

# Supplementary Information

## 1. Histology

*Birkenia*

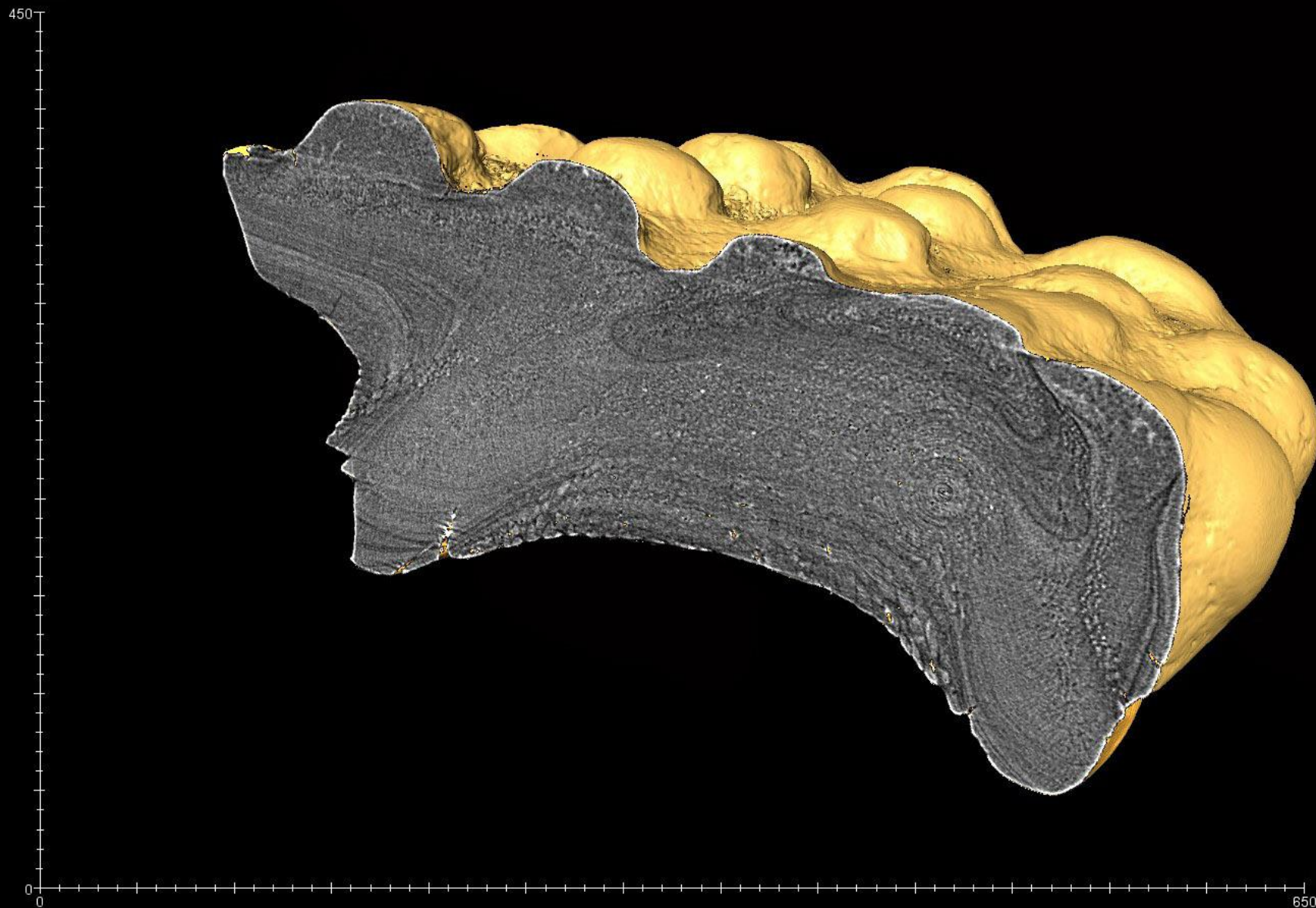


Fig. 1. Specimen NHMUK PV P73701. SRXTM slice through a body scale of *Birkenia*. Data collected using 20X objective. Scale bars in  $\mu\text{m}$ .

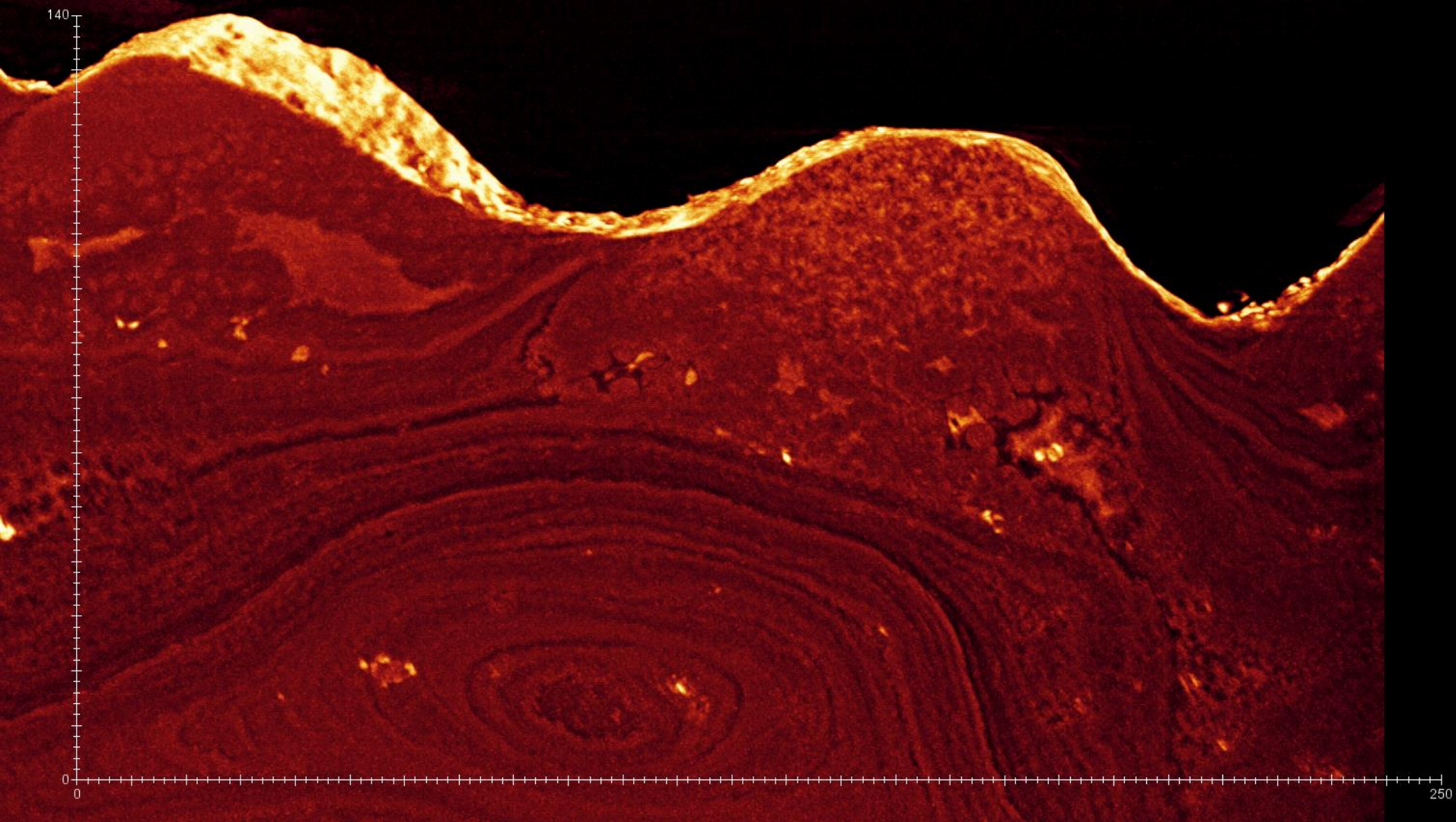


Fig. 2. Specimen ANASP\_02. SRXTM volume rendered thin section through the superficial layer of *Birkenia*. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .

*Birkenia*

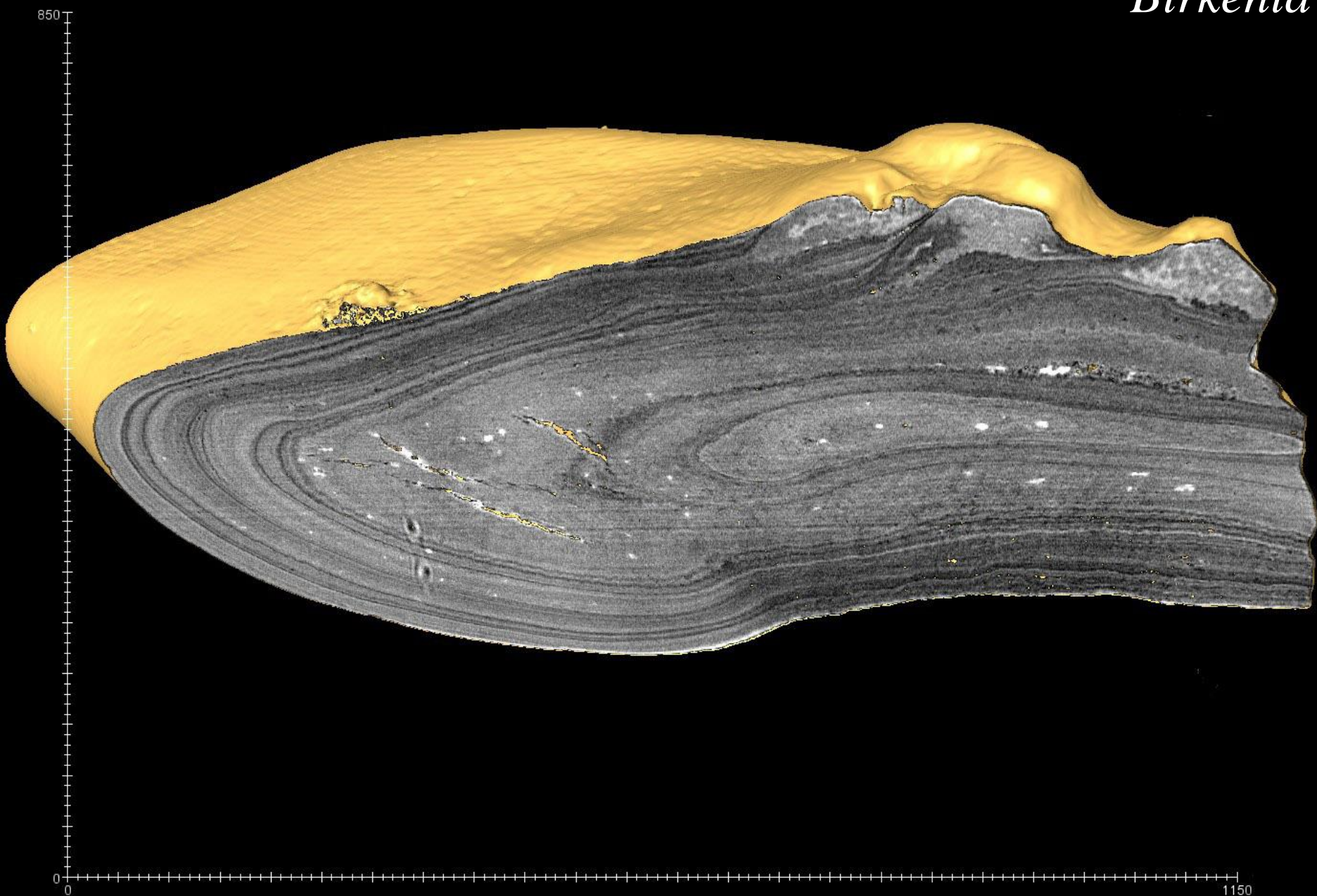


Fig. 3. Specimen ANASP\_02. SRXTM longitudinal slice through a body scale of *Birkenia*. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

*Birkenia*

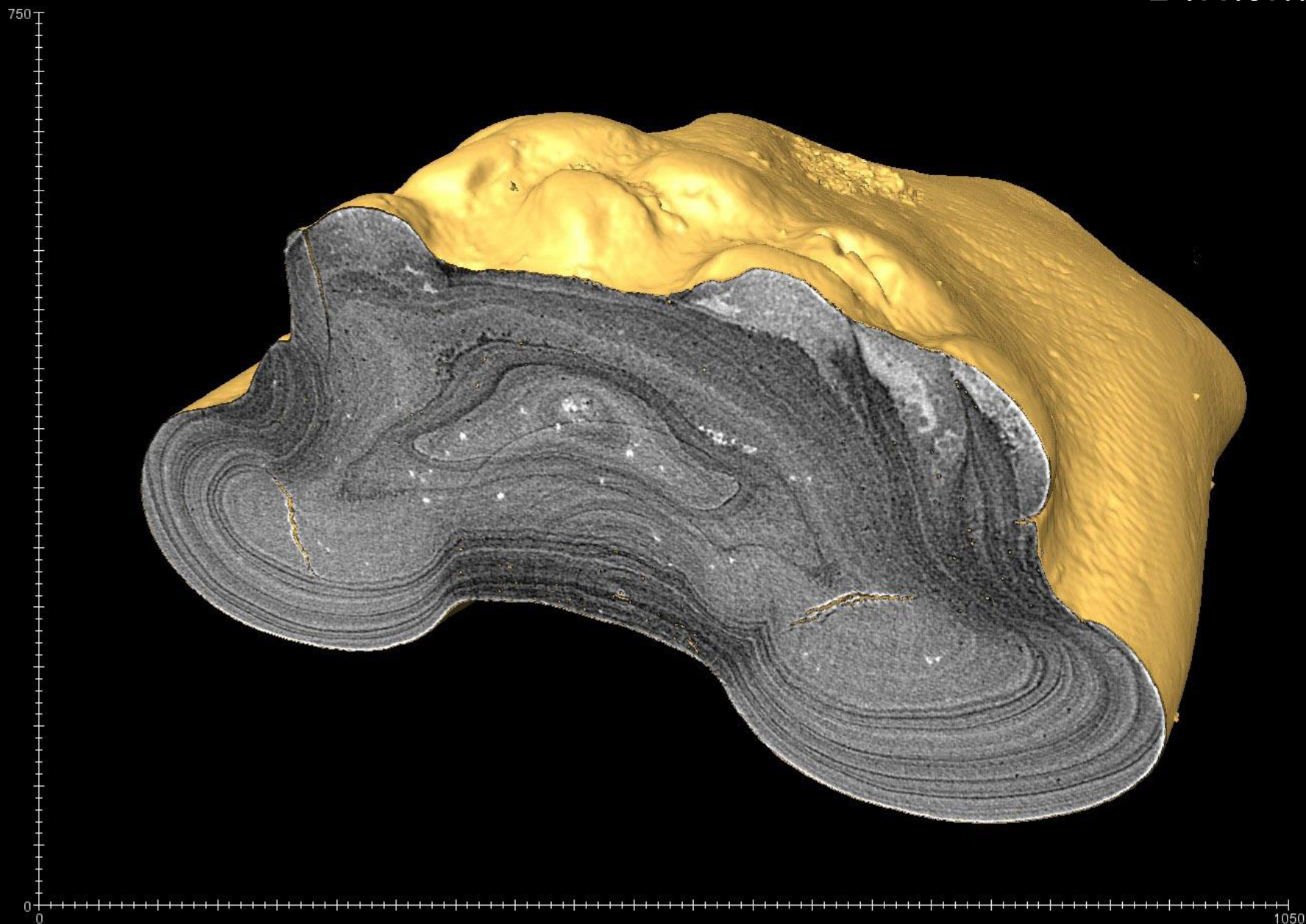


Fig. 4. Specimen ANASP\_02. SRXTM slice through a body scale of *Birkenia*. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

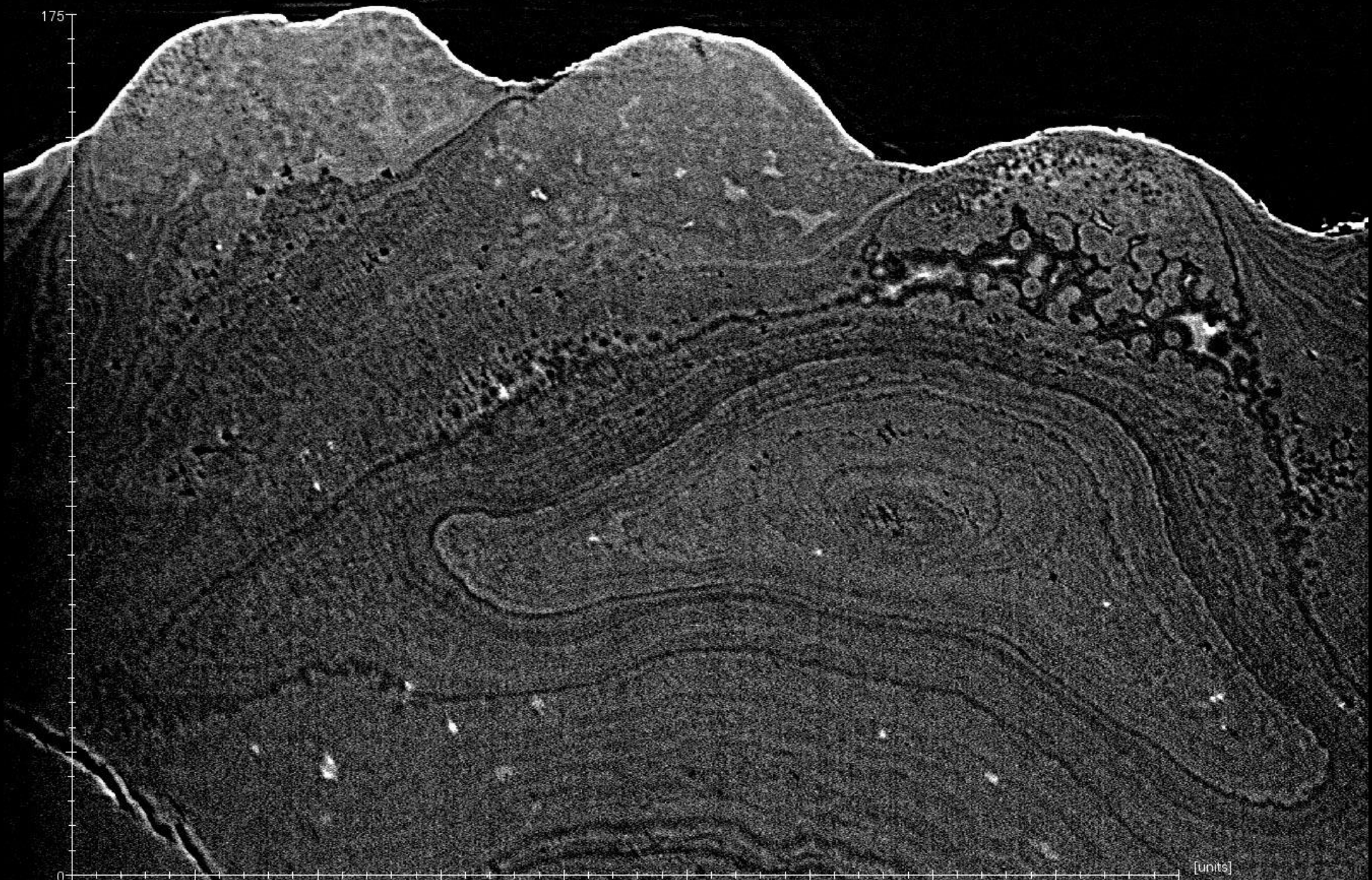


Fig. 5. Specimen ANASP\_02. SRXTM slice through the superficial layer of *Birkenia*. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .

