

PROCEEDINGS OF SPIE

Developments in X-Ray Tomography VII

Stuart R. Stock

Editor

2-5 August 2010

San Diego, California, United States

Sponsored and Published by

SPIE

Volume 7804

Proceedings of SPIE, 0277-786X, v. 7804

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Developments in X-Ray Tomography VII*, edited by Stuart R. Stock, Proceedings of SPIE Vol. 7804 (SPIE, Bellingham, WA, 2010) Article CID Number.

ISSN 0277-786X
ISBN 9780819483003

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Copyright © 2010, Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/10/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIE 
Digital Library

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID number.

Contents

- ix *Conference Committee*
- xi *Introduction*
- xiii **Competition: Most Artistic Tomography-based Image [7804-19]**
S. R. Stock, Northwestern Univ. (United States)

OPENING REMARKS

- 7804 02 **Trends in micro- and nanoComputed Tomography 2008-2010 [7804-01]**
S. R. Stock, Northwestern Univ. (United States)

SESSION 1 PHASE CONTRAST

- 7804 03 **High-resolution x-ray phase tomography (Invited Paper) [7804-02]**
A. G. Peele, La Trobe Univ. (Australia) and Australian Research Council Ctr. of Excellence for Coherent X-ray Science (Australia); C. D. L. Thomas, J. G. Clement, The University of Melbourne (Australia); B. D. Arhatari, K. M. Hannah, C. Doshi, C. T. Putkunz, La Trobe Univ. (Australia) and Australian Research Council Ctr. of Excellence for Coherent X-ray Science (Australia); J. N. Clark, La Trobe Univ. (Australia), Australian Research Council Ctr. of Excellence for Coherent X-ray Science (Australia), and Univ. College London (United Kingdom)
- 7804 04 **An examination of phase retrieval algorithms as applied to phase contrast tomography using laboratory sources (Invited Paper) [7804-03]**
R. S. Bradley, A. McNeil, P. J. Withers, The Univ. of Manchester (United Kingdom)
- 7804 05 **Four-dimensional x-ray phase tomography with Talbot interferometer and white synchrotron light [7804-04]**
A. Momose, W. Yashiro, S. Harasse, H. Kuwabara, K. Kawabata, The Univ. of Tokyo (Japan)

- 7804 06 **Recent developments in x-ray Talbot interferometry at ESRF-ID19** [7804-05]
T. Weitkamp, European Synchrotron Radiation Facility (France) and Synchrotron Soleil (France); I. Zanette, European Synchrotron Radiation Facility (France); C. David, Paul Scherrer Institut (Switzerland); J. Baruchel, European Synchrotron Radiation Facility (France); M. Bech, Technische Univ. München (Germany); P. Bernard, European Synchrotron Radiation Facility (France); H. Deyhle, Univ. Basel (Switzerland); T. Donath, Paul Scherrer Institut (Switzerland); J. Kenntner, Karlsruher Institut für Technologie (Germany); S. Lang, Univ. Basel (Switzerland); J. Mohr, Karlsruher Institut für Technologie (Germany); B. Müller, Univ. Basel (Switzerland); F. Pfeiffer, Technische Univ. München (Germany); E. Reznikova, Karlsruher Institut für Technologie (Germany); S. Rutishauser, Paul Scherrer Institut (Switzerland); G. Schulz, Univ. Basel (Switzerland); A. Tapfer, Technische Univ. München (Germany); J.-P. Valade, European Synchrotron Radiation Facility (France)
- 7804 07 **X-ray grating interferometer for imaging at a second-generation synchrotron radiation source** [7804-06]
J. Herzen, GKSS-Forschungszentrum Geesthacht (Germany) and Technische Univ. München (Germany); F. Beckmann, GKSS-Forschungszentrum Geesthacht (Germany); T. Donath, Dectris AG (Switzerland) and Paul Scherrer Institut (Switzerland); M. Ogurreck, GKSS-Forschungszentrum Geesthacht (Germany); C. David, Paul Scherrer Institut (Switzerland); F. Pfeiffer, Technische Univ. München (Germany); J. Mohr, E. Reznikova, Karlsruher Institut für Technologie (Germany); S. Riekehr, A. Haibel, GKSS-Forschungszentrum Geesthacht (Germany); G. Schulz, B. Müller, Univ. Basel (Switzerland); A. Schreyer, GKSS-Forschungszentrum Geesthacht (Germany)
- 7804 08 **Front- and backside structuring of gratings for phase contrast imaging with x-ray tubes** [7804-07]
J. Kenntner, T. Grund, B. Matthis, M. Boerner, J. Mohr, T. Scherer, Karlsruher Institut für Technologie (Germany); M. Walter, Microworks GmbH (Germany); M. Willner, A. Tapfer, M. Bech, F. Pfeiffer, Technische Univ. München (Germany)

