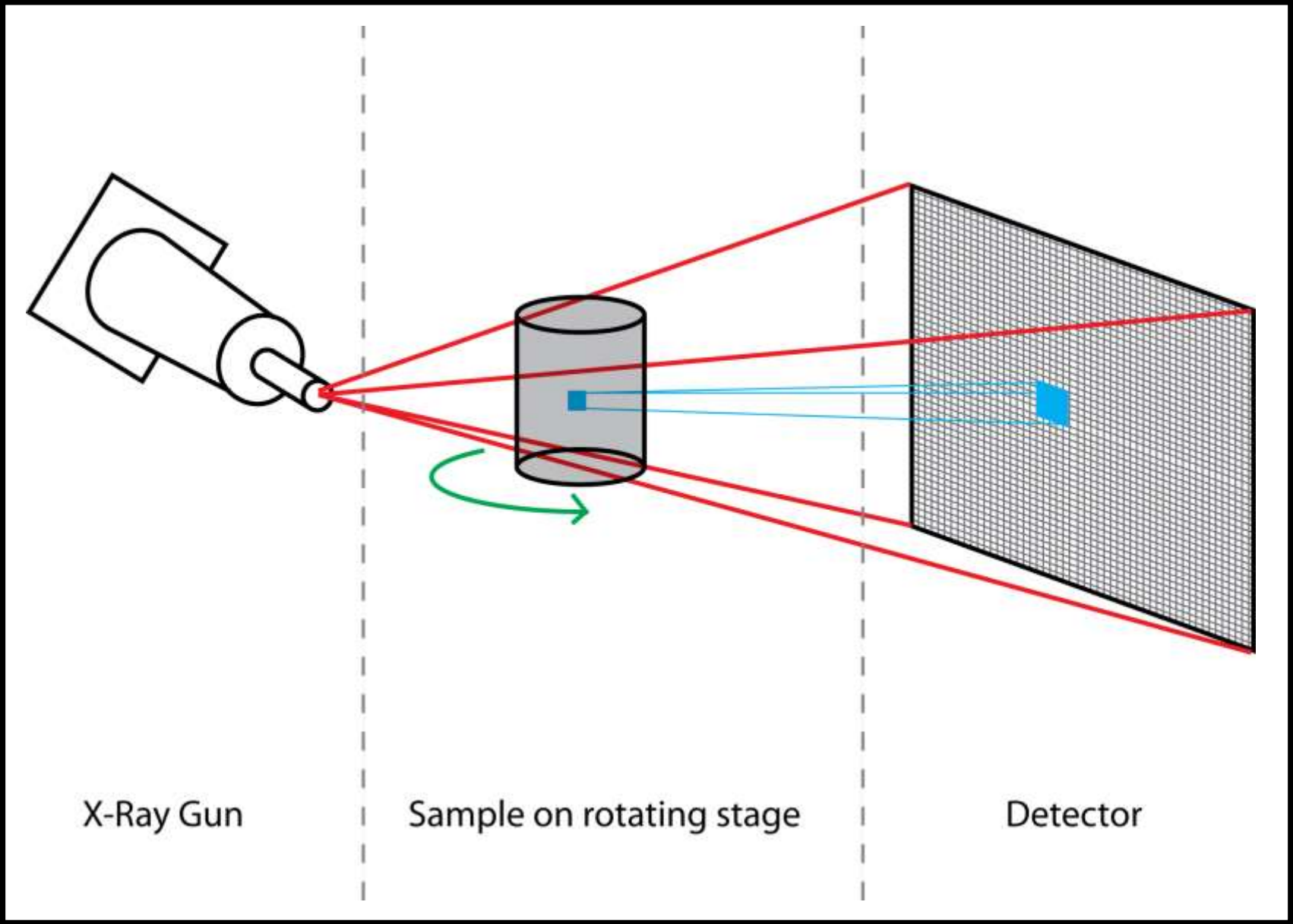
v

1971

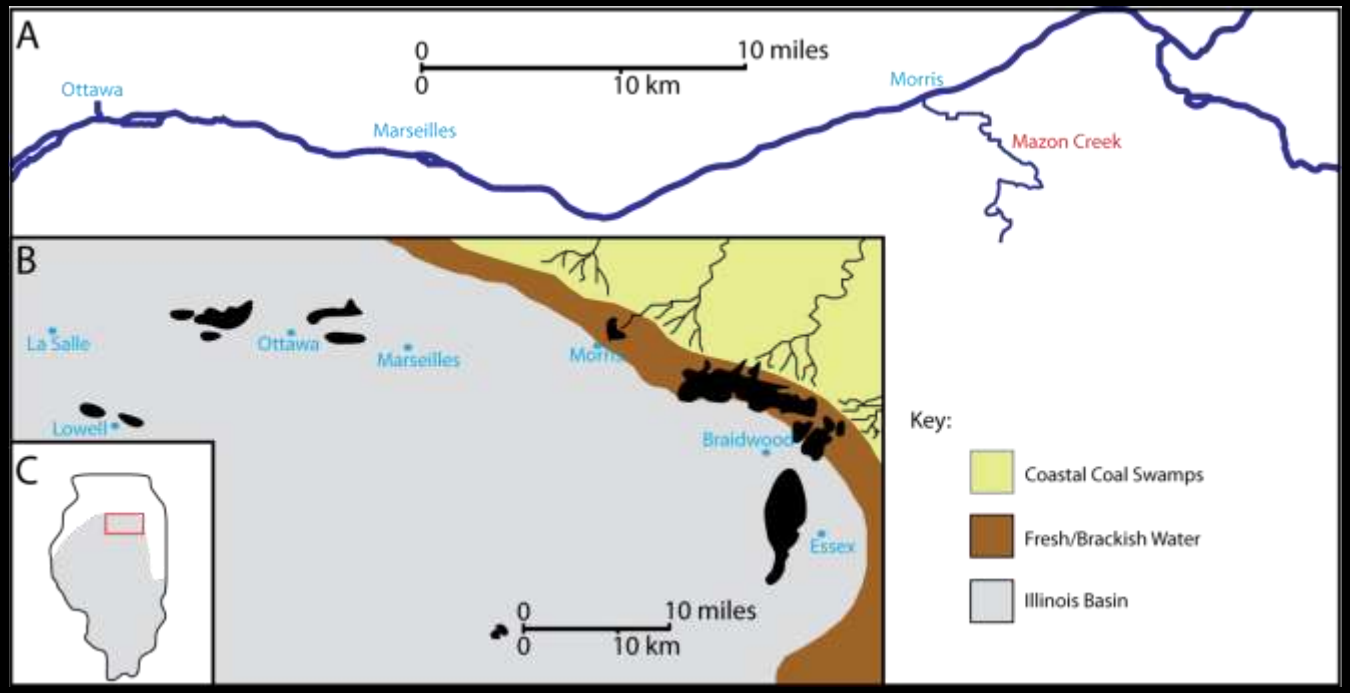
>>>

Present

How does XMT work?