*Birkenia*

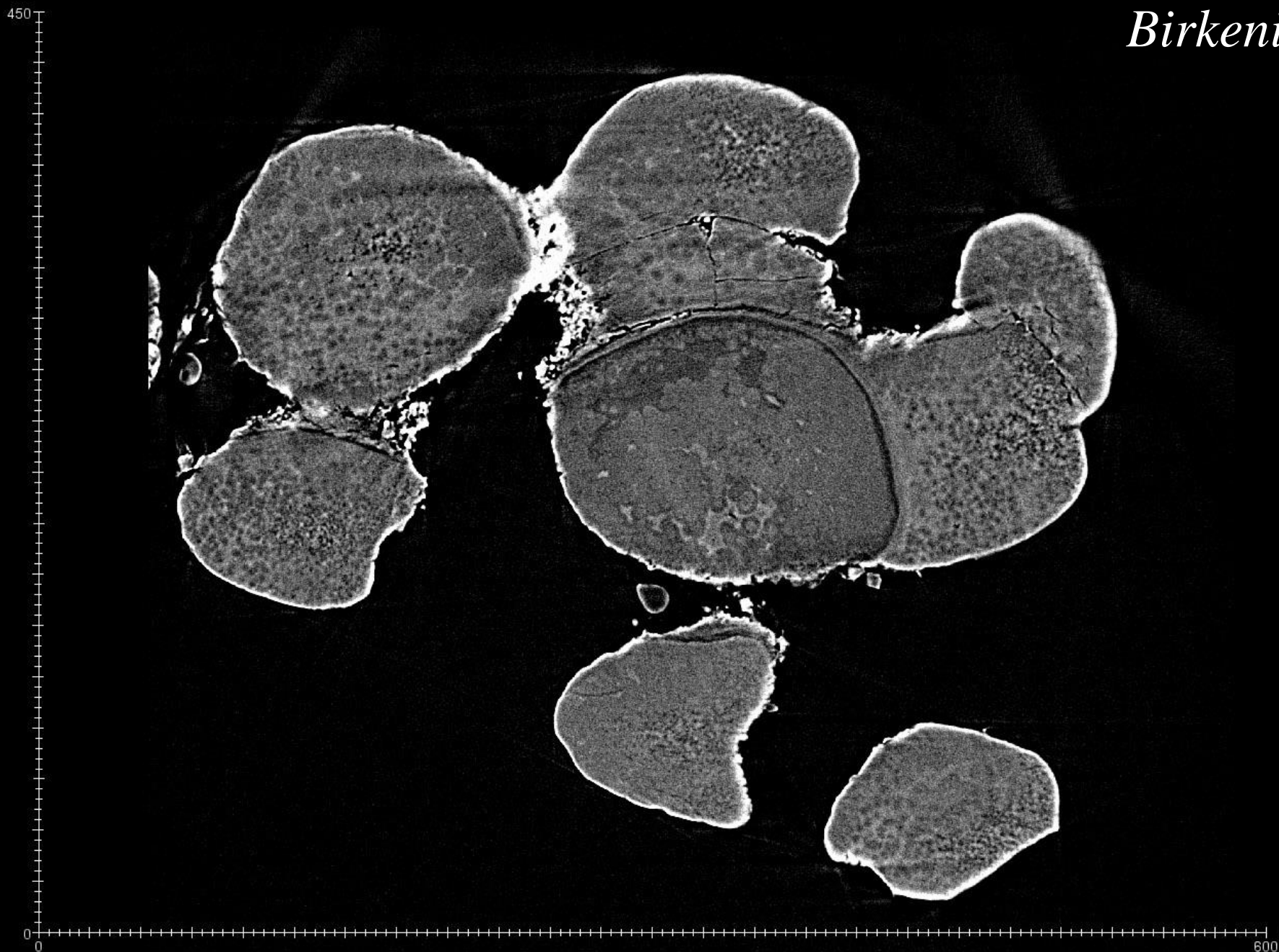


Fig. 6. Specimen ANASP\_02. SRXTM horizontal slice through the superficial layer of *Birkenia*. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .

*Birkenia*

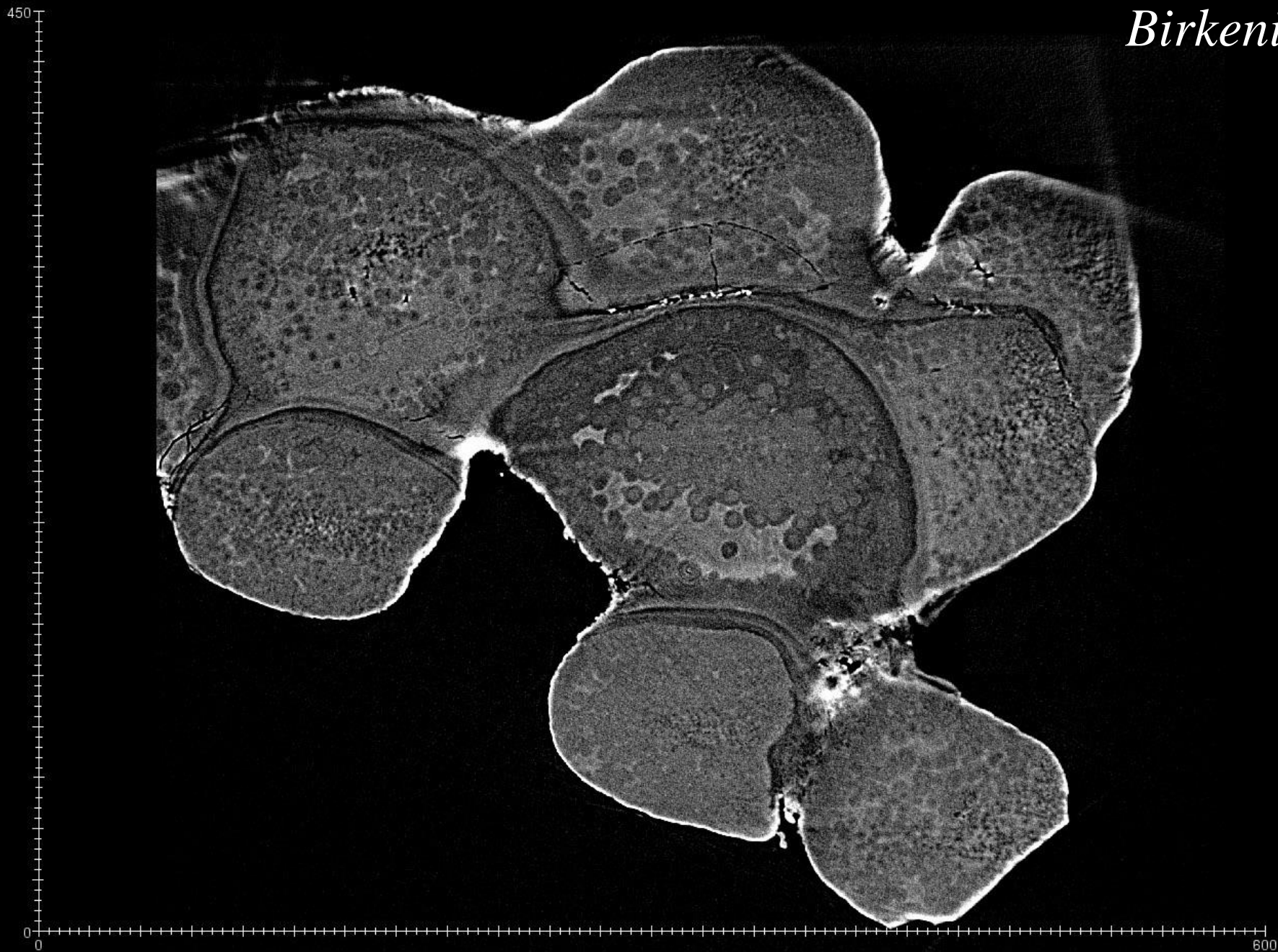


Fig. 7. Specimen ANASP\_02. SRXTM horizontal slice through the superficial layer of *Birkenia*. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .



*Birkenia*

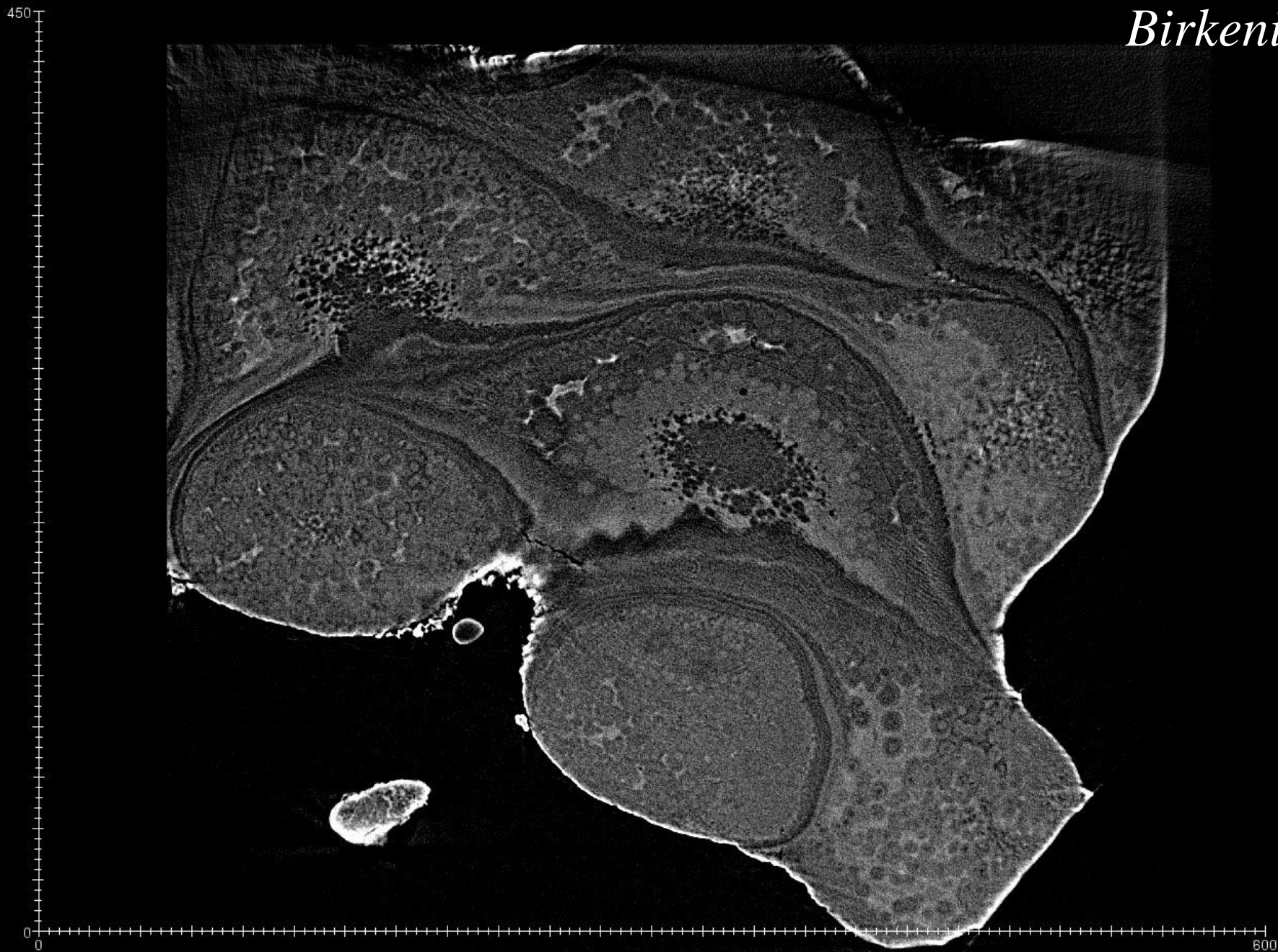


Fig. 8. Specimen ANASP\_02. SRXTM horizontal slice through the superficial layer of *Birkenia*. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .

*Birkenia*

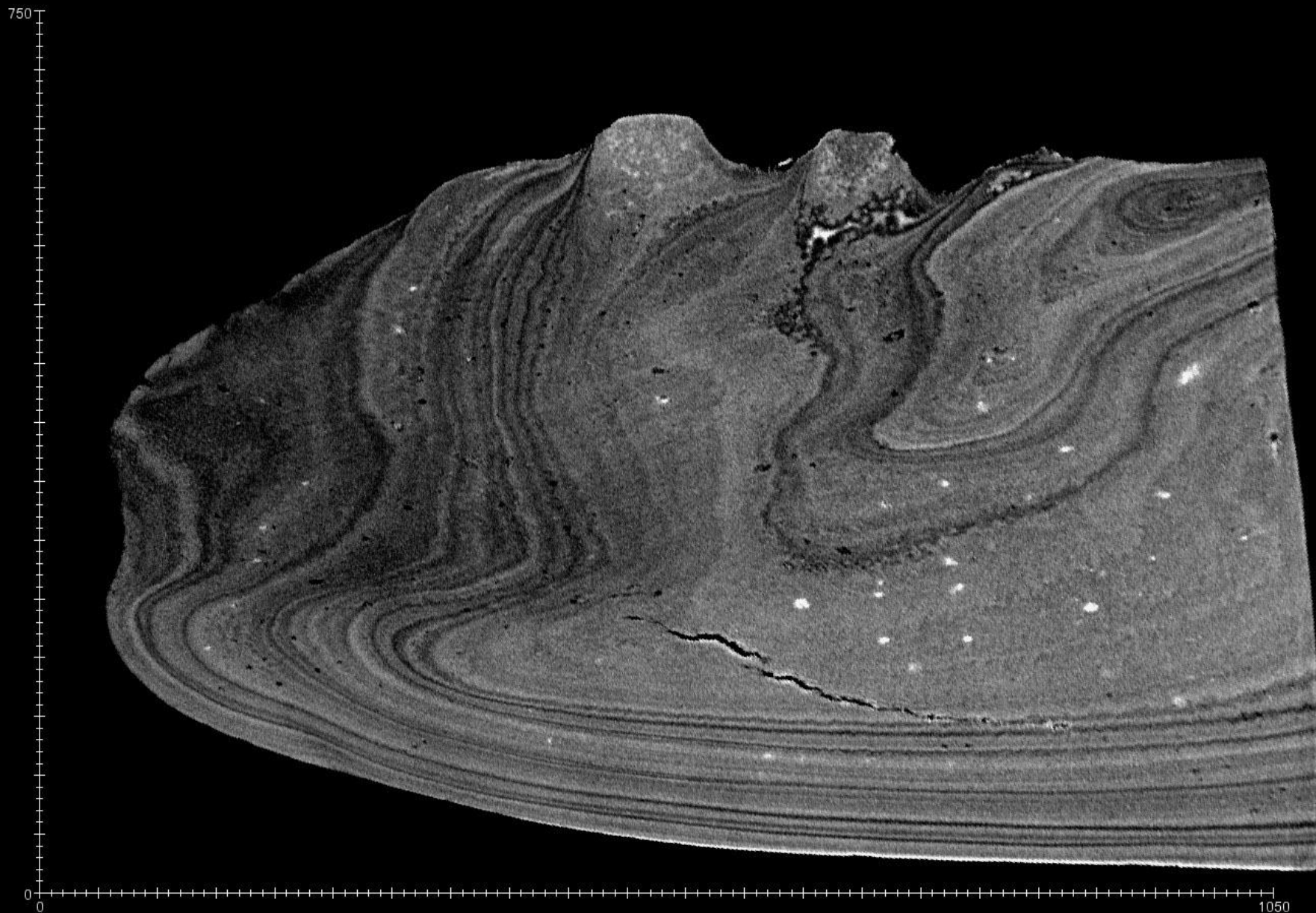


Fig. 9. Specimen ANASP\_02. SRXTM longitudinal slice through a body scale of *Birkenia*. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

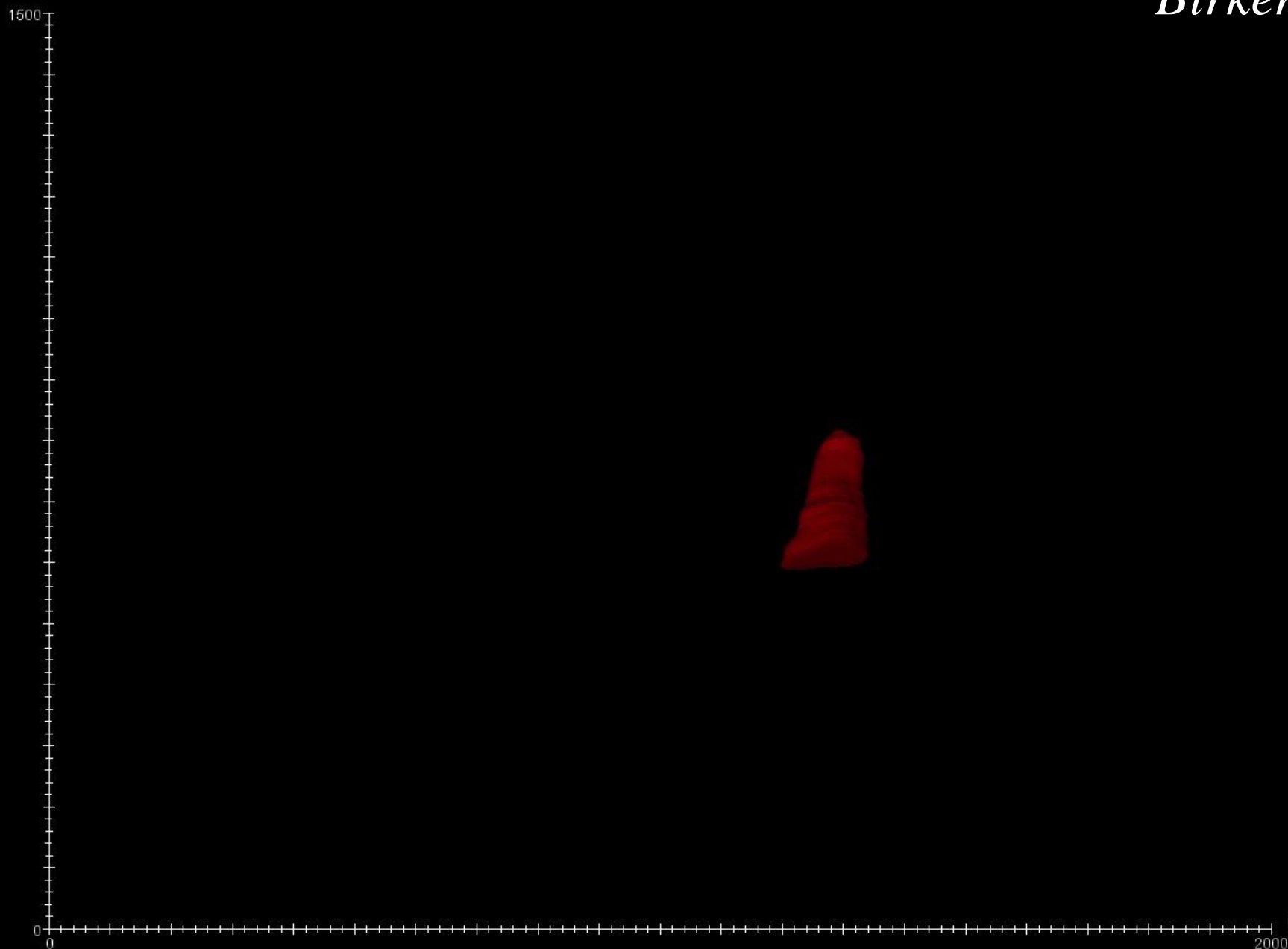


Fig. 10. Specimen ANASP\_02. SRXTM segmentation of discrete growth increments. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