SESSION 2 SYNCHROTRON TOMOGRAPHY

- 7804 09 **Recent developments in computed tomography at GSECARS (Invited Paper)** [7804-08]
M. L. Rivers, D. T. Citron, Y. Wang, The Univ. of Chicago (United States)
- 7804 0B **Micro- and nano-tomography at the GKSS Imaging Beamline at PETRA III** [7804-10]
A. Haibel, M. Ogurreck, F. Beckmann, T. Dose, F. Wilde, J. Herzen, M. Müller, A. Schreyer, GKSS-Forschungszentrum Geesthacht (Germany); V. Nazmov, M. Simon, A. Last, J. Mohr, Karlsruher Institut für Technologie (Germany)

SESSION 3 BIOLOGICAL SAMPLES

- 7804 0D **Morphology of urethral tissues (Invited Paper)** [7804-12]
B. Müller, G. Schulz, Univ. Basel (Switzerland); J. Herzen, GKSS-Forschungszentrum Geesthacht (Germany); S. Mushkolaj, T. Bormann, Univ. Basel (Switzerland); F. Beckmann, GKSS-Forschungszentrum Geesthacht (Germany); K. Püschel, Univ. Hospital Hamburg-Eppendorf (Germany)

- 7804 OE **Ex vivo and in vitro synchrotron-based micro-imaging of biocompatible materials applied in dental surgery** [7804-13]
A. Rack, European Synchrotron Radiation Facility (France); M. Stiller, K. Nelson, C. Knabe, T. Rack, Charité Universitätsmedizin Berlin (Germany); S. Zabler, Technische Univ. Berlin (Germany); O. Dalügge, Charité Universitätsmedizin Berlin (Germany); H. Riesemeier, Bundesanstalt für Materialforschung und -prüfung (Germany); A. Cecilia, Karlsruher Institut für Technologie (Germany); J. Goebbels, Bundesanstalt für Materialforschung und -prüfung (Germany)
- 7804 OF **Evaluating the microstructure of human brain tissues using synchrotron radiation-based micro-computed tomography** [7804-14]
G. Schulz, Univ. of Basel (Switzerland); A. Morel, Univ. Hospital Zurich (Switzerland); M. S. Imholz, H. Deyhle, Univ. of Basel (Switzerland); T. Weitkamp, I. Zanette, European Synchrotron Radiation Facility (France); F. Pfeiffer, Technische Univ. München (Germany); C. David, Paul Scherrer Institut (Switzerland); M. Müller-Gerbl, B. Müller, Univ. of Basel (Switzerland)

SESSION 4 TUBE-BASED TOMOGRAPHY

- 7804 OH **Overview of multisource CT systems and methods (Invited Paper)** [7804-16]
J. Zhao, Y. Lu, T. Zhuang, Shanghai Jiao Tong Univ. (China); G. Wang, Virginia Polytechnic Institute and State Univ. (United States)
- 7804 OI **Quantitative x-ray microtomography with a conventional source (Invited Paper)** [7804-17]
G. Davis, A. Evershed, J. Elliott, D. Mills, Queen Mary, Univ. of London (United Kingdom) and London School of Medicine and Dentistry (United Kingdom)
- 7804 OJ **An auto-focus method for generating sharp 3D tomographic images** [7804-18]
A. M. Kingston, A. Sakellariou, A. P. Sheppard, T. K. Varslot, S. J. Latham, The Australian National Univ. (Australia)

SESSION 5 ANALYSIS

- 7804 OL **Deciphering complex, functional structures with synchrotron-based absorption and phase contrast tomographic microscopy (Invited Paper)** [7804-20]
M. Stampanoni, Paul Scherrer Institut (Switzerland) and ETH Zurich (Switzerland); J. Reichold, ETH Zurich (Switzerland); B. Weber, Univ. Zürich (Switzerland); D. Haberthür, J. Schittny, Univ. Bern (Switzerland); J. Eller, F. N. Büchi, F. Marone, Paul Scherrer Institut (Switzerland)
- 7804 OM **Optimizing synchrotron microCT for high-throughput phenotyping of zebrafish (Invited Paper)** [7804-21]
P. J. La Rivière, The Univ. of Chicago (United States); D. Clark, Penn State College of Medicine (United States); A. Rojek, P. Vargas, The Univ. of Chicago (United States); X. Xiao, F. DeCarlo, Argonne National Lab. (United States); G. Kindlmann, The Univ. of Chicago (United States); K. Cheng, Penn State College of Medicine (United States)
- 7804 ON **Data-constrained microstructure modeling with multi-spectrum x-ray CT (Invited Paper)** [7804-22]
Y. S. Yang, A. M. Tulloh, T. Muster, A. Trinchi, S. C. Mayo, S. W. Wilkins, Commonwealth Scientific and Industrial Research Organisation (Australia)