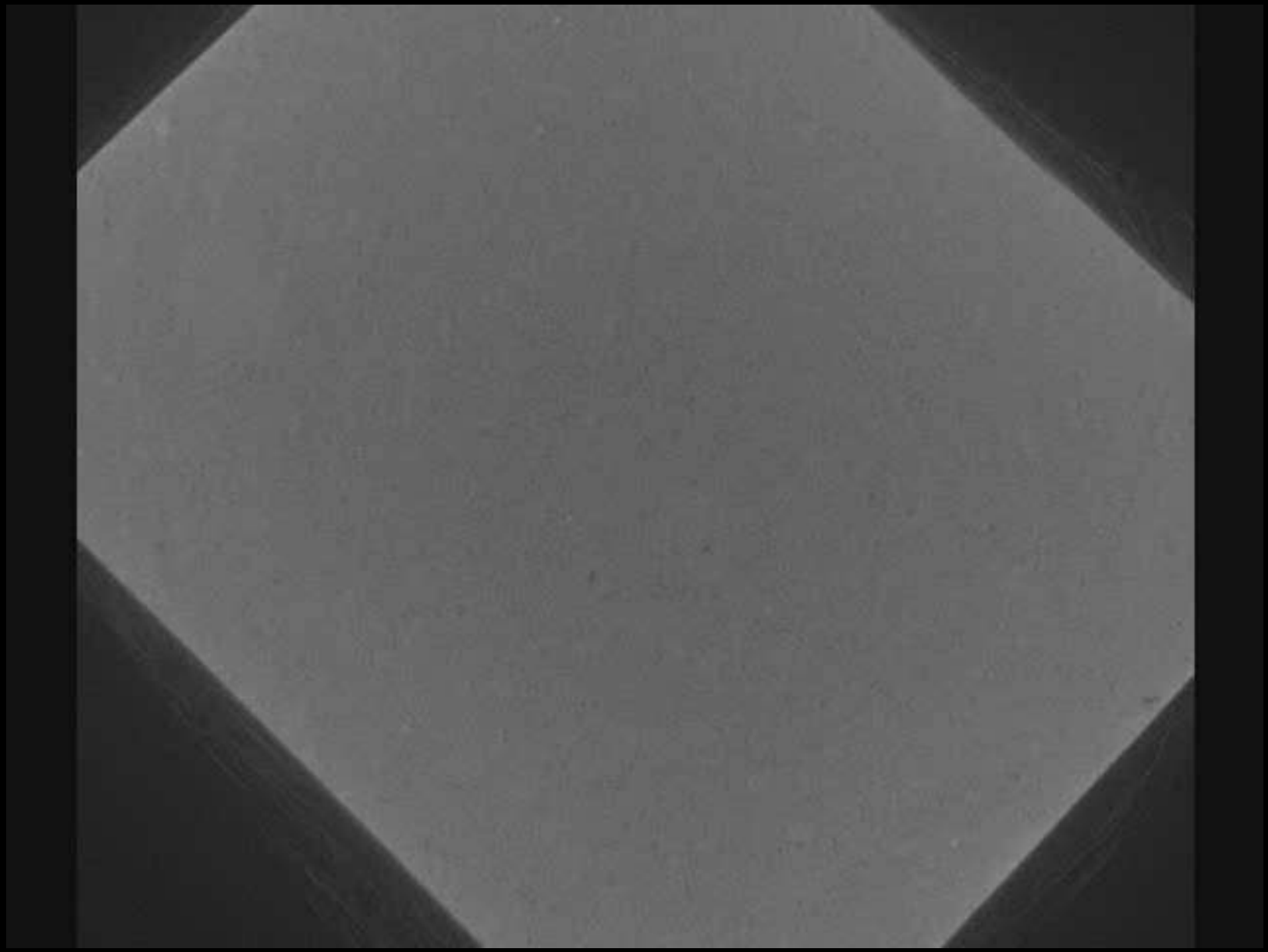


Specimen P30420



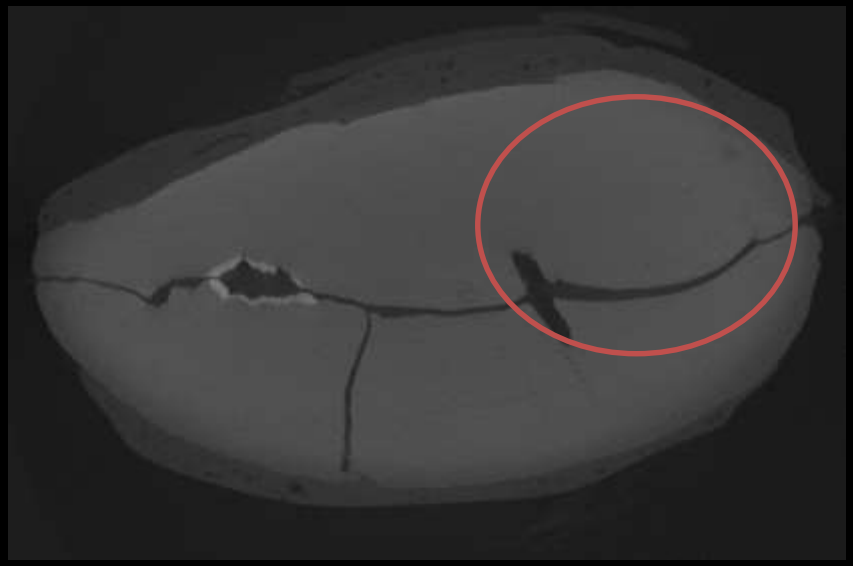
Location:	Francis Creek Shale , Mazon Creek, Il, USA
Age:	Carboniferous, Pennsylvanian (318-299 Ma)