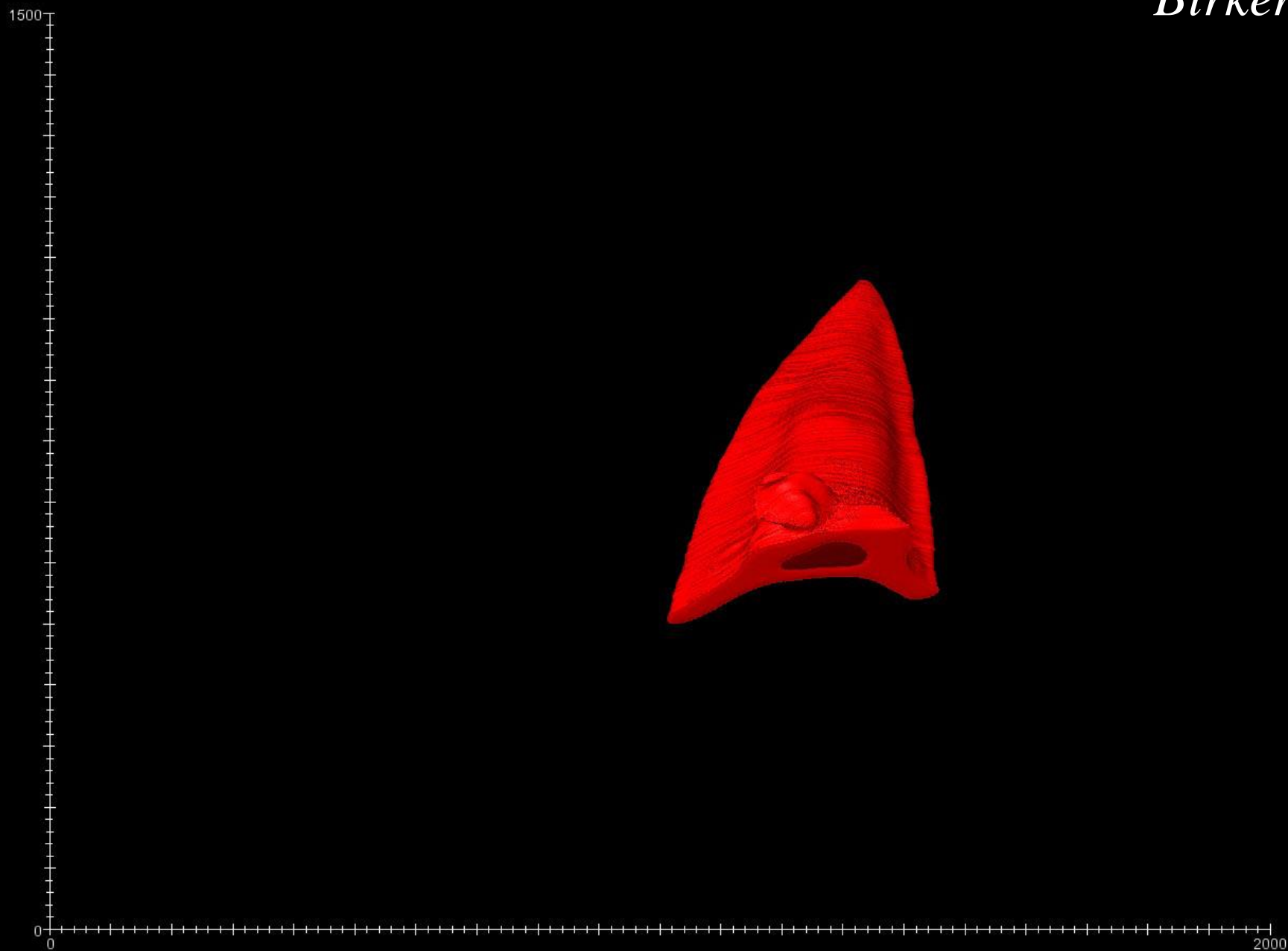


Fig. 11. Specimen ANASP\_02. SRXTM segmentation of discrete growth increments. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

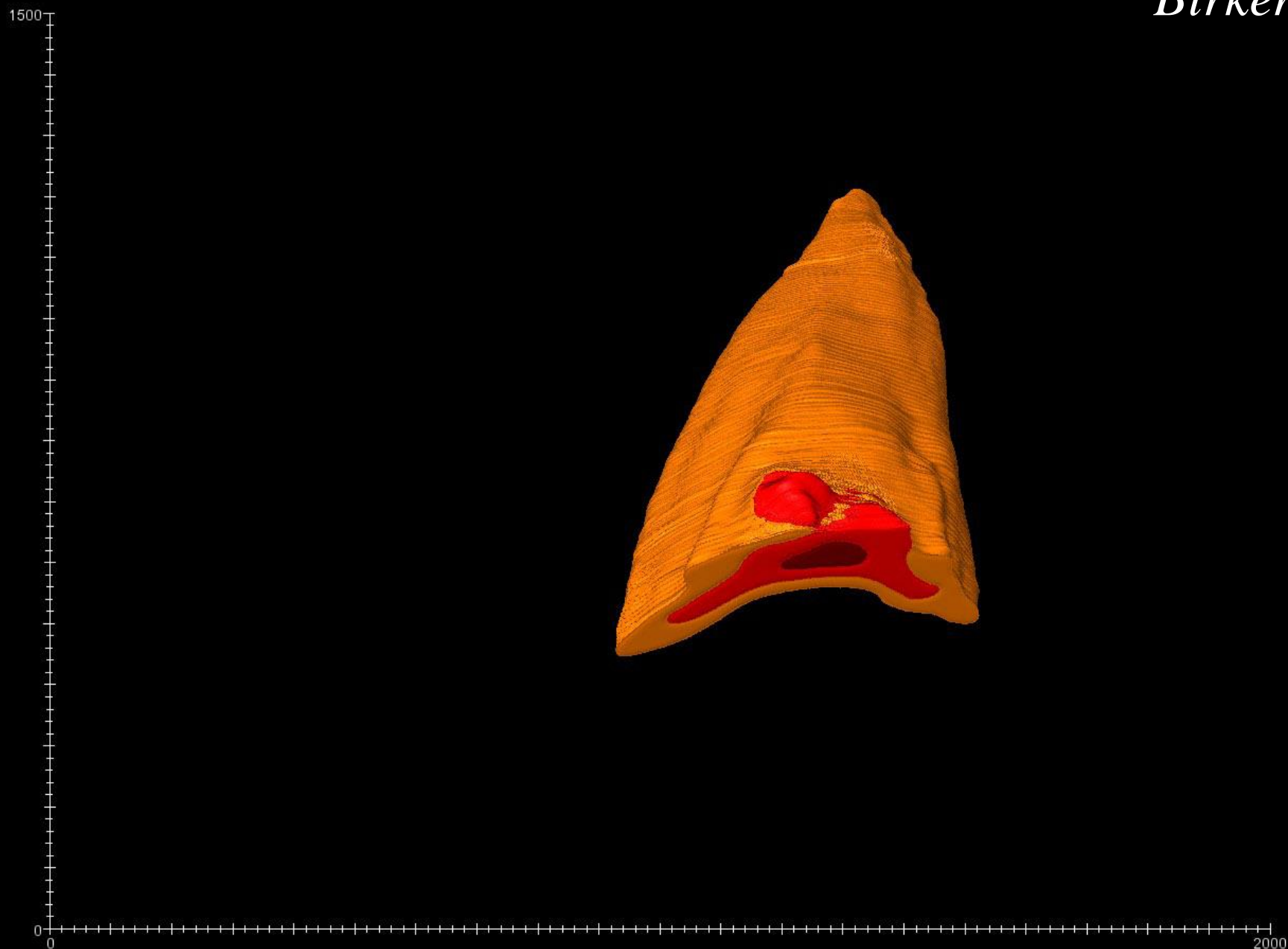


Fig. 12. Specimen ANASP\_02. SRXTM segmentation of discrete growth increments. Data collected using 20X objective. Scale bars in  $\mu\text{m}$ .

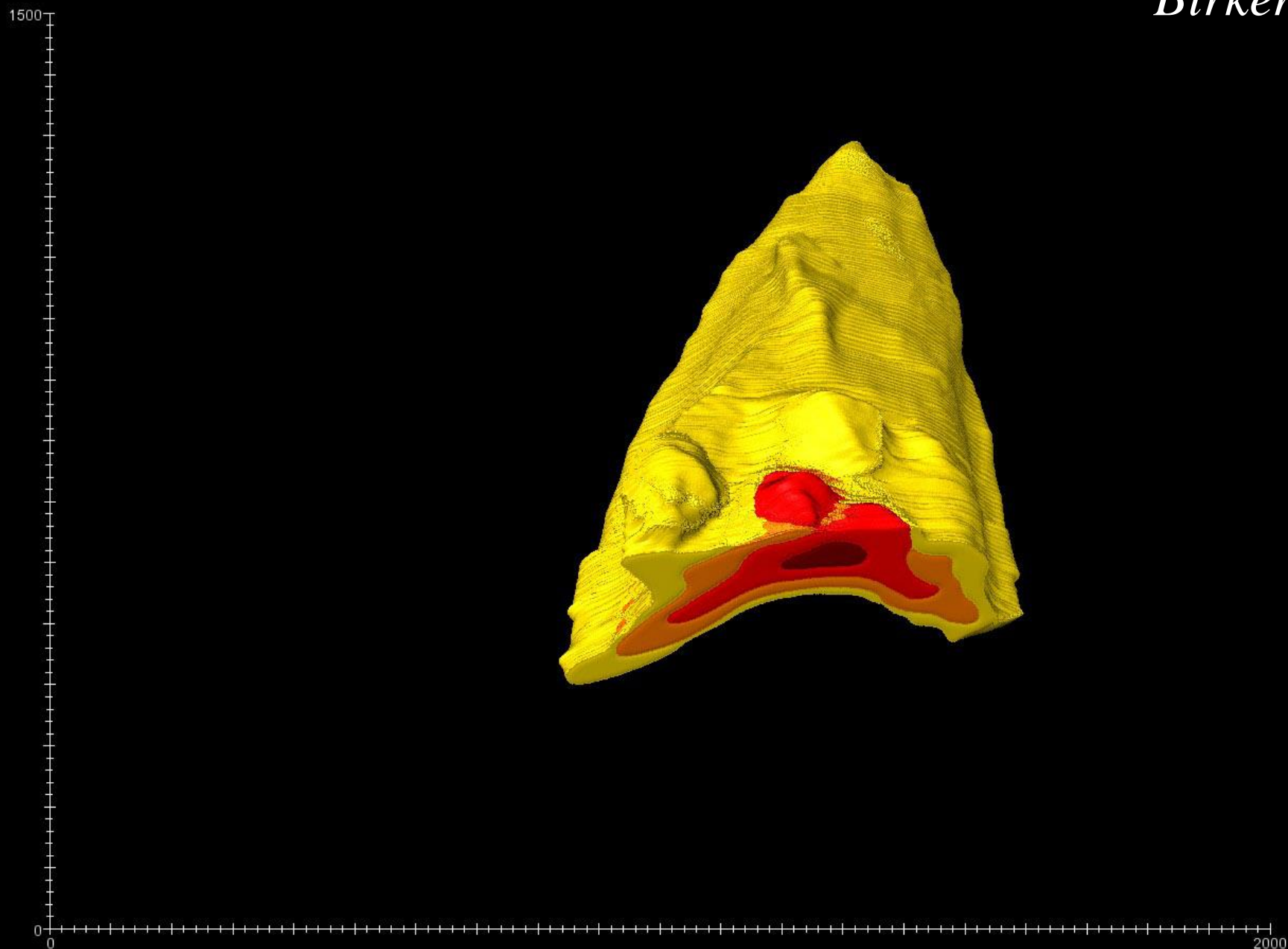


Fig. 13. Specimen ANASP\_02. SRXTM segmentation of discrete growth increments. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

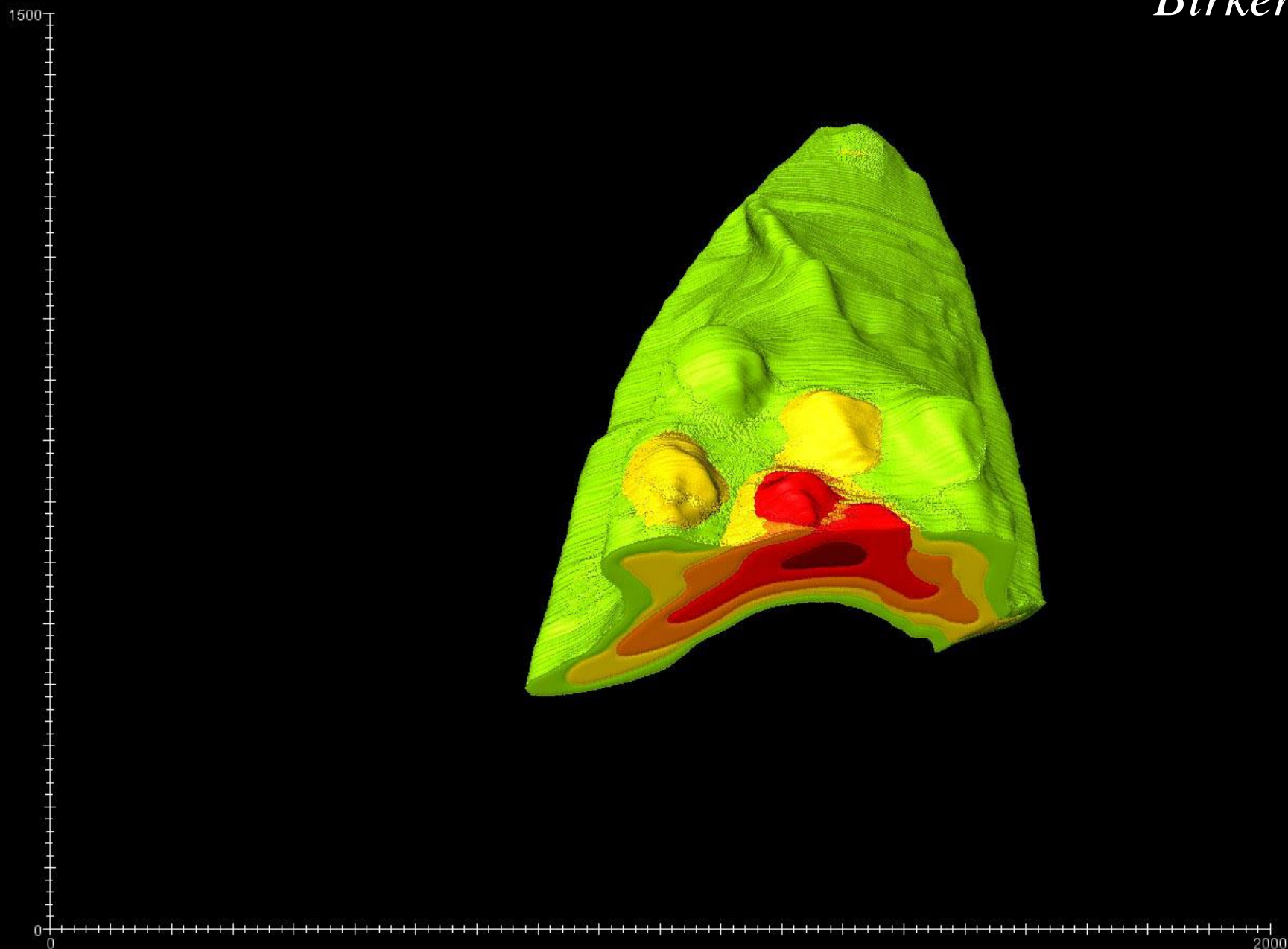


Fig. 14. Specimen ANASP\_02. SRXTM segmentation of discrete growth increments. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

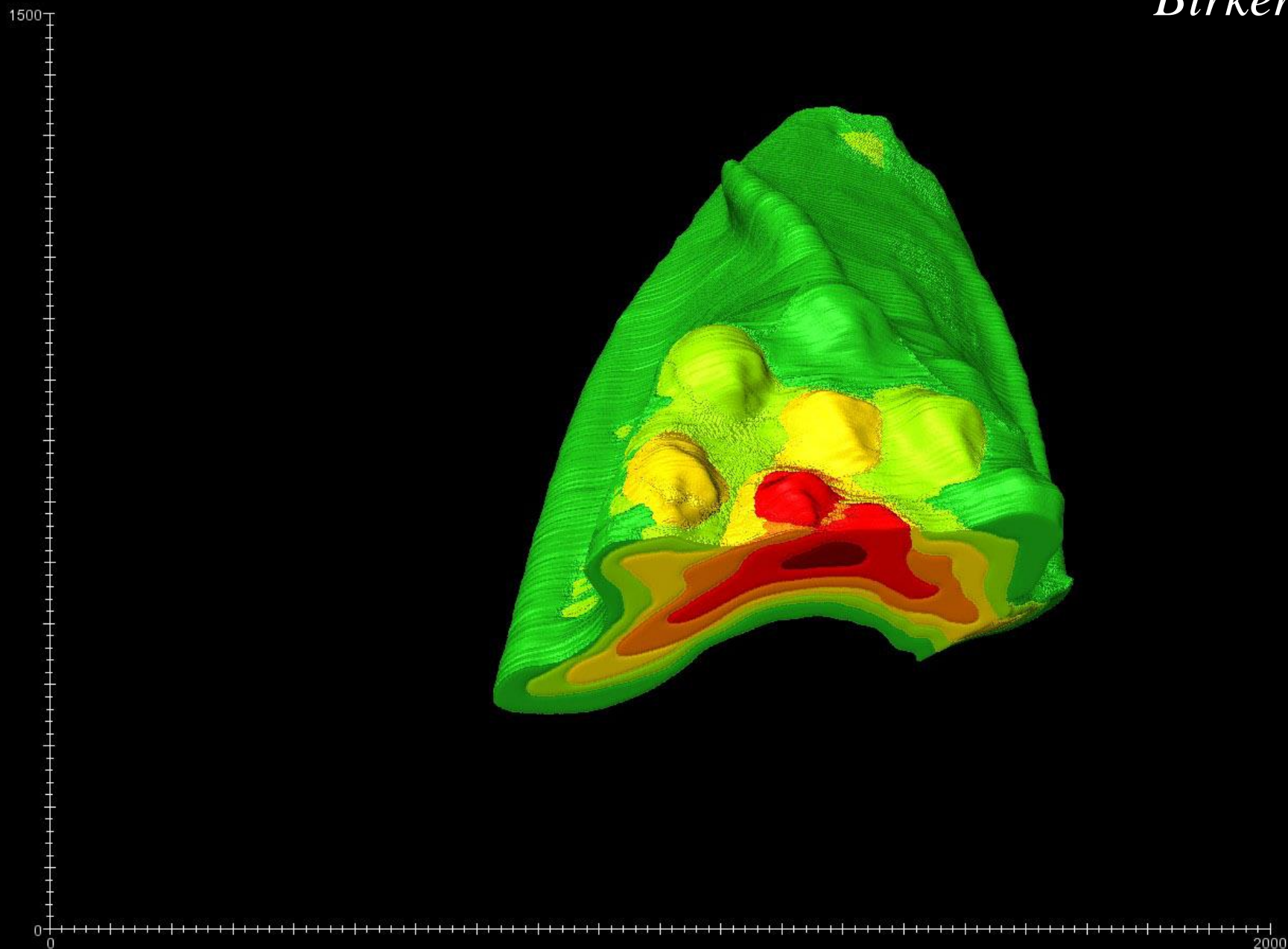


Fig. 15. Specimen ANASP\_02. SRXTM segmentation of discrete growth increments. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .



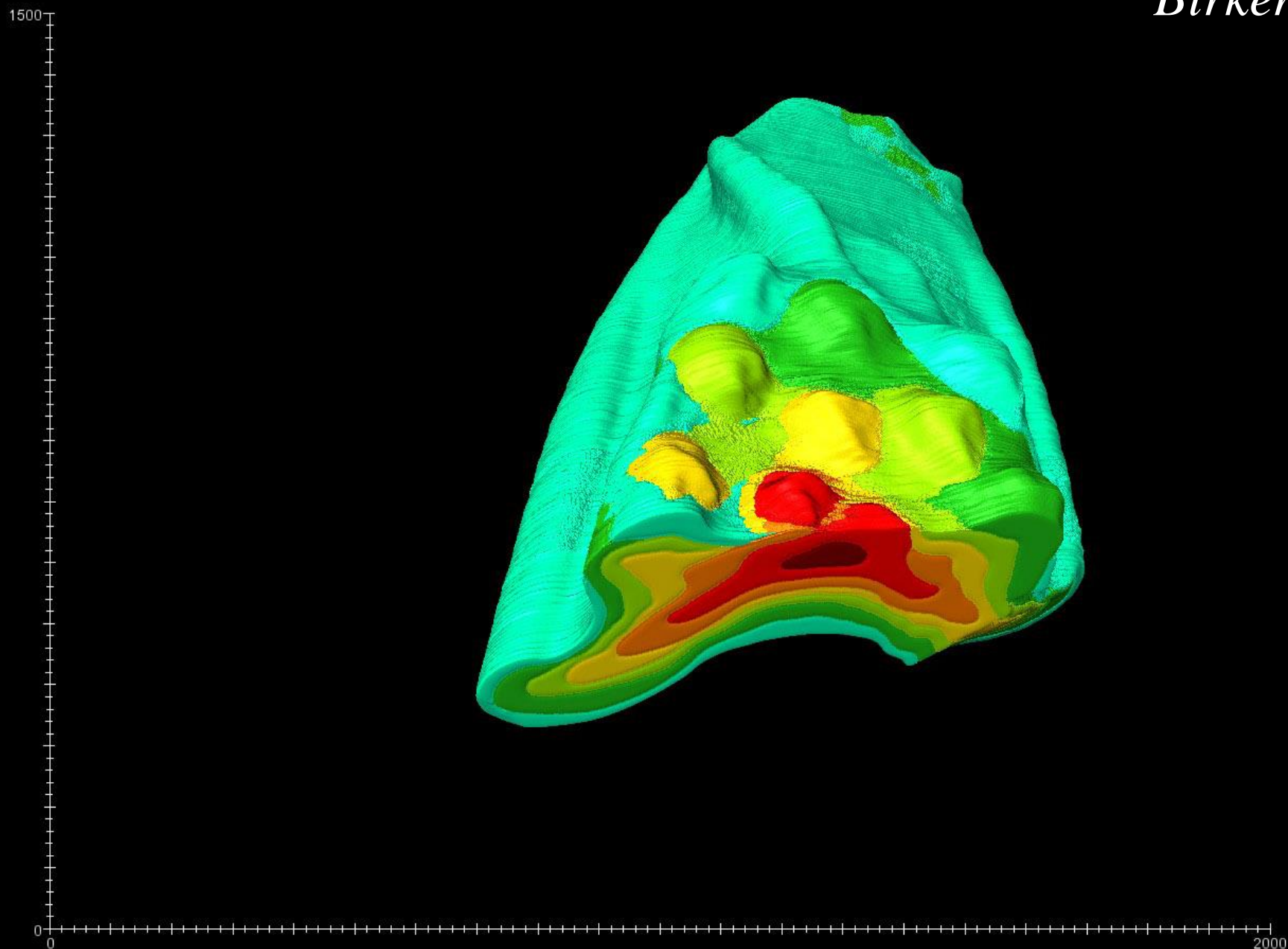


Fig. 16. Specimen ANASP\_02. SRXTM segmentation of discrete growth increments. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

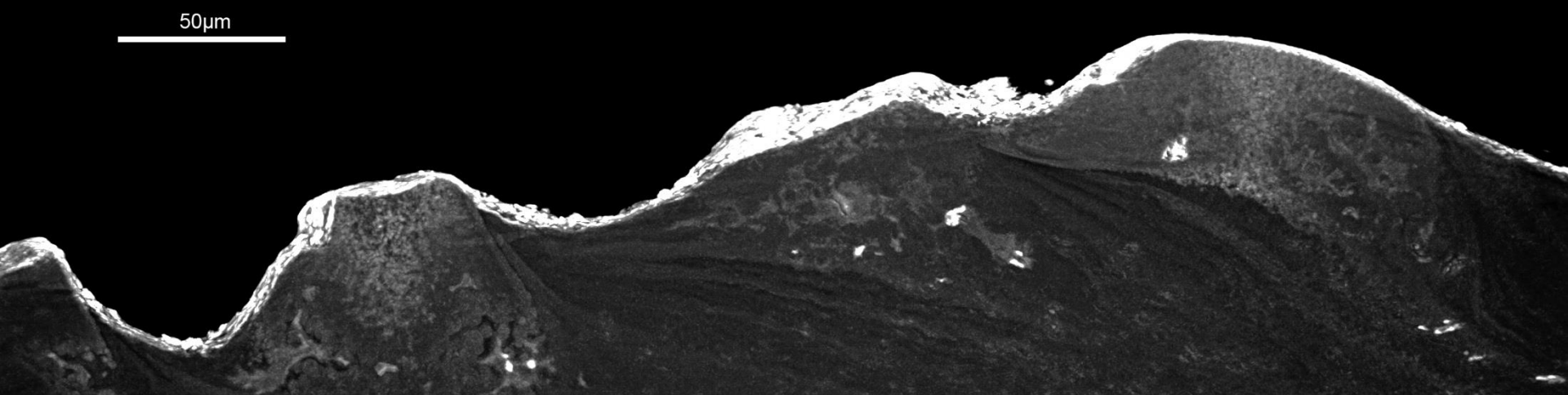


Fig. 17. Specimen ANASP\_02. SRXTM volume rendered thin section of the superficial layer. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .

*Birkenia*



Fig. 18. Specimen NHMUK PV P73702. SRXTM longitudinal slice through a body scale of *Birkenia*. Data collected using 10X objective. Scale

*Birkenia*



Fig. 19. Specimen NHMUK PV P73702. SRXTM longitudinal slice through a body scale of *Birkenia*. Data collected using 10X objective. Scale

*Birkenia*

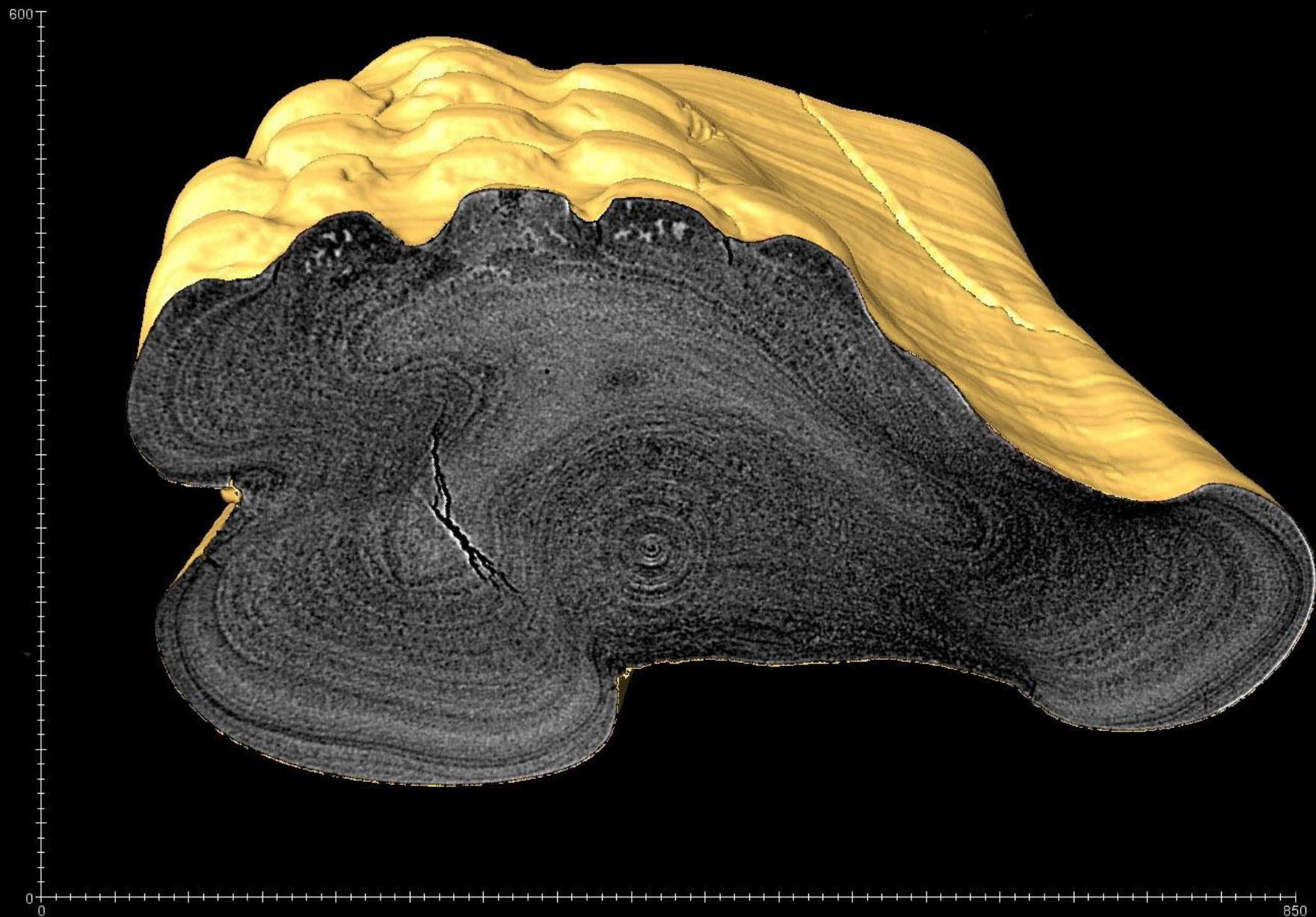


Fig. 20. Specimen NHMUK PV P73703. SRXTM slice through a body scale of *Birkenia*. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

*Rhyncholepis*

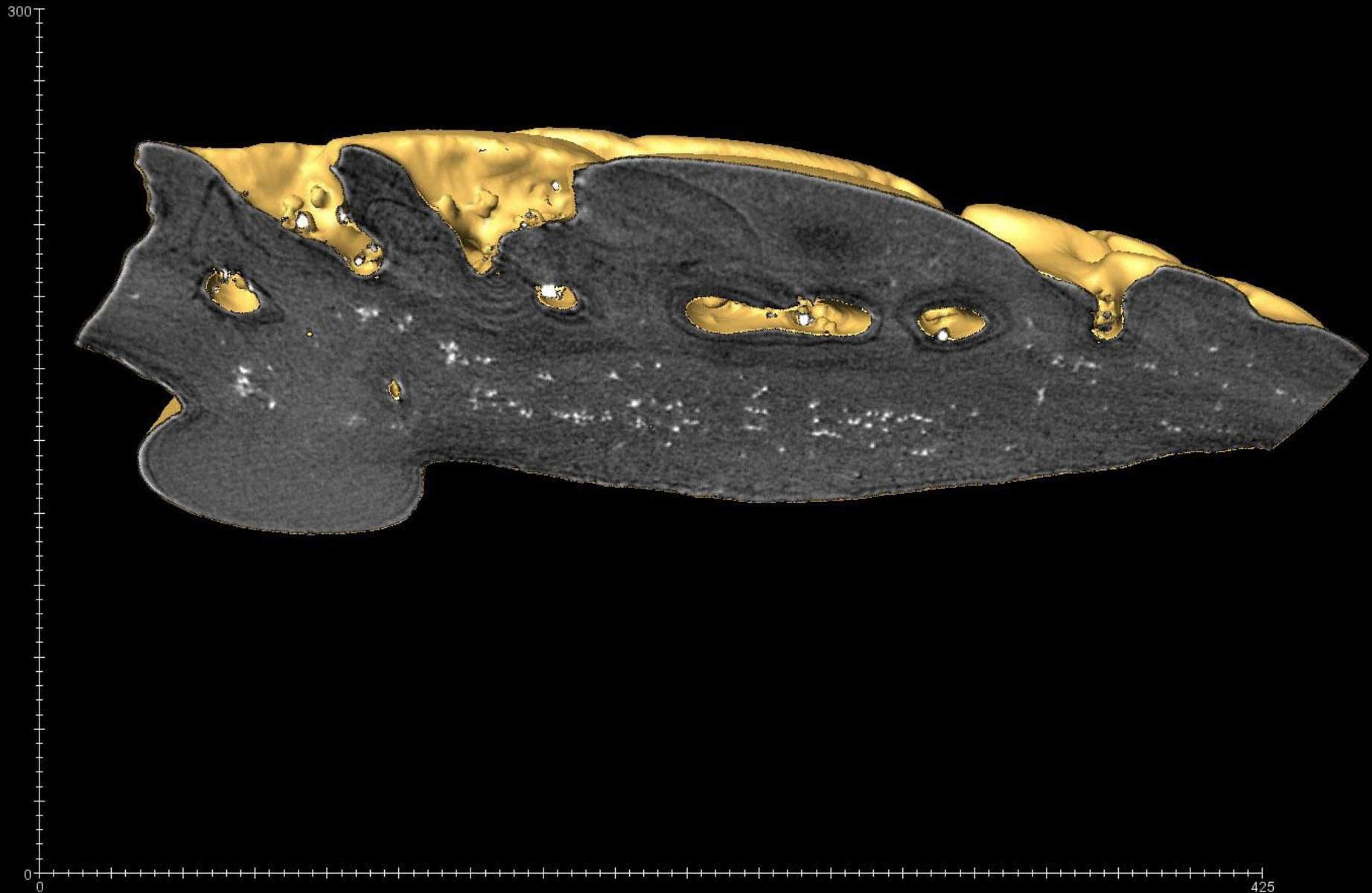


Fig. 21. Specimen NHMUK PV P73704. SRXTM slice through a body scale of *Rhyncholepis*. Data collected using 10X objective. Scale bars in

# *Rhyncholepis*

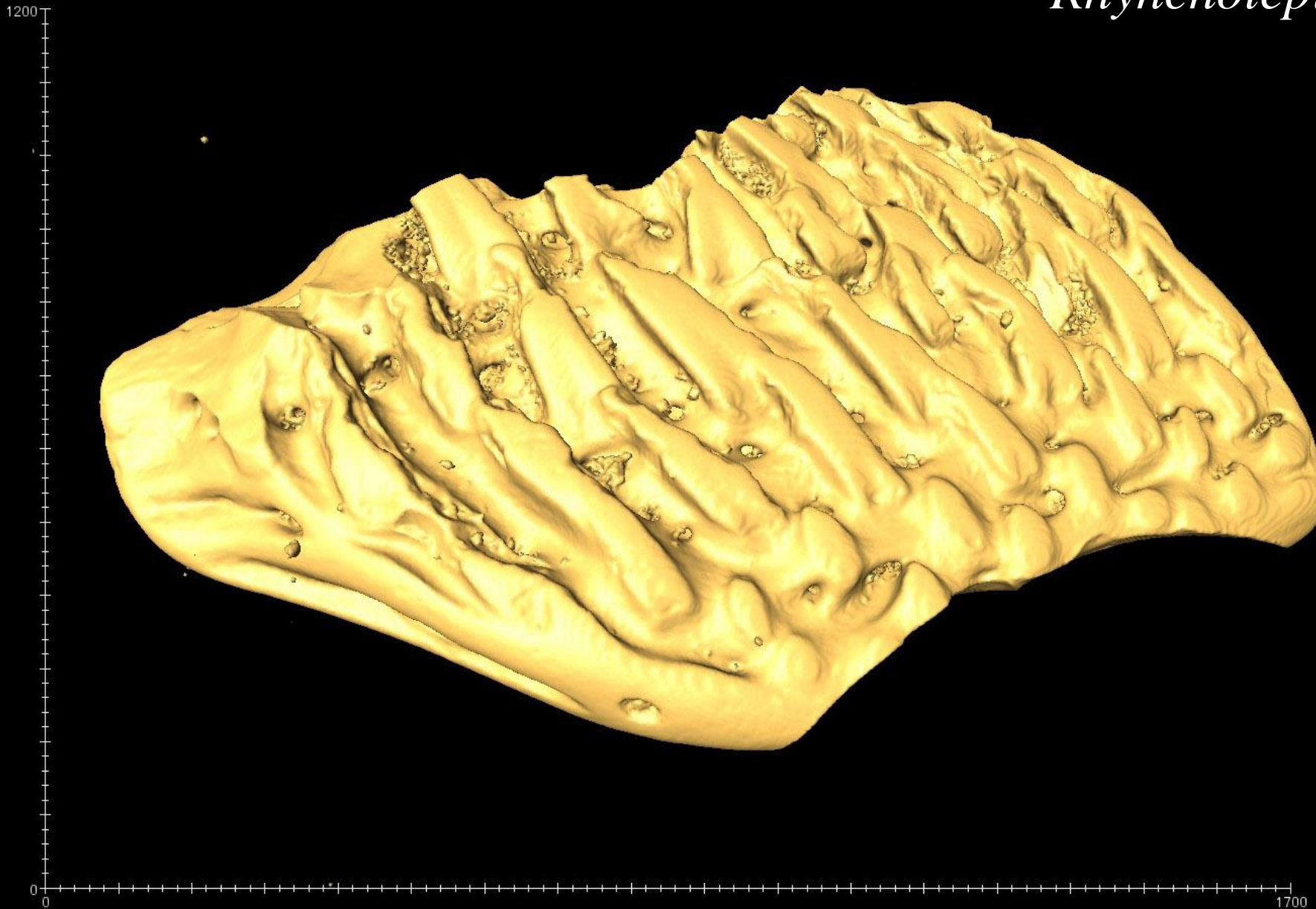


Fig. 22. Specimen NHMUK PV P73704. SRXTM isosurface of a *Rhyncholepis* body scale. Note the pores between the tubercles, which open into the pore canal network. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