- 7804 0O **Precise 3D dimensional metrology using high-resolution x-ray computed tomography (μ CT)** [7804-23]
O. Brunke, GE Sensing & Inspection Technologies GmbH (Germany); J. Santillan, GE Sensing & Inspection Technologies Inc. (United States); A. Suppes, GE Sensing & Inspection Technologies GmbH (Germany)
- 7804 0P **Tomographic image analysis and processing to simulate micro-petrophysical experiments** [7804-24]
A. Sakellariou, A. M. Kingston, T. K. Varslot, A. P. Sheppard, S. J. Latham, The Australian National Univ. (Australia); R. M. Sok, Digital Core Labs. Pty Ltd. (Australia); C. H. Arns, The Univ. of New South Wales (Australia); T. J. Senden, M. A. Knackstedt, The Australian National Univ. (Australia)

SESSION 6 NANOTOMOGRAPHY

- 7804 0Q **New type of x-ray source for lensless laboratory nano-CT with 50-nm resolution** [7804-25]
A. Sasov, B. Pauwels, P. Bruyndonckx, SkyScan N.V. (Belgium)
- 7804 0R **High-resolution 3D imaging of polymerized photonic crystals by lab-based x-ray nanotomography with 50-nm resolution** [7804-26]
L. Yin, Y.-C. Chen, Univ. of Illinois at Urbana-Champaign (United States); J. Gelb, Xradia, Inc. (United States); D. M. Stevenson, P. A. Braun, Univ. of Illinois at Urbana-Champaign (United States)
- 7804 0S **X-ray nanotomography in a SEM** [7804-27]
B. Pauwels, X. Liu, A. Sasov, SkyScan N.V. (Belgium)
- 7804 0U **Key components for artifact-free micro-CT and nano-CT instruments** [7804-29]
A. Sasov, B. Pauwels, X. Liu, P. Bruyndonckx, SkyScan N.V. (Belgium)

SESSION 7 RECONSTRUCTION

- 7804 0V **Recent progress in local reconstruction (Invited Paper)** [7804-30]
H. Yu, Wake Forest Univ. Health Sciences (United States) and Virginia Polytechnic Institute and State Univ. (United States); Q. Xu, X. Mou, Xi'an Jiaotong Univ. (China); G. Wang, Wake Forest Univ. Health Sciences (United States) and Virginia Polytechnic Institute and State Univ. (United States)
- 7804 0X **Three-dimensional reconstruction with x-ray shape-from-silhouette** [7804-32]
E. Simioni, F. Ratti, Istituto di Fotonica e Nanotecnologie, CNR (Italy) and Univ. degli Studi di Padova (Italy); I. Calliari, Univ. degli Studi di Padova (Italy); L. Poletto, Istituto di Fotonica e Nanotecnologie, CNR (Italy) and Univ. degli Studi di Padova (Italy)
- 7804 0Z **Regularization methods for inverse problems in x-ray tomography** [7804-34]
V. Titarenko, R. Bradley, C. Martin, P. J. Withers, The Univ. of Manchester (United Kingdom); S. Titarenko, Lomonosov Moscow State Univ. (Russian Federation)

7804 10 **Fast reconstruction algorithm dealing with tomography artifacts** [7804-35]
F. Marone, Paul Scherrer Institut (Switzerland); B. Münch, EMPA Materials Science and Technology (Switzerland); M. Stampanoni, Paul Scherrer Institut (Switzerland) and ETH Zürich (Switzerland)

7804 11 **X-ray phase laminography with Talbot interferometer** [7804-36]
S. Harasse, N. Hirayama, W. Yashiro, A. Momose, The Univ. of Tokyo (Japan)

SESSION 8 NONCONVENTIONAL ALTERNATIVES

7804 12 **Development of a CT scanner based on the Medipix family of detectors (Invited Paper)** [7804-37]
P. J. Bones, Univ. of Canterbury (New Zealand); A. P. H. Butler, J. P. Ronaldson, Univ. of Otago (New Zealand); A. M. T. Opie, Univ. of Canterbury (New Zealand)

7804 13 **Fast high-resolution micro-CT with exact reconstruction methods** [7804-38]
T. Varslot, A. Kingston, A. Sheppard, A. Sakellariou, The Australian National Univ. (Australia)