Preservation:	Siderite Nodule ($FeCO_3$)
Owner:	The Field Museum, Chicago, USA
Description:	*Stephanospermum* Seed

2D Tomographic Data Set:

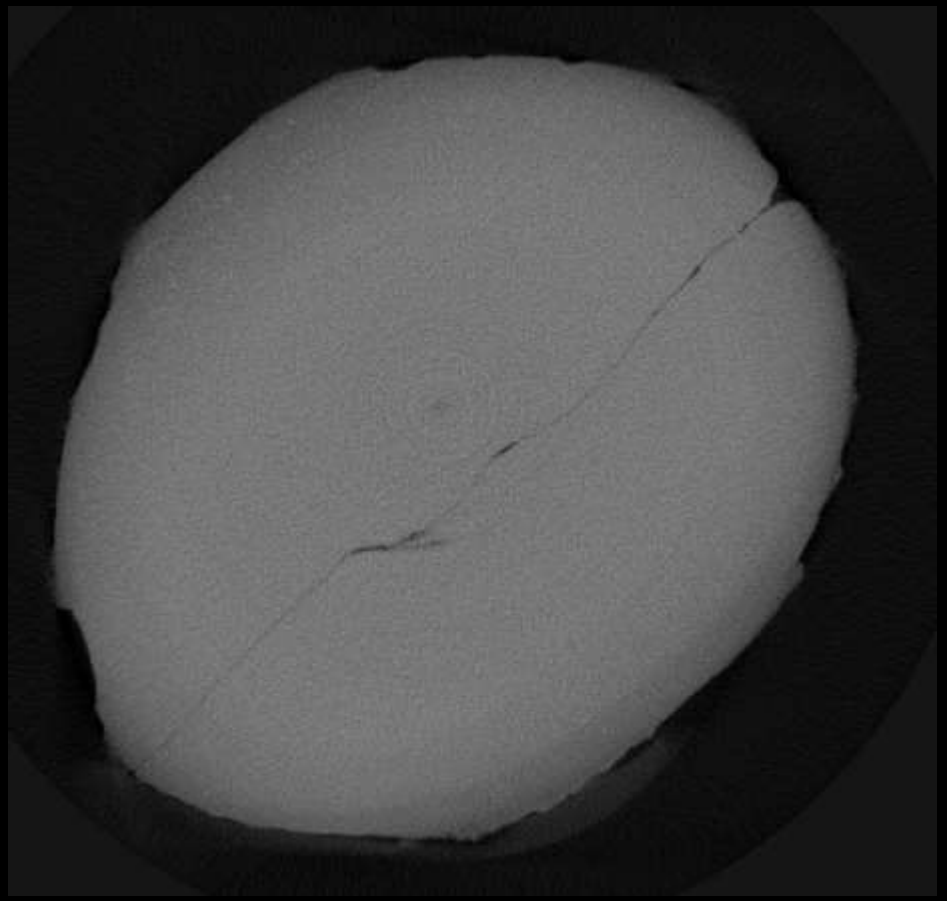


Problems with XMT Data collection:

Low phase contrast



Artefacts

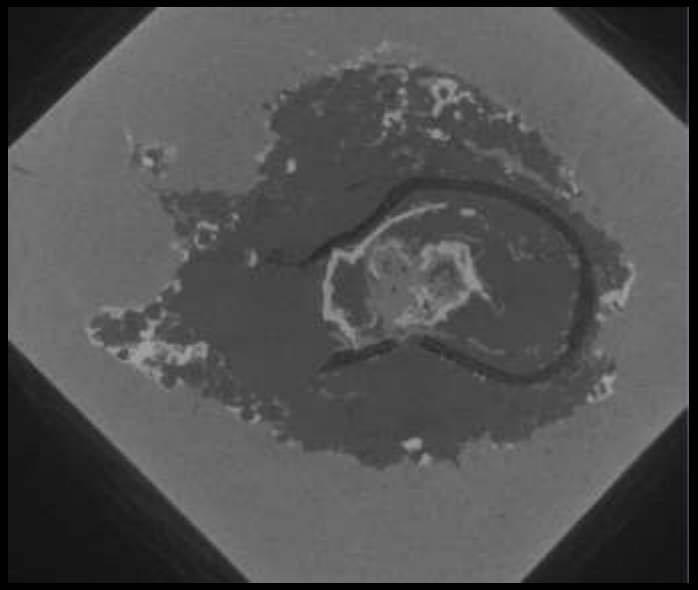


Data Set Size (storage)

Direct from Scanner = 2.02 GB
After conversion to BMP = 1.01 GB
After initial conversion for Modelling = 6.10 GB (depending on complexity)

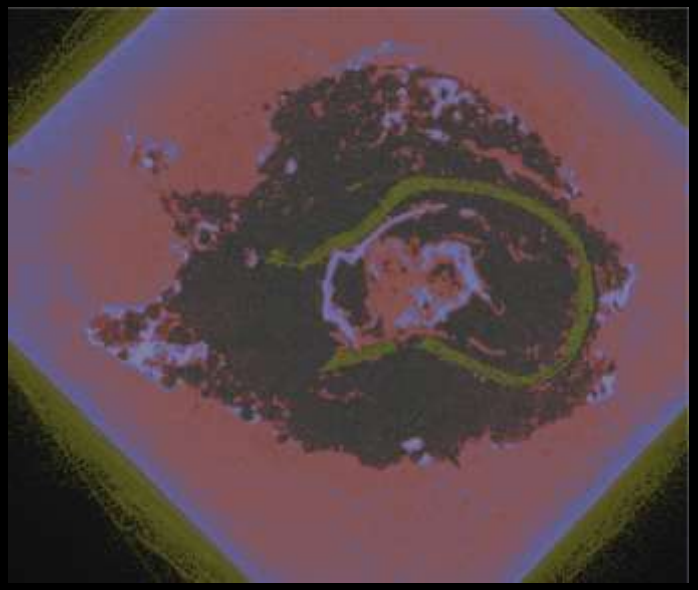
TOTAL: = 9.11 GB (before anything useable is outputted)

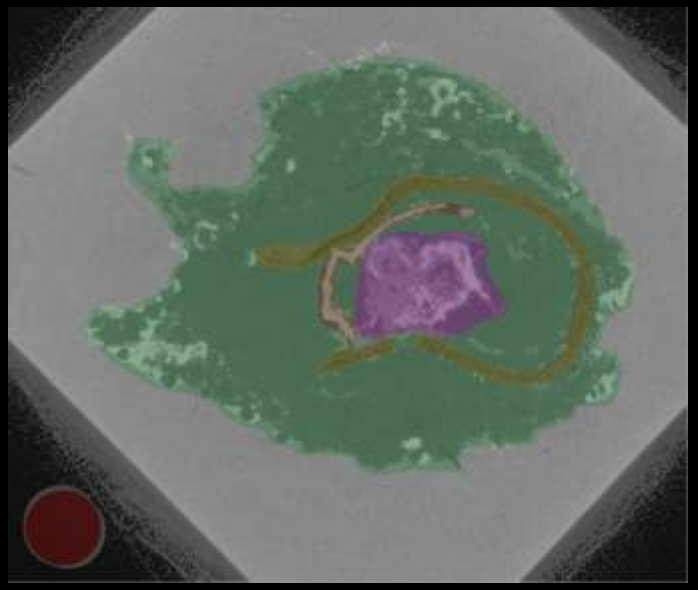
From 2D to 3D: Sections, Masks & Models



< Ct Data (1)