*Rhyncholepis*

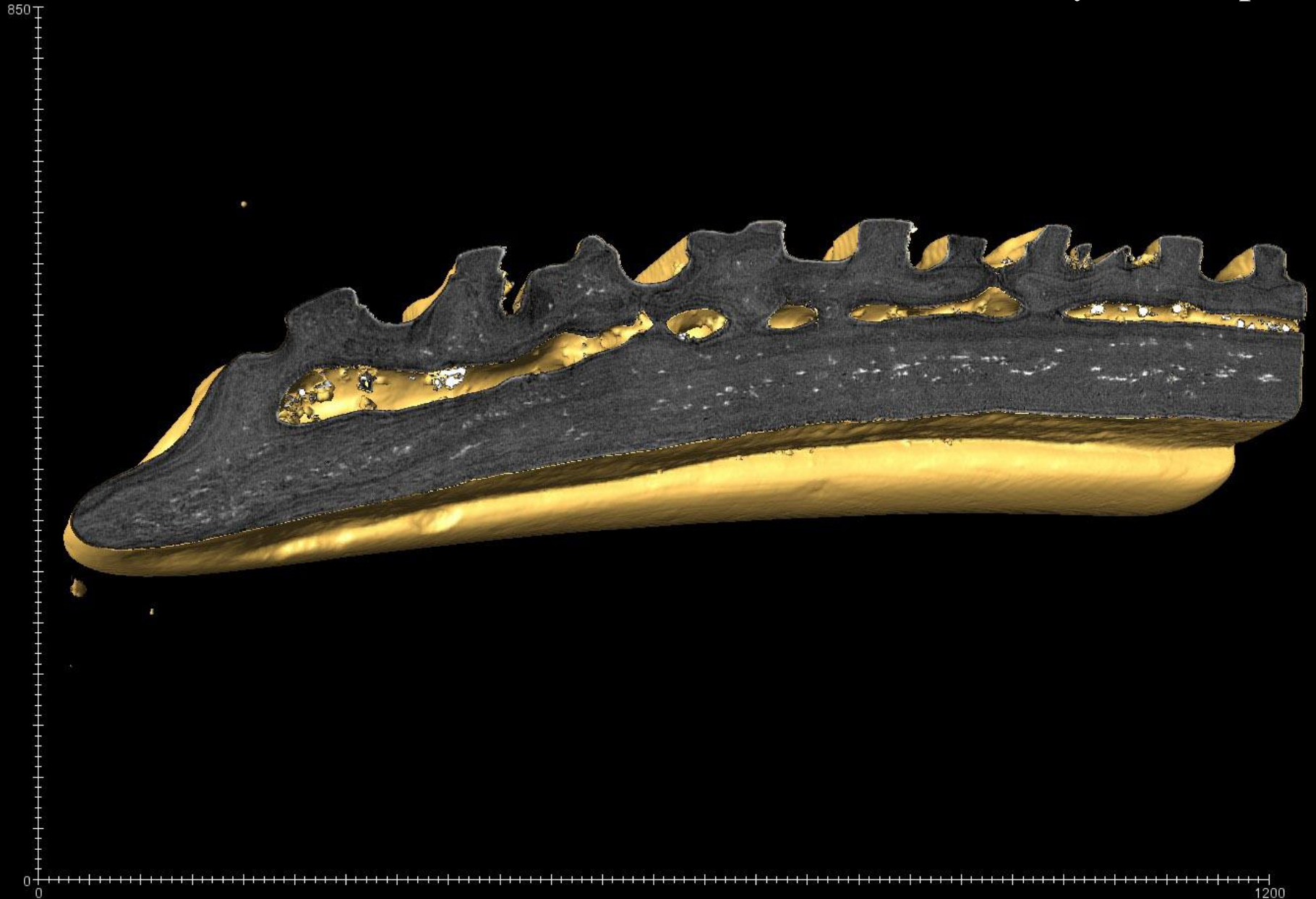


Fig. 23. Specimen NHMUK PV P73704. SRXTM longitudinal slice of a *Rhyncholepis* body scale Data collected using 20X objective. Scale bars in



# *Rhyncholepis*

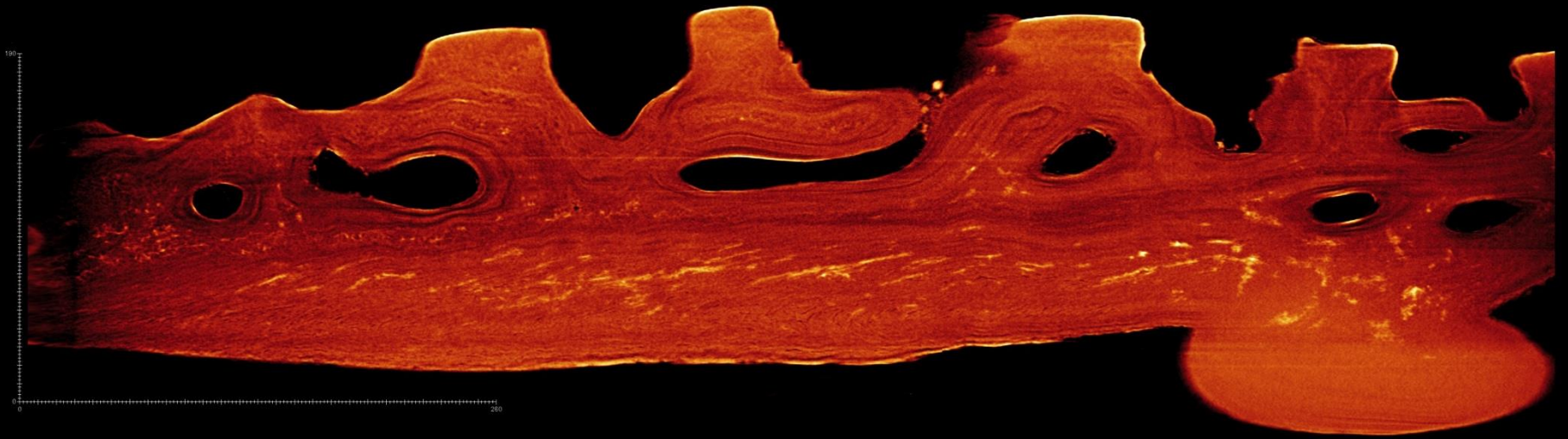


Fig. 24. Specimen NHMUK PV P73704. SRXTM longitudinal volume rendered thin section of a *Rhyncholepis* body scale Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

*Rhyncholepis*

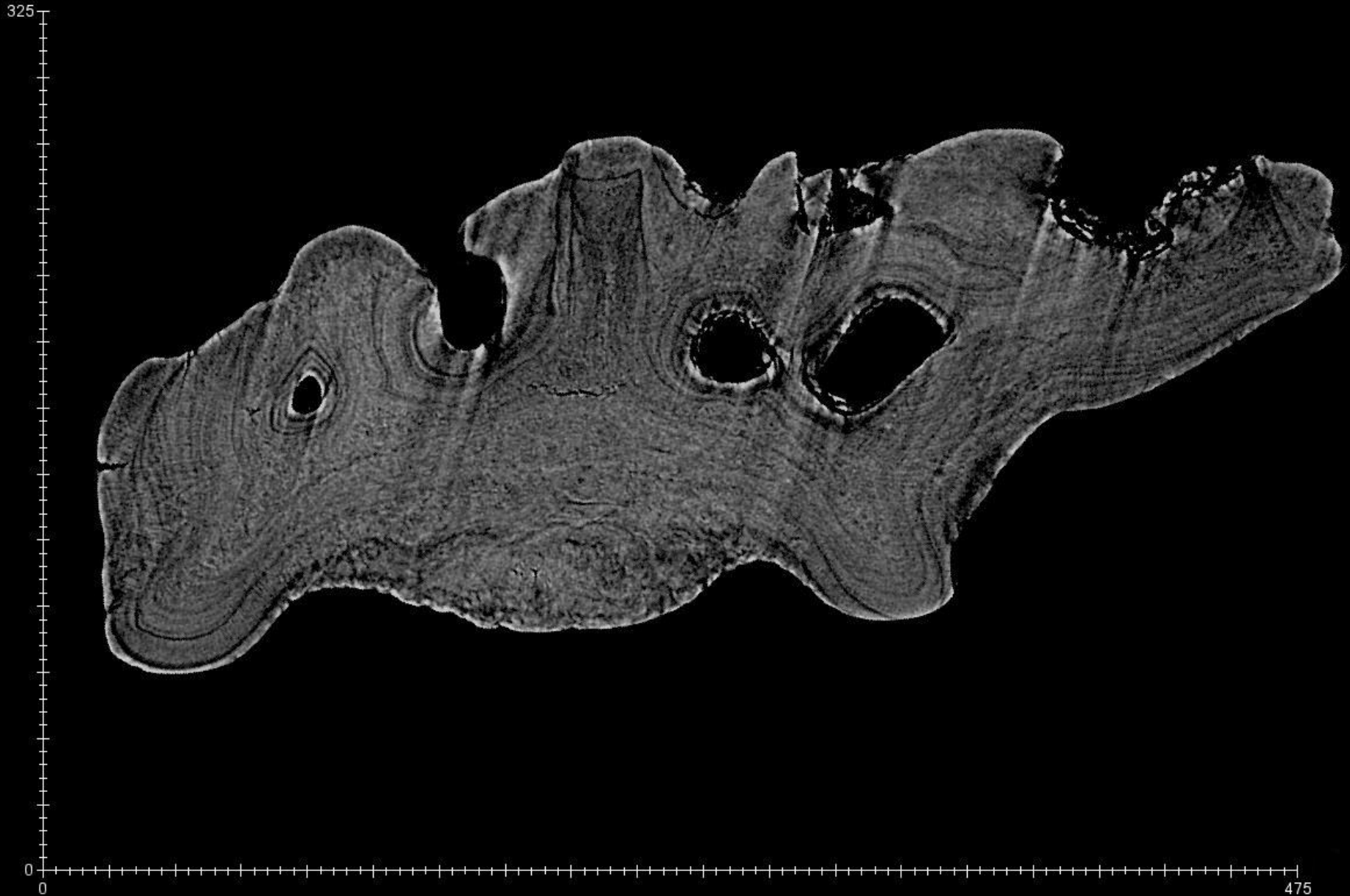


Fig. 25. Specimen NHMUK PV P73705. SRXTM slice of a *Rhyncholepis* body scale Data collected using 20X objective. Scale bars in  $\mu\text{m}$ .

*Rhyncholepis*

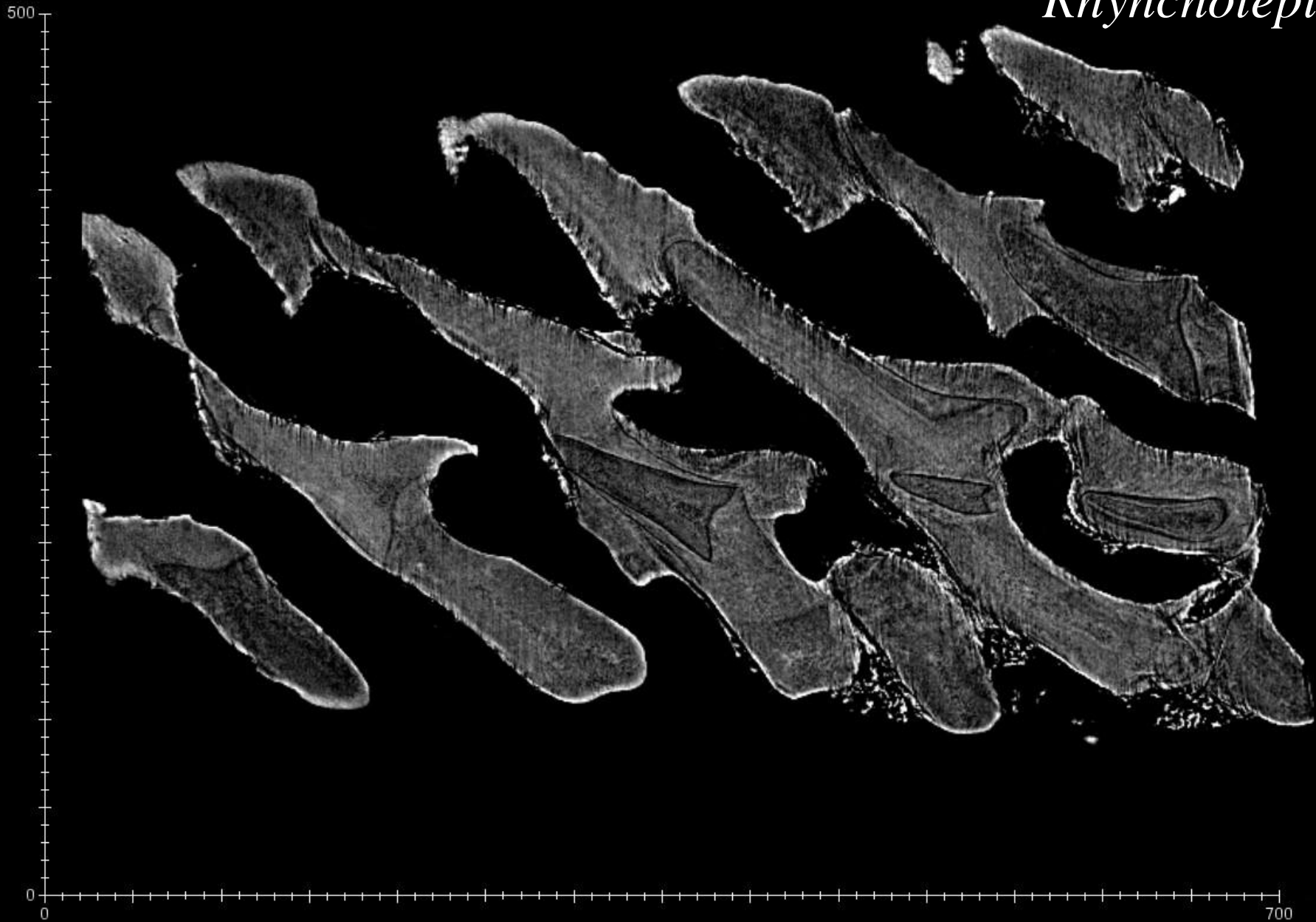


Fig. 26. Specimen NHMUK PV P73705. SRXTM horizontal slice through the superficial layer of a *Rhyncholepis* body scale. Data collected using 20X objective. Scale bars in µm.

*Rhyncholepis*



Fig. 27. Specimen NHMUK PV P73705. SRXTM horizontal slice through the superficial layer of a *Rhyncholepis* body scale Data collected using 20X objective. Scale bars in  $\mu\text{m}$ .

# *Rhyncholepis*



Fig. 28. Specimen NHMUK PV P73705. SRXTM slice of a *Rhyncholepis* body scale Data collected using 20X objective. Scale bars in  $\mu\text{m}$ .

# *Rhyncholepis*



Fig. 29. Specimen NHMUK PV P73705. SRXTM slice of a *Rhyncholepis* body scale Data collected using 20X objective. Scale bars in  $\mu\text{m}$ .

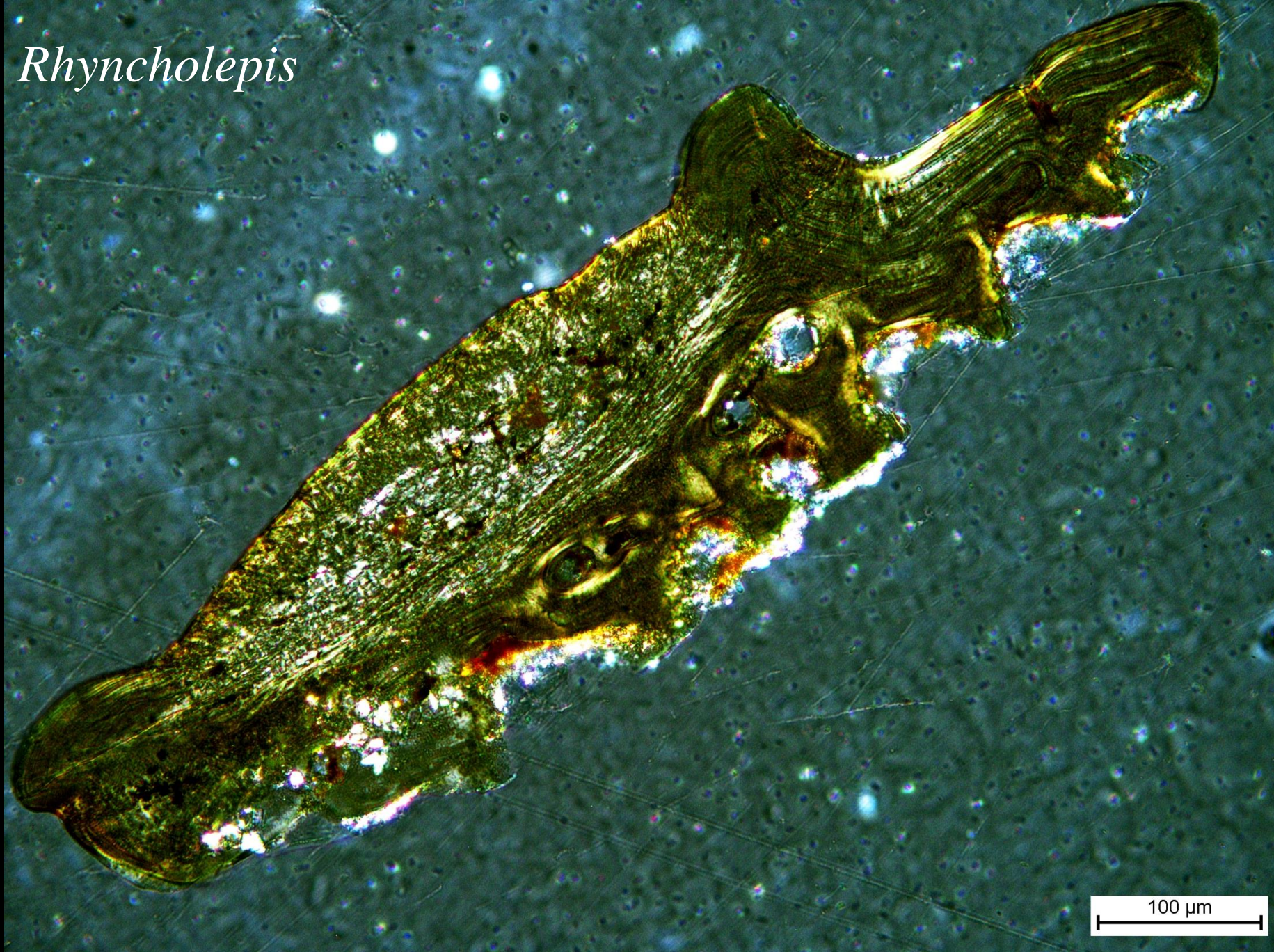
*Rhyncholepis*



100  $\mu$ m

Fig. 30. Specimen NHMUK PV P73706. LM thin section of a *Rhyncholepis* body scale.

*Rhyncholepis*

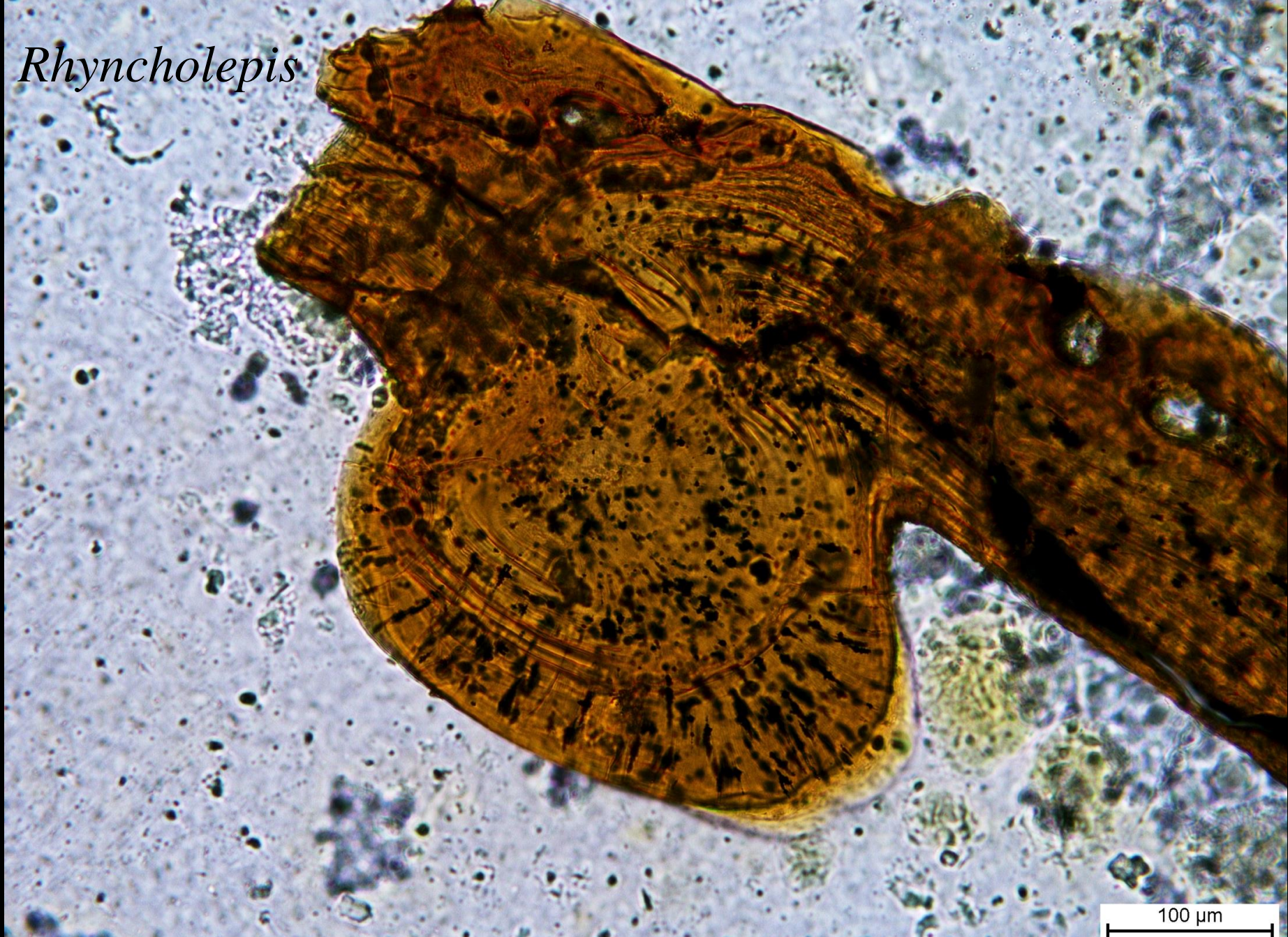


100  $\mu$ m

Fig. 31. Specimen NHMUK PV P73706. LM thin section of a *Rhyncholepis* body scale under cross-polarized light.



*Rhyncholepis*



100  $\mu$ m

Fig. 32. Specimen NHMUK PV P73707. LM thin section of the median visceral rib of *Rhyncholepis*. Note the radial thread-like spaces in filled with pyrite.

*Rhyncholepis*

100  $\mu$ m

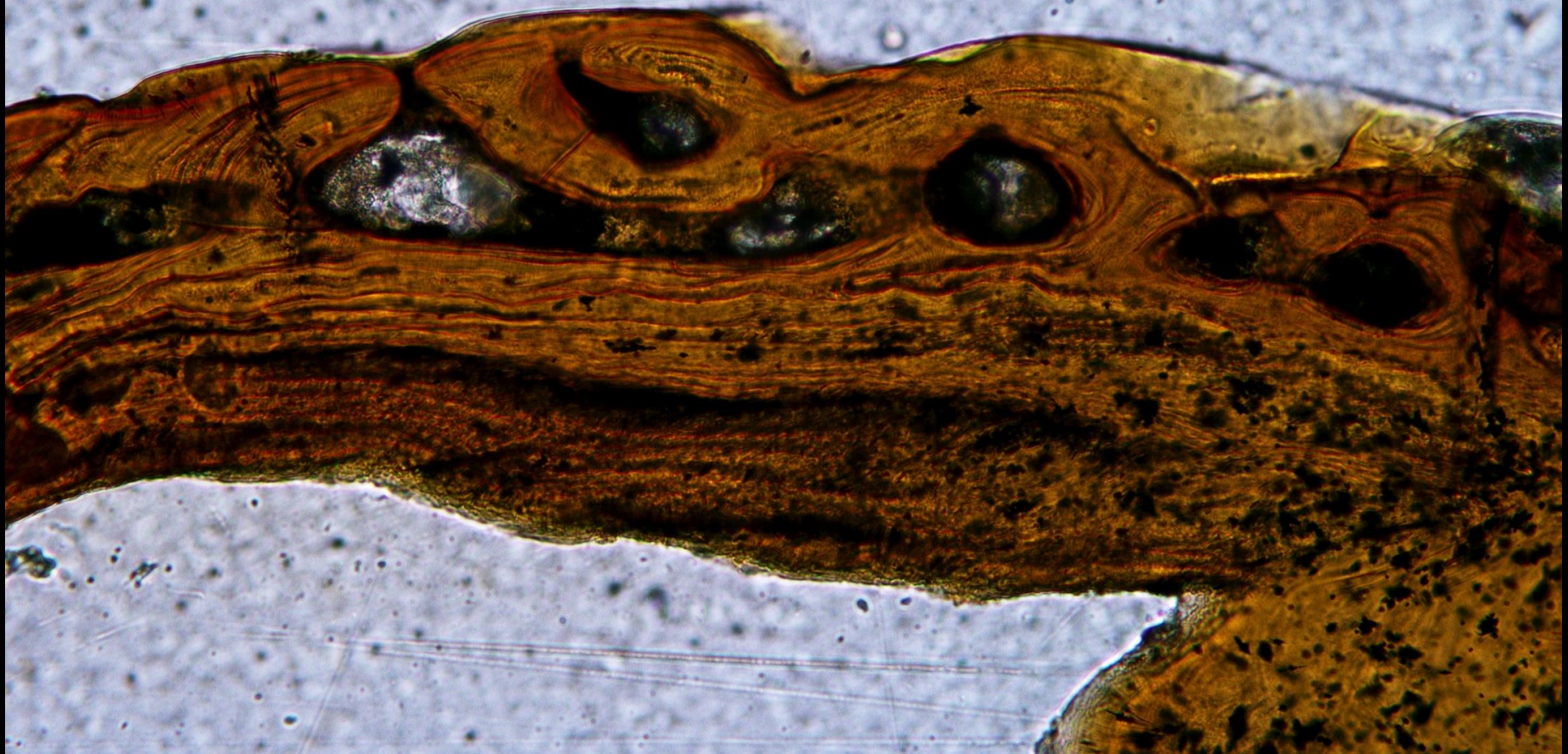


Fig. 33. Specimen NHMUK PV P73707. LM thin section of a *Rhyncholepis* body scale.

*Rhyncholepis*

100  $\mu\text{m}$

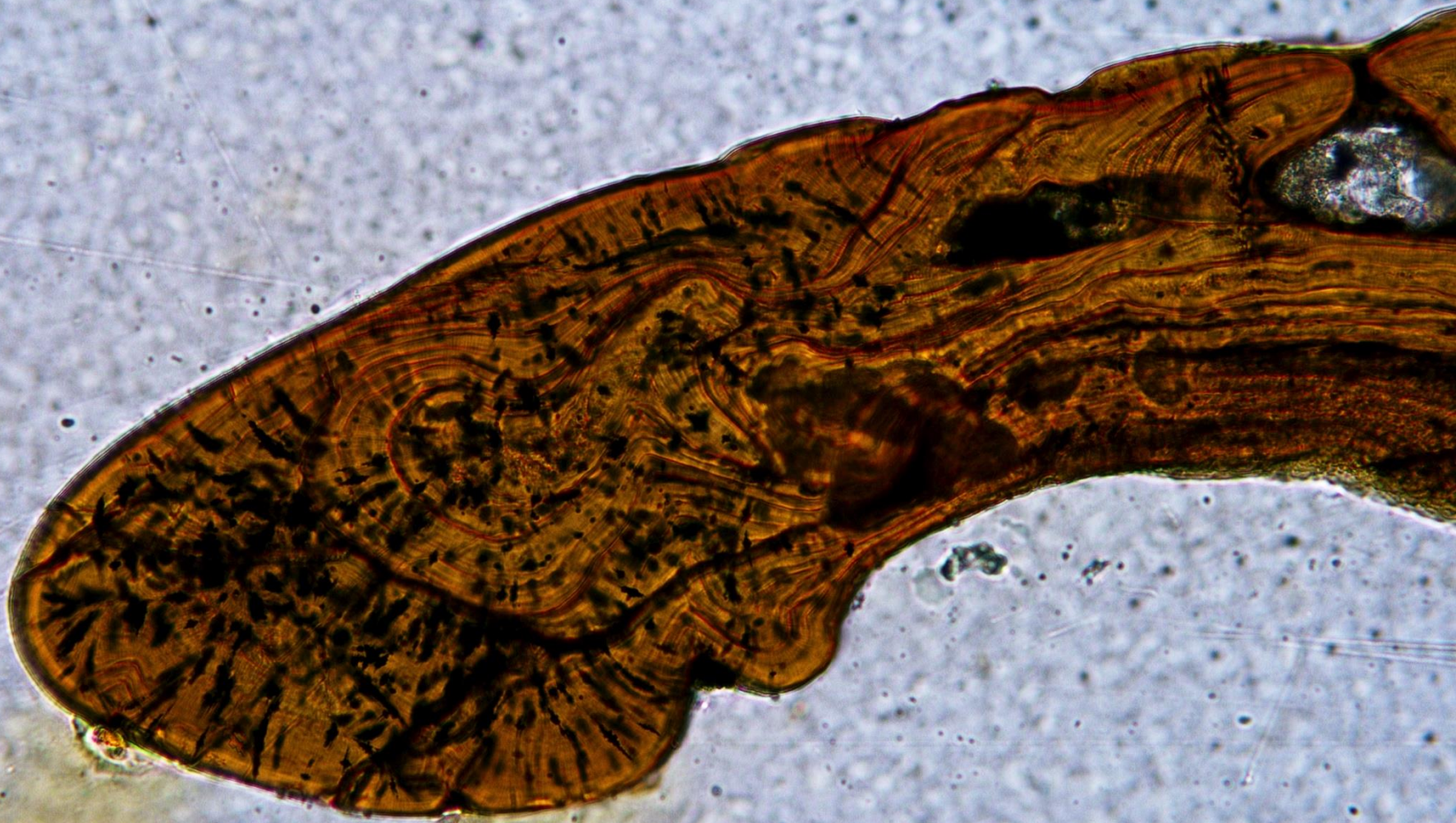


Fig. 34. Specimen NHMUK PV P73707. LM thin section of the anterior visceral rib of a *Rhyncholepis* body scale.

*Rhyncholepis*

100  $\mu\text{m}$

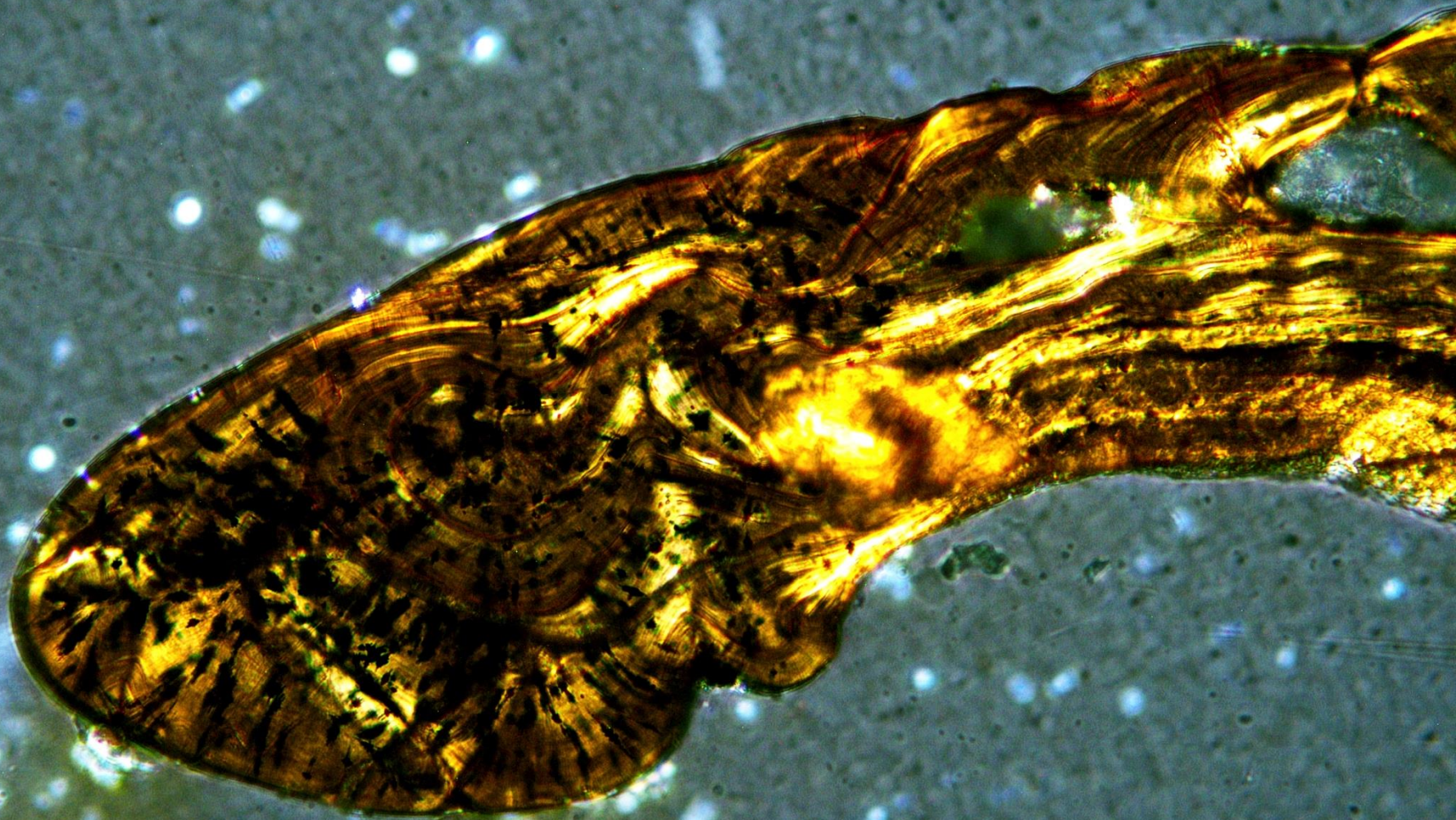


Fig. 35. Specimen NHMUK PV P73707. LM thin section of the anterior visceral rib of a *Rhyncholepis* body scale under cross polarized light.

*Vesikulepis*

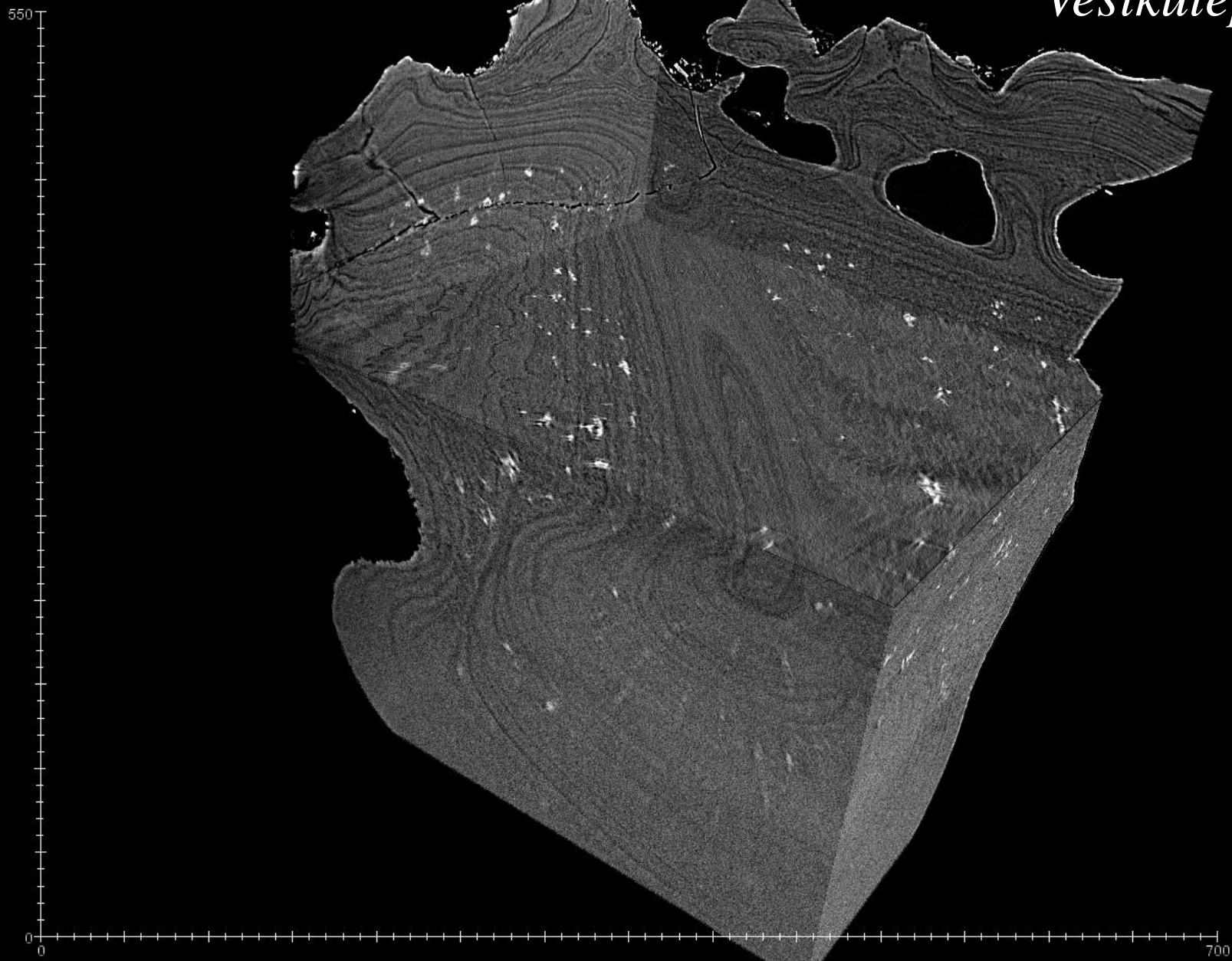
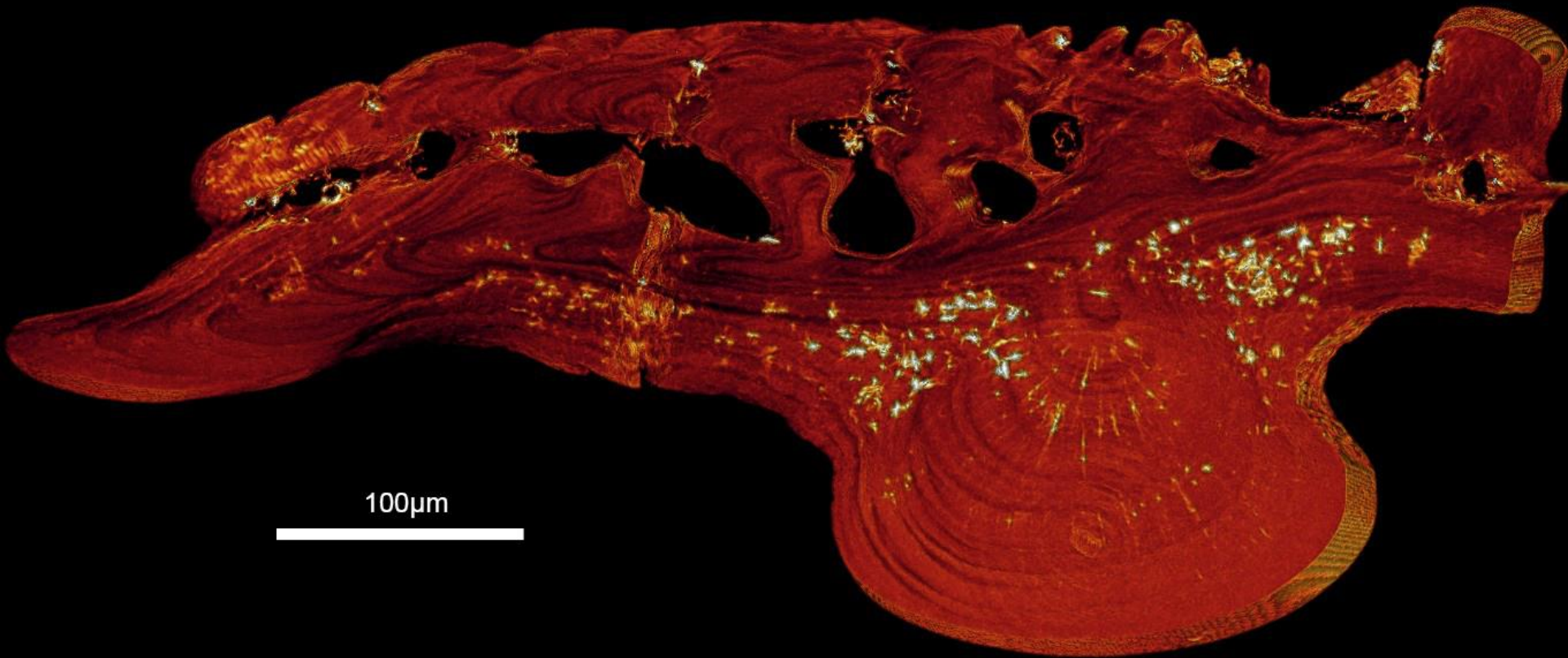


Fig. 36. Specimen NHMUK PV P73708. Block model of SRXTM slices through a body scale of *Vesikulepis*. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .