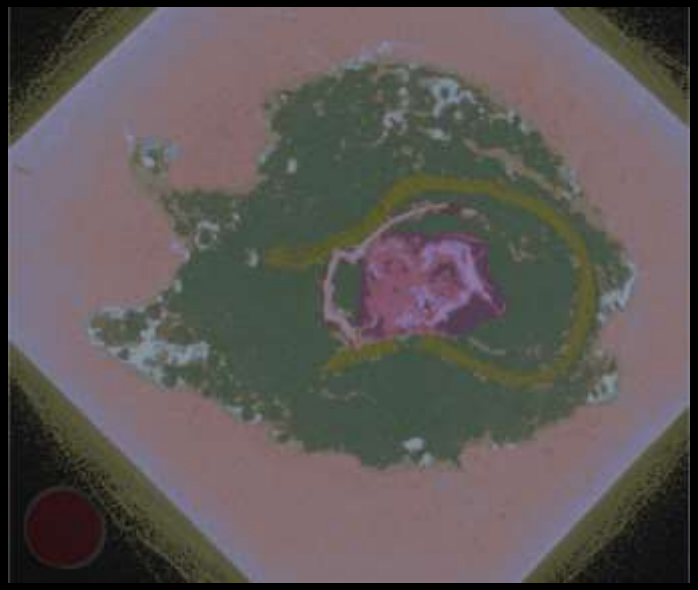
Sections (2) >



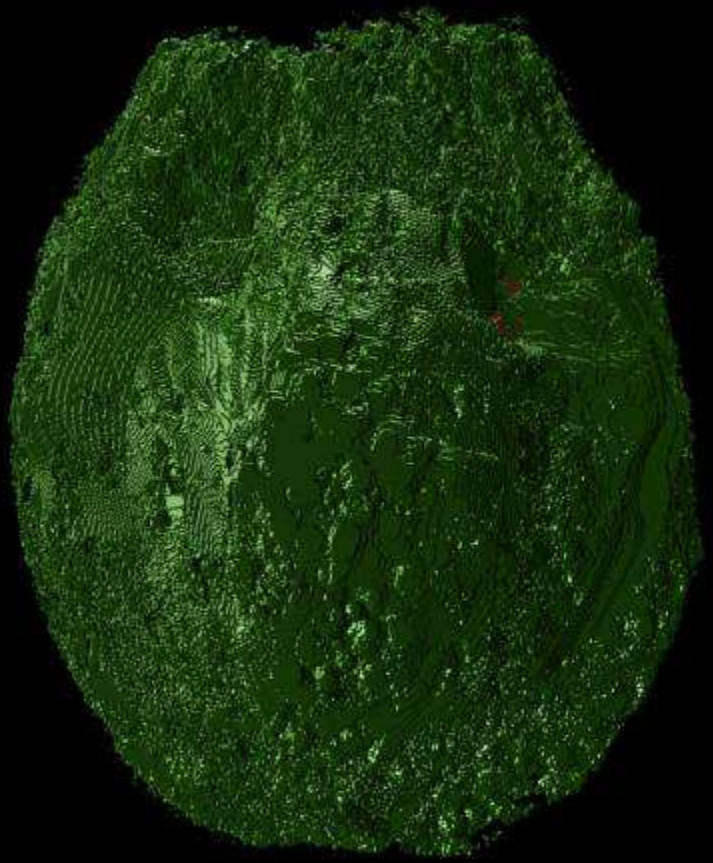


< Mask (3)