*Vesikulepis*



100 $\mu$ m

Fig. 37. Specimen NHMUK PV P73708. SRXTM volume rendered virtual thin section of a body scale of *Vesikulepis*. Data collected using 10X objective. Scale bars in  $\mu$ m.

*Vesikulepis*

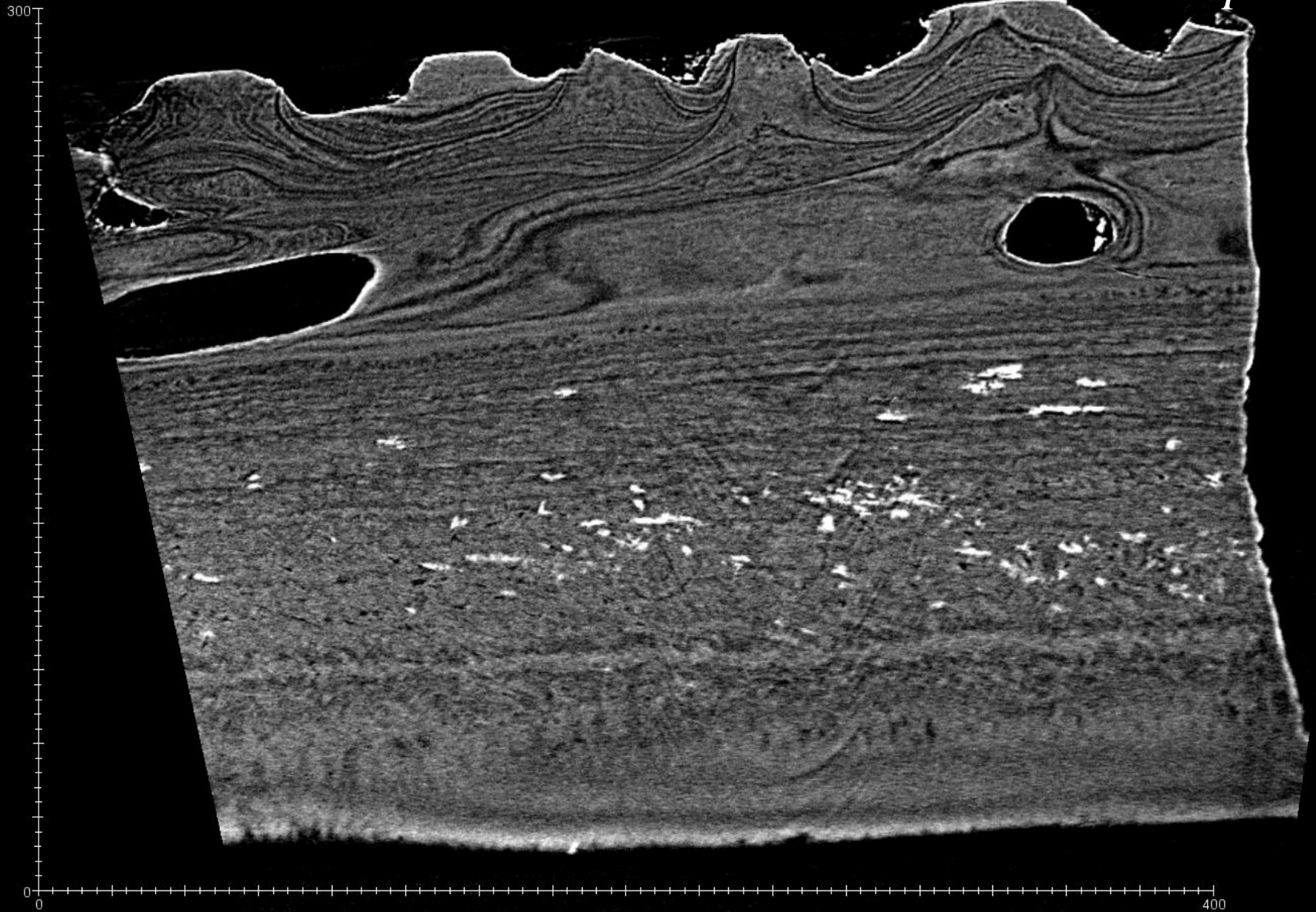


Fig. 38. Specimen NHMUK PV P73708. SRXTM longitudinal slice through the superficial layer and median visceral rib of a *Vesikulepis* body scale. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .

# *Vesikulepis*

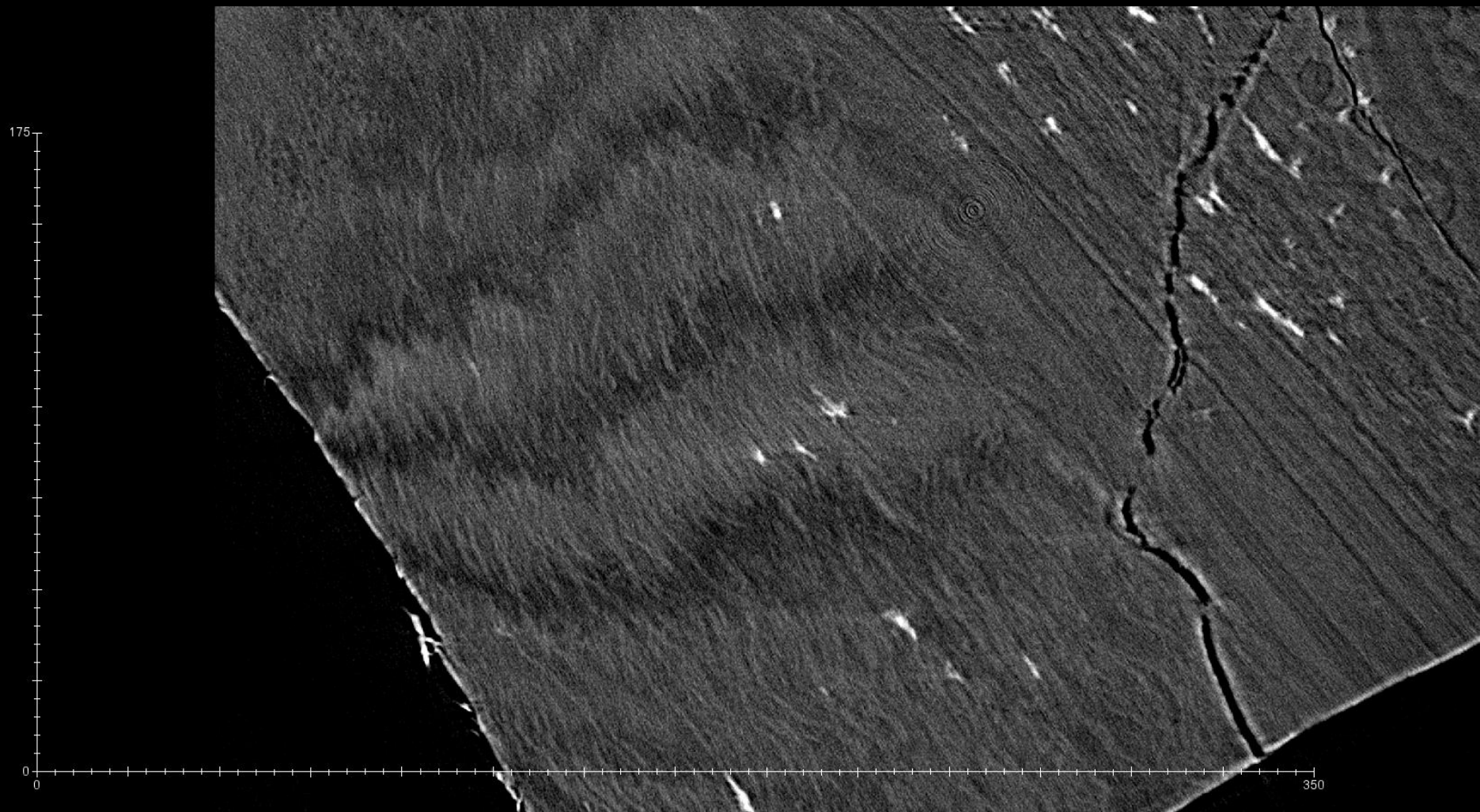


Fig. 39. Specimen NHMUK PV P73708. SRXTM horizontal slice through the basal layer of a *Vesikulepis* body scale. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .



# *Vesikulepis*

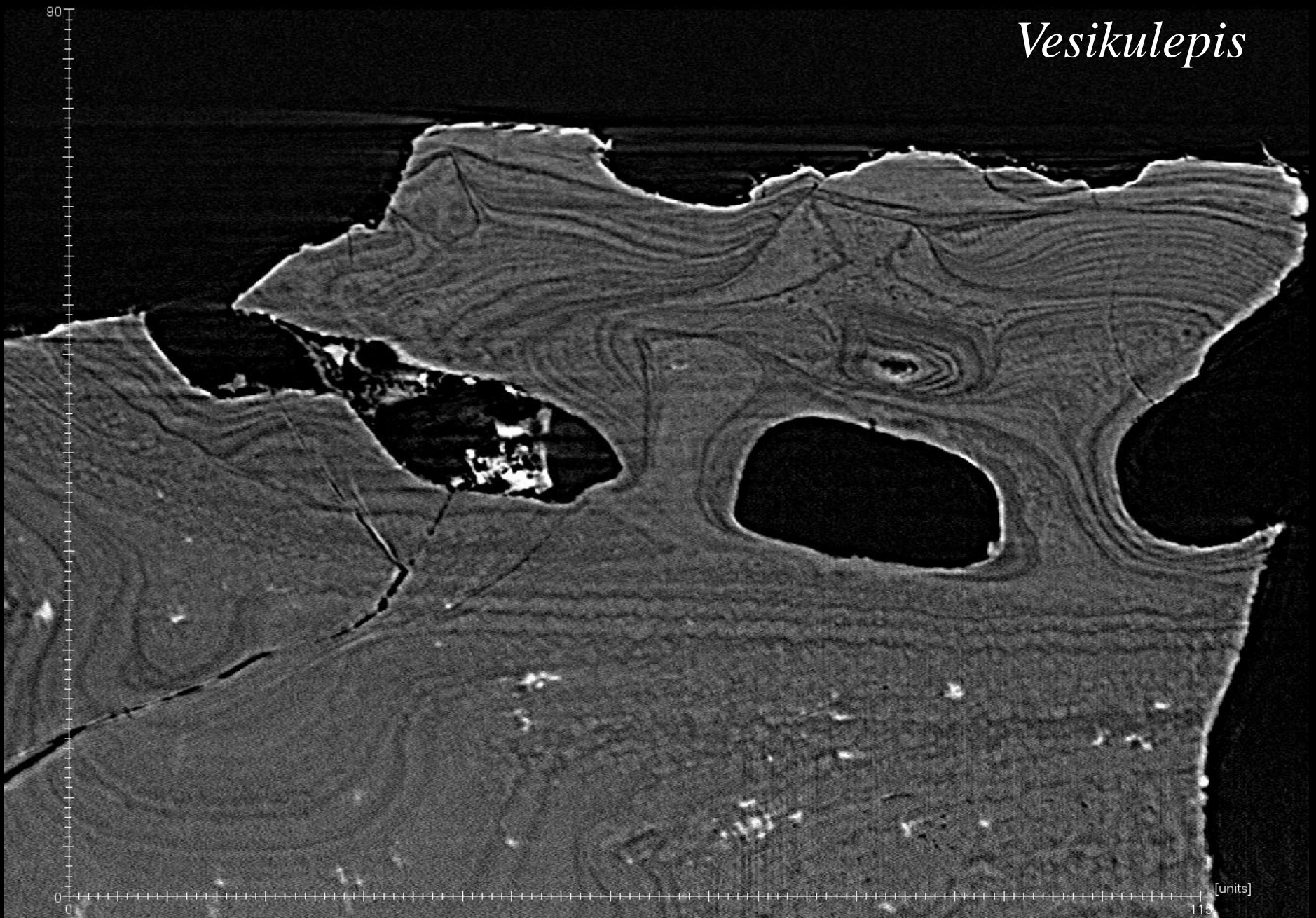


Fig. 40. Specimen NHMUK PV P73708. SRXTM slice through the superficial layer and canal network of a *Vesikulepis* body scale. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .

# *Vesikulepis*

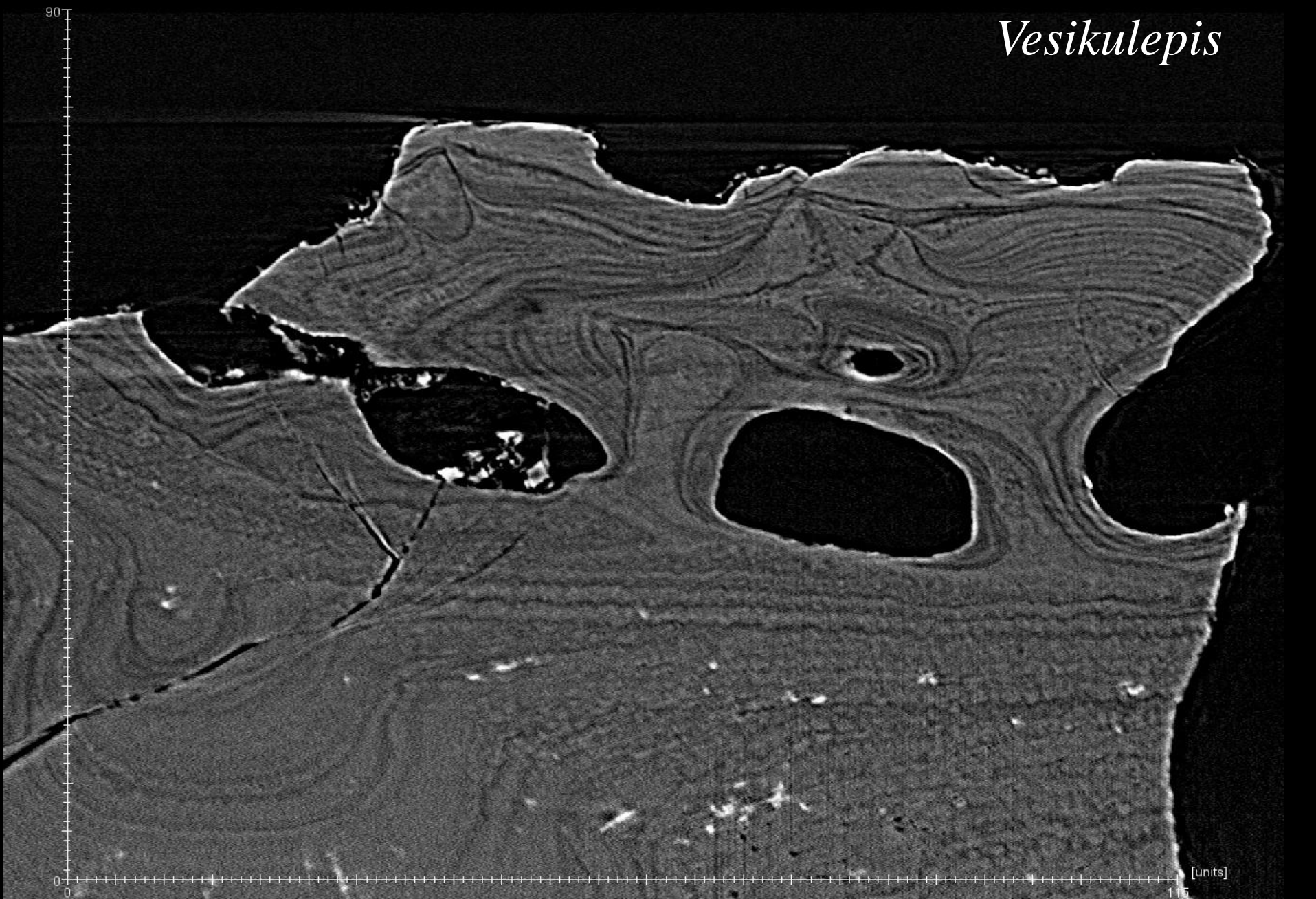


Fig. 41. Specimen NHMUK PV P73708. SRXTM slice through the superficial layer and canal network of a *Vesikulepis* body scale. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .

*Vesikulepis*

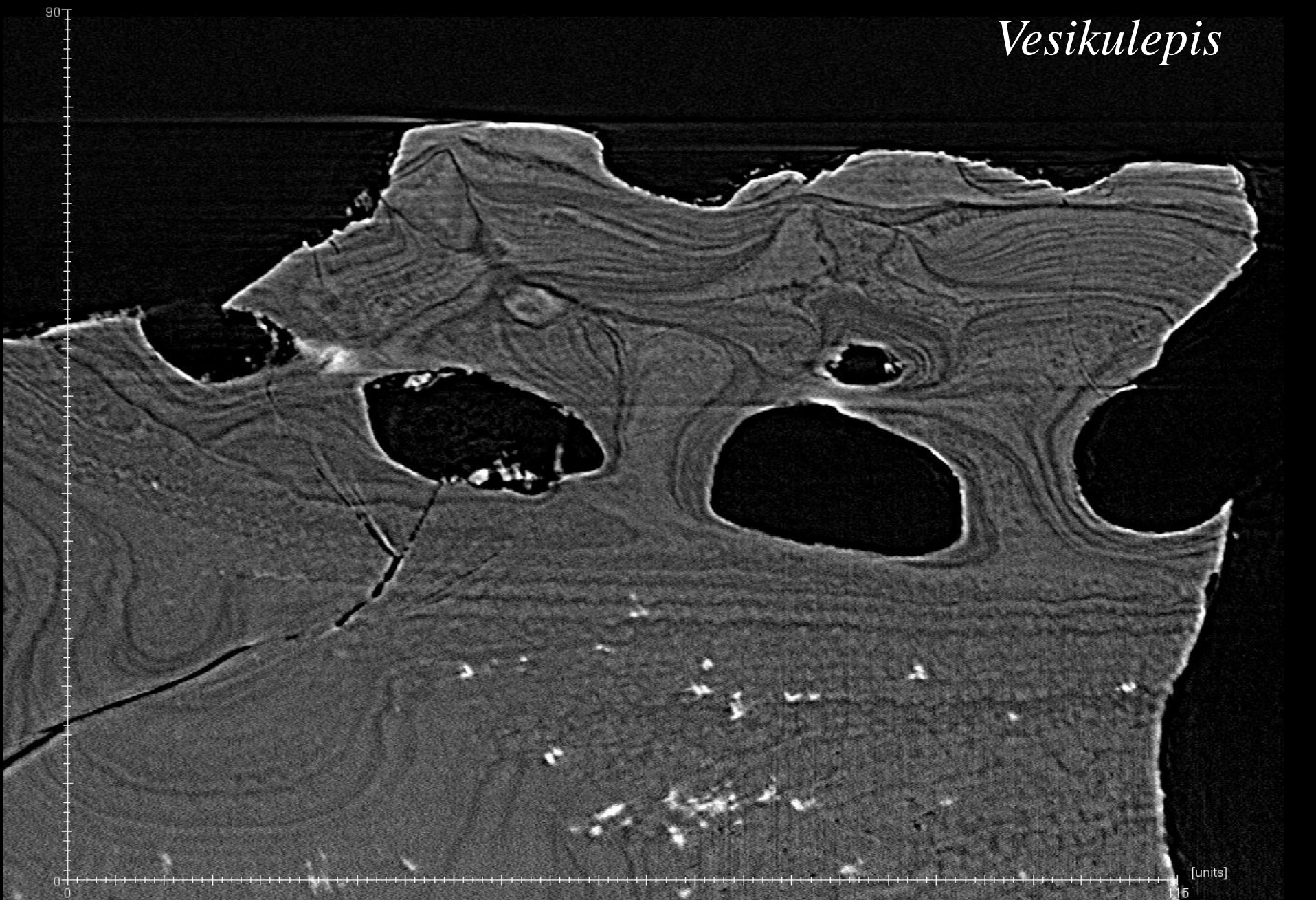


Fig. 42. Specimen NHMUK PV P73708. SRXTM slice through the superficial layer and canal network of a *Vesikulepis* body scale. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .

*Vesikulepis*

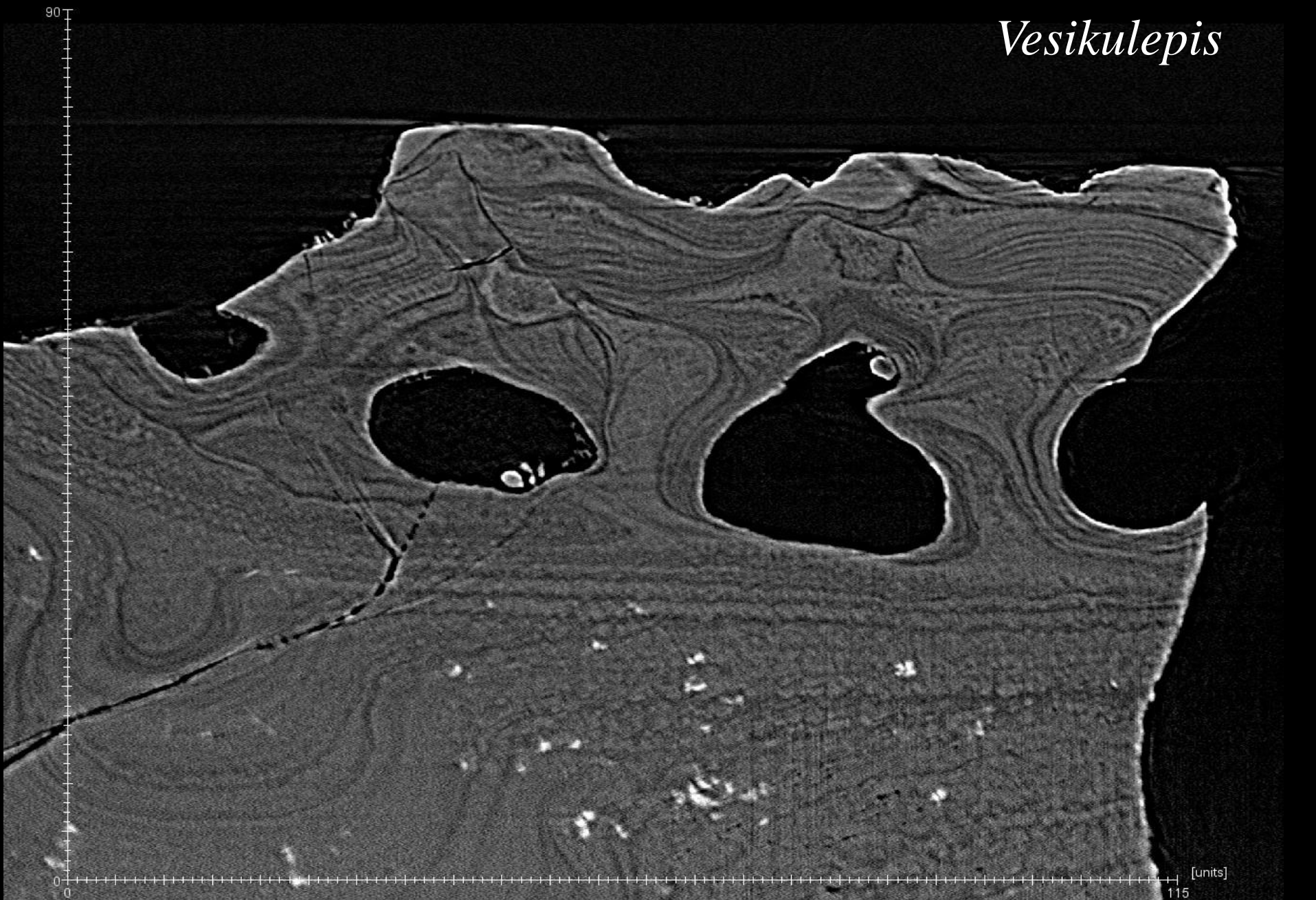


Fig. 43. Specimen NHMUK PV P73708. SRXTM slice through the superficial layer and canal network of a *Vesikulepis* body scale. Data collected using 40X objective. Scale bars in  $\mu\text{m}$ .

*Vesikulepis*

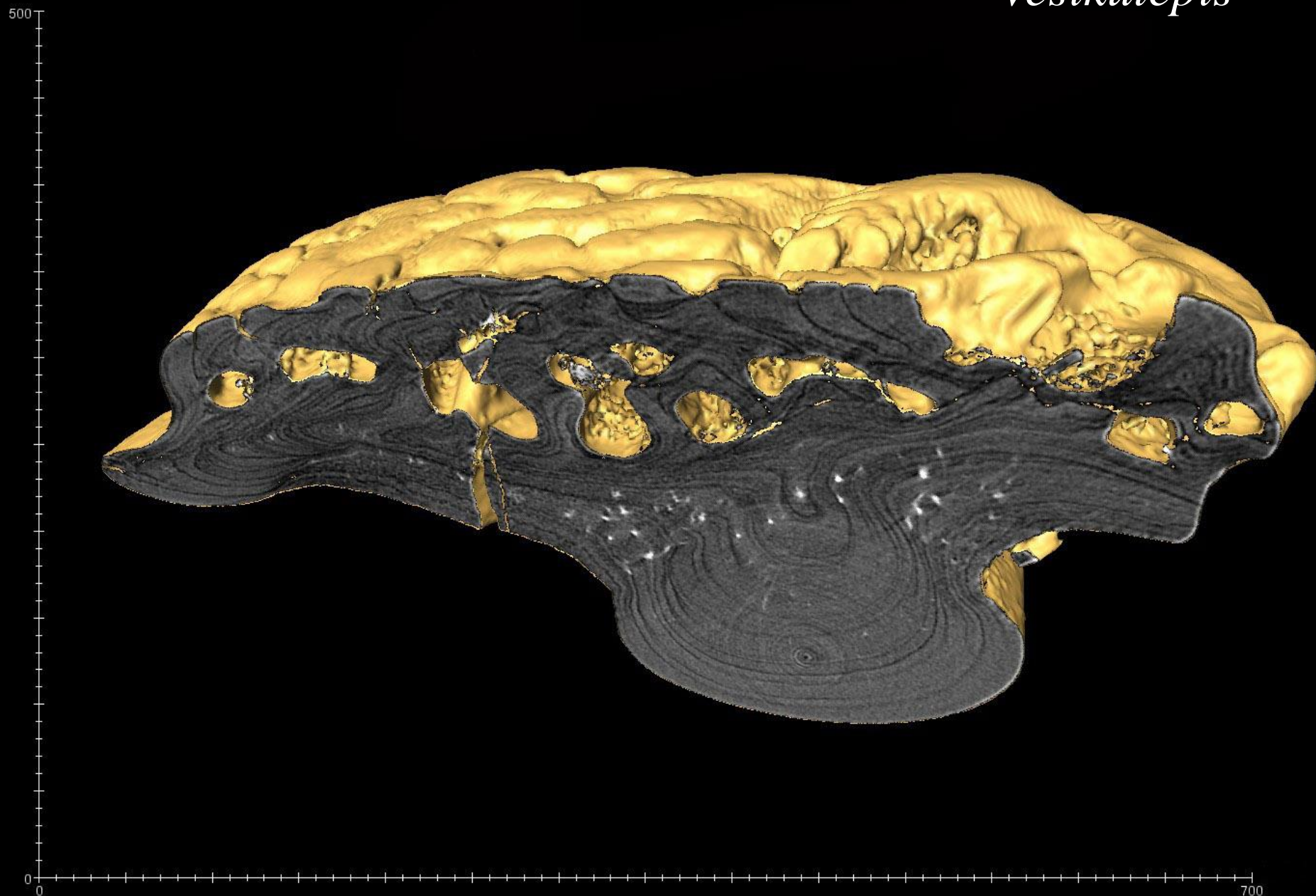
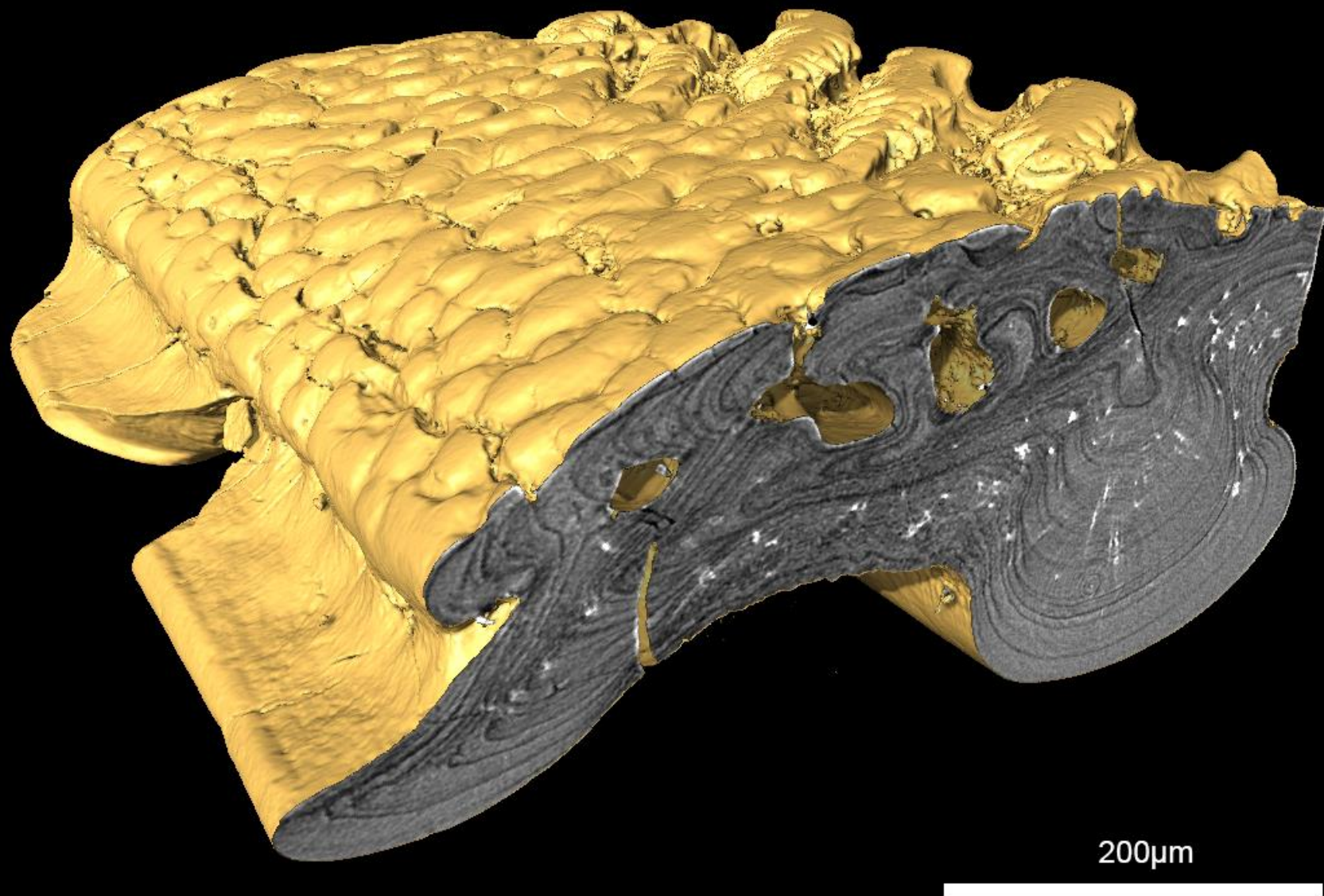


Fig. 44. Specimen NHMUK PV P73708. SRXTM slice through a *Vesikulepis* body scale. Data collected using 10X objective. Scale bars in  $\mu\text{m}$ .

*Vesikulepis*



200 $\mu$ m

Fig. 45. Specimen NHMUK PV P73708. SRXTM slice through a *Vesikulepis* body scale. Data collected using 10X objective. Scale bars in  $\mu$ m.

*Vesikulepis*



Fig. 46. Specimen NHMUK PV P73708. SRXTM isosurface of a *Vesikulepis* body scale. Data collected using 20X objective. Scale bars in  $\mu\text{m}$ .

*Vesikulepis*

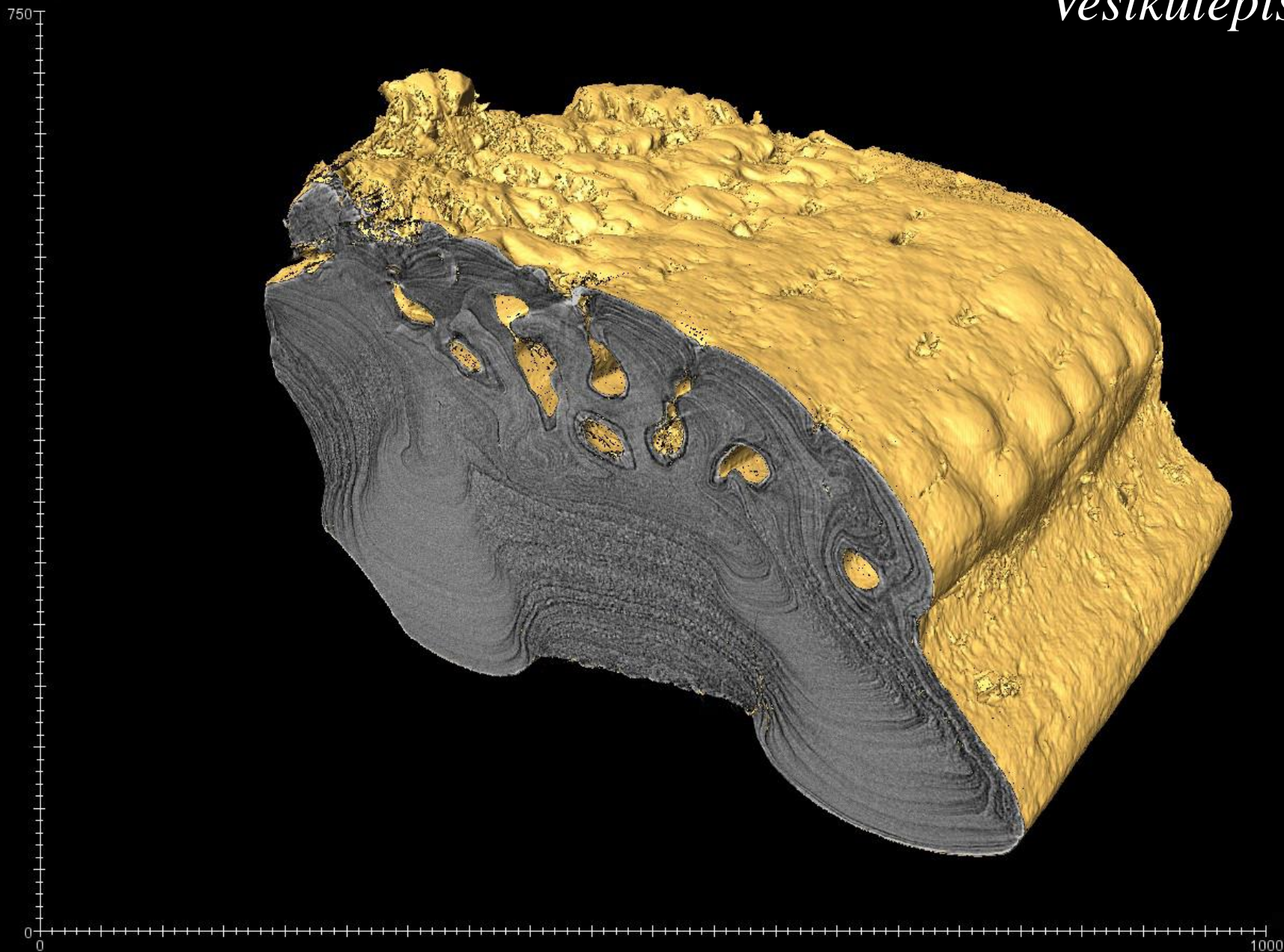


Fig. 47. Specimen NHMUK PV P73709. SRXTM slice through a *Vesikulepis* body scale. Data collected using 20X objective. Scale bars in  $\mu\text{m}$ .



*Vesikulepis*



Fig. 48. Specimen NHMUK PV P73709. SRXTM slice through a *Vesikulepis* body scale. Data collected using 20X objective. Scale bars in  $\mu\text{m}$ .

# *Vesikulepis*



100µm

Fig. 49. Specimen NHMUK PV P73710. LM thin section of a *Vesikulepis* body scale..

*Vesikulepis*



100 μm

Fig. 50. Specimen NHMUK PV P73710. LM thin section of a *Vesikulepis* body scale under cross polarized light.