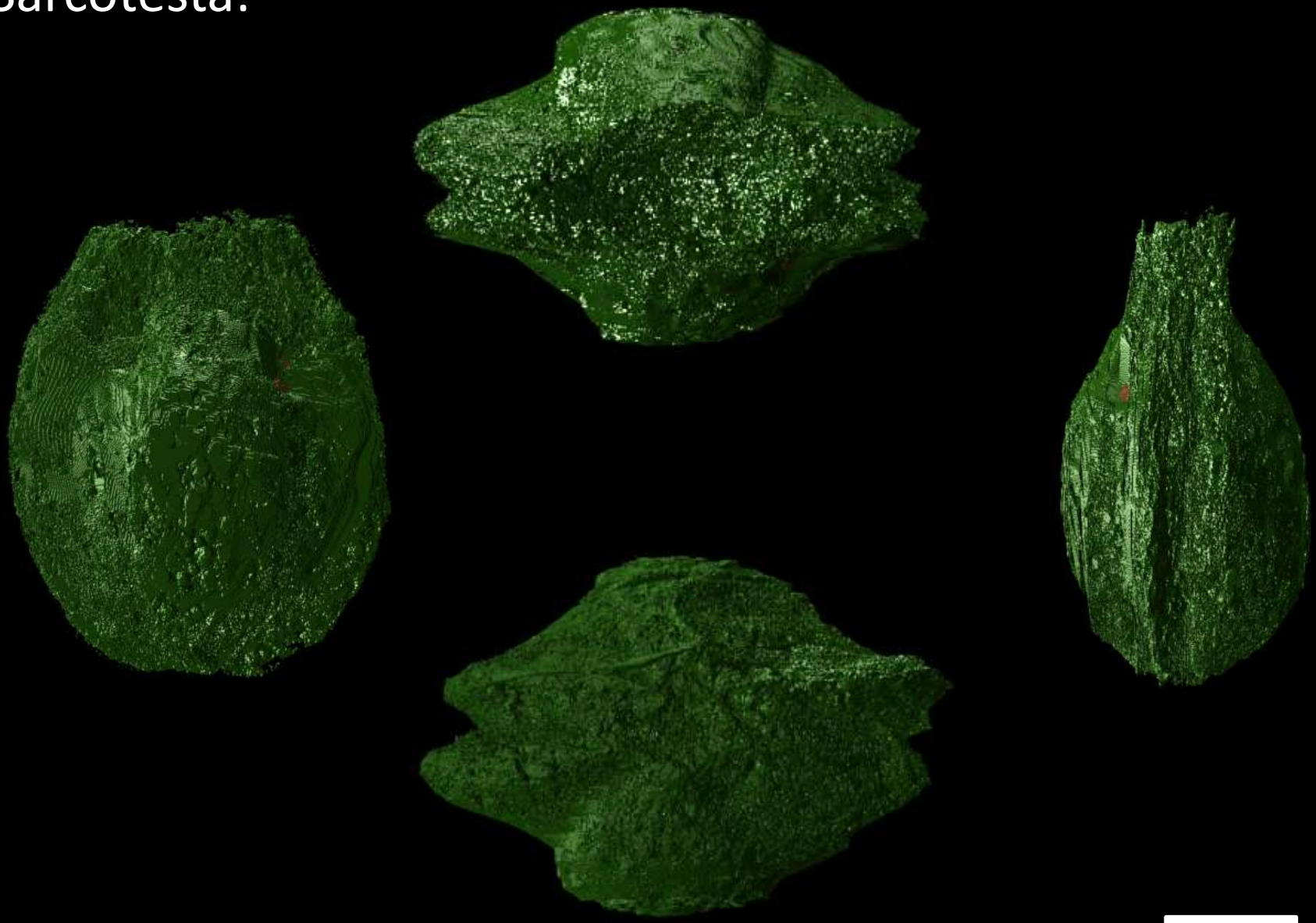
Composite >



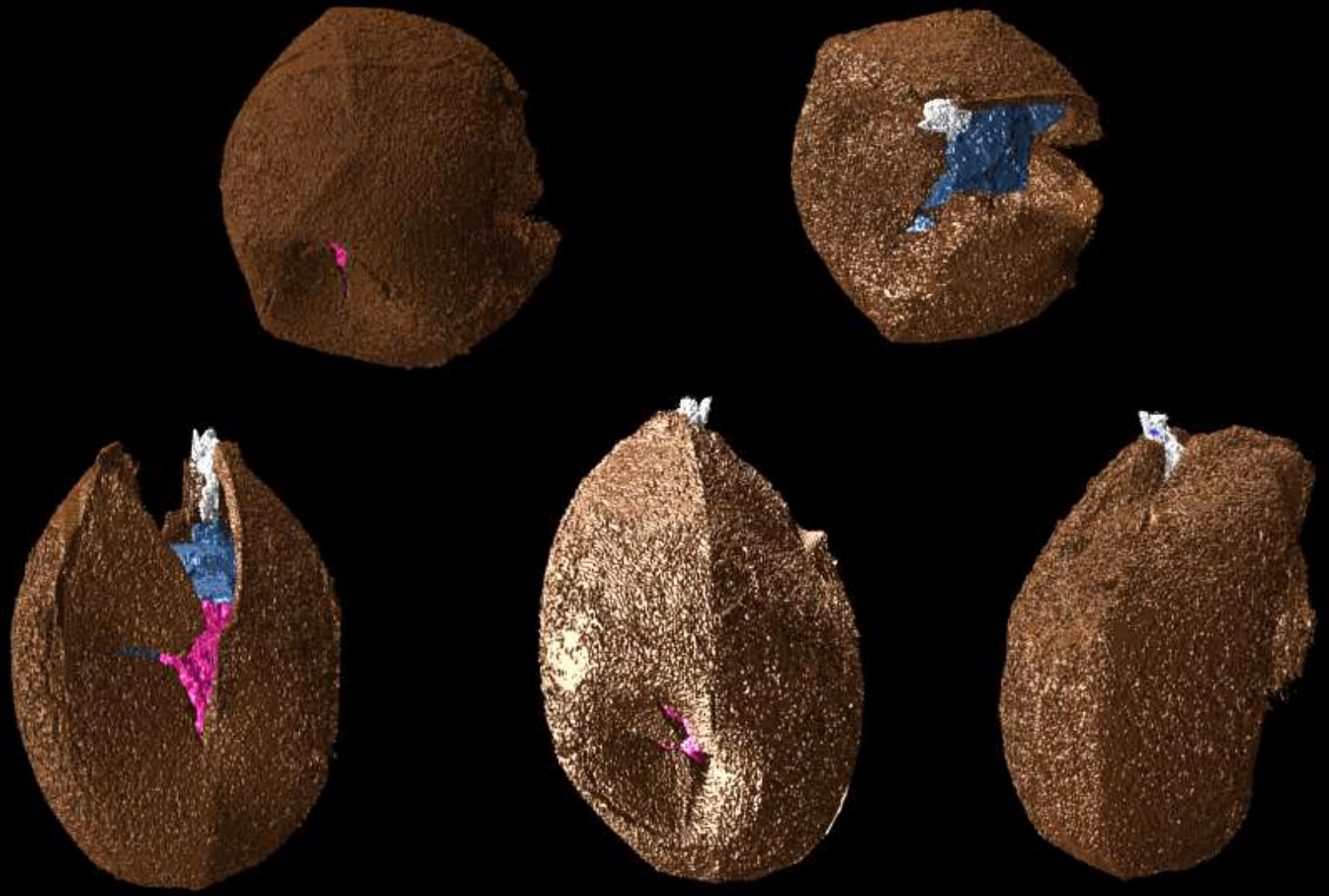
3D Model:



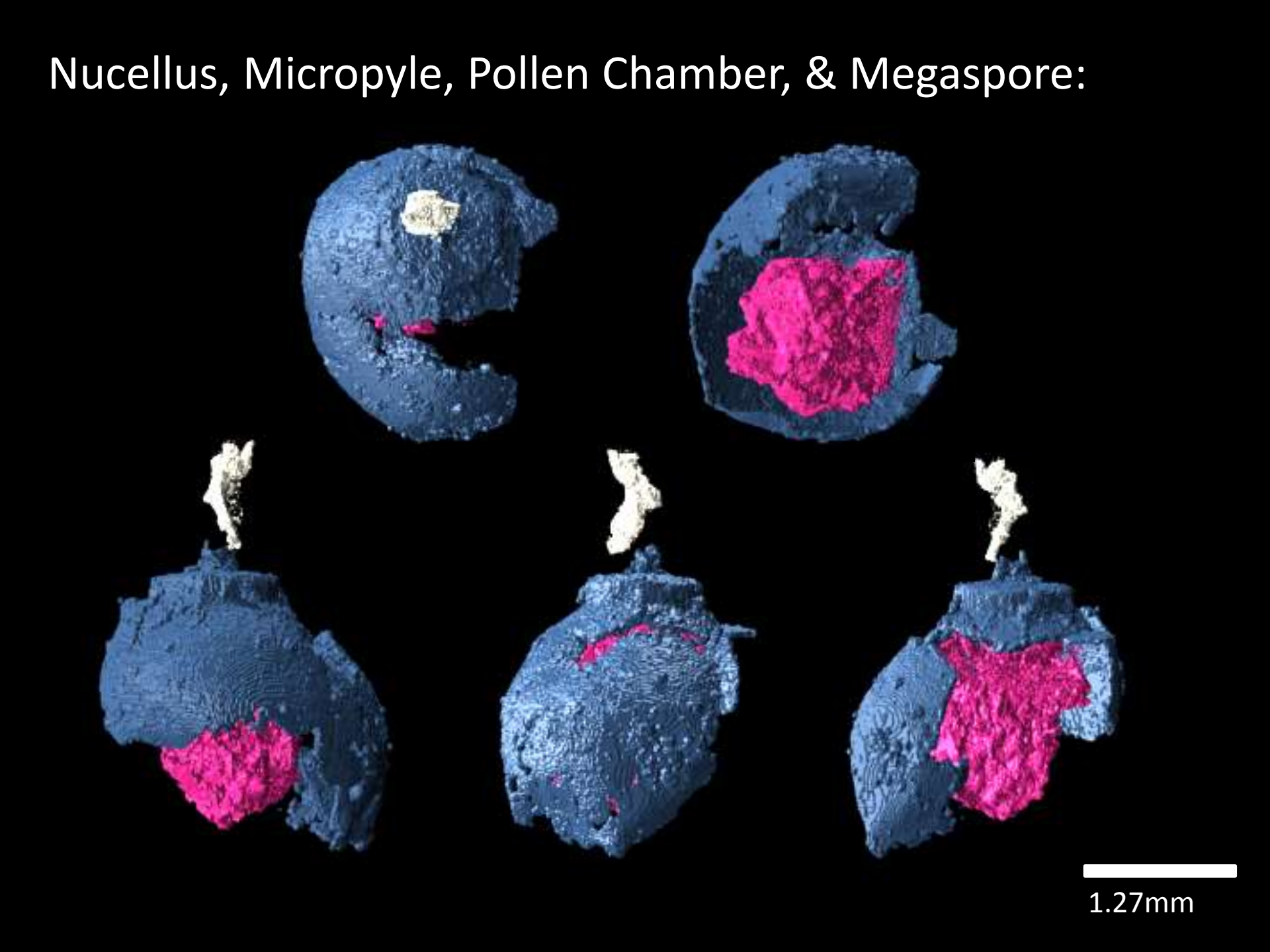
Sarcotesta:



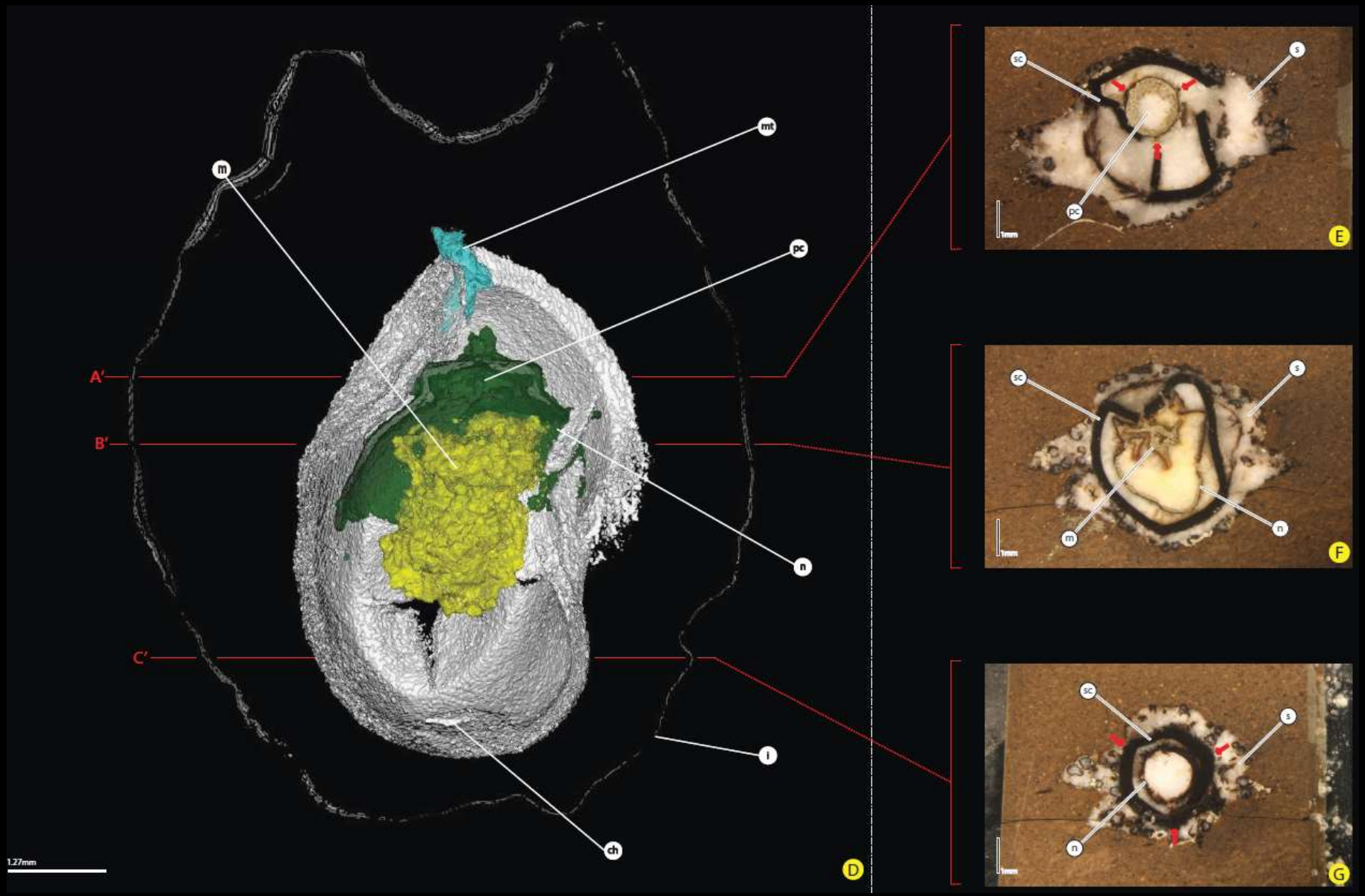
Sclerotesta:



Nucellus, Micropyle, Pollen Chamber, & Megaspore:



Real World vs Virtual:



Conclusion:

PROS

- the ability to virtually dissect fossils
- recovery of full morphological data
- all within a non-destructive environment
- models can be used to guide the application of traditional destructive techniques

CONS

- resolution required to render detail, for example the nucellus membrane , is compromised by the need to reconstruct an entire fossil
- only fossil material that has a high enough phase contrast under x-ray can produce a scan of sufficient quality for successful 3D reconstruction
- time required to produce detailed model

The combination of XMT with traditional techniques provides a powerful approach to the study of three-dimensionally preserved palaeobotanical specimens by allowing the traditional approaches to perform to their maximal potential.

The End

(...runs away to hide from zombies)