SESSION 9 NATURAL MATERIALS

7804 16 **X-ray tomography verification for determining phase proportions in volcanic rocks** [7804-41]
D. M. Stevenson, L. Yin, Univ. of Illinois at Urbana-Champaign (United States) and Beckman Institute for Advanced Science and Technology (United States); M. A. Stewart, Univ. of Illinois at Urbana-Champaign (United States) and School of Earth, Society, and Environment (United States)

7804 17 **Evaluating tooth restorations: micro-computed tomography in practical training for students in dentistry** [7804-42]
H. Deyhle, Univ. Basel, Univ. Hospital (Switzerland) and Univ. Basel (Switzerland);
F. Schmidli, G. Krastl, Univ. Basel (Switzerland); B. Müller, Univ. Basel, Univ. Hospital (Switzerland) and Univ. Basel (Switzerland)

SESSION 10 FLUORESCENCE

7804 19 **Reconstruction algorithms for laboratory microCT/microXRF system** [7804-44]
X. Liu, P. Bruyndonckx, A. Sasov, SkyScan N.V. (Belgium)

7804 1A **Progress in development of a laboratory microXRF-microCT system** [7804-45]
P. Bruyndonckx, A. Sasov, X. Liu, J. Van Geert, SkyScan N.V. (Belgium)

7804 1B **X-ray fluorescence tomography using imaging detectors** [7804-46]
L.-J. Meng, G. Fu, N. Li, Univ. of Illinois at Urbana-Champaign (United States); M. Newville, P. Eng, Consortium for Advanced Radiation Sources, The Univ. of Chicago (United States); P. La Rivière, The Univ. of Chicago (United States)

POSTER SESSION

- 7804 1F **Computed tomography to quantify tooth abrasion** [7804-50]
L. Kofmehl, G. Schulz, H. Deyhle, A. Filippi, Univ. Basel (Switzerland); G. Hotz, Natural History Museum Basel (Switzerland) and Univ. Basel (Switzerland); D. Berndt-Dagassan, S. Kramis, Univ. Basel (Switzerland); F. Beckmann, GKSS-Forschungszentrum Geesthacht (Germany); B. Müller, Univ. of Basel (Switzerland)
- 7804 1G **The microstructure of mandibular bone grafts and three-dimensional cell clusters** [7804-51]
S. Gürel, C. Unold, H. Deyhle, G. Schulz, S. Kühl, Univ. Basel (Switzerland); B. Saldamli, J. Tübel, R. Burgkart, Technische Univ. München (Germany); F. Beckmann, GKSS-Forschungszentrum Geesthacht (Germany); B. Müller, Univ. Basel (Switzerland)
- 7804 1H **The morphology of amputated human teeth and its relation to mechanical properties after restoration treatment** [7804-52]
J. Gugger, G. Krastl, Univ. Basel (Switzerland); M. Huser, Image Lab GmbH (Switzerland); H. Deyhle, B. Müller, Univ. Basel (Switzerland)
- 7804 1I **Statistical interior tomography** [7804-53]
Q. Xu, Xi'an Jiaotong Univ. (China); H. Yu, Wake Forest Univ. Health Sciences (United States); X. Mou, Xi'an Jiaotong Univ. (China); G. Wang, Wake Forest Univ. Health Sciences (United States) and Virginia Polytechnic Institute and State Univ. (United States)
- 7804 1J **Scanning multiple samples simultaneously in tube-based microCT systems** [7804-54]
S. R. Stock, N. M. Rajamannan, Northwestern Univ. (United States); T. C. Spelsberg, S. Malayannan, Mayo Clinic (United States); R. Riaz, M. Polavarapu, E. L. Hsu, W. K. Hsu, Y. Chen, M. Zhang, Northwestern Univ. (United States)
- 7804 1M **Determination of strain fields in porous shape memory alloys using micro-computed tomography** [7804-58]
T. Bormann, Univ. Basel (Switzerland) and Univ. of Applied Sciences, Northwestern Switzerland (Switzerland); S. Friess, Gloor Instruments AG (Switzerland); M. de Wild, R. Schumacher, Univ. of Applied Sciences, Northwestern Switzerland (Switzerland); G. Schulz, B. Müller, Univ. Basel (Switzerland)
- 7804 1O **Tomographic imaging of coherent x-ray scatter momentum transfer distribution using spectral x-ray detection and polycapillary optic** [7804-60]
D. R. Eaker, S. M. Jorgensen, Mayo Clinic (United States); A. P. H. Butler, Univ. of Canterbury (New Zealand) and Univ. of Otago Medical School (New Zealand); E. L. Ritman, Mayo Clinic (United States)
- 7804 1Q **Imaging fossilised spiders in amber using lab-based phase contrast x-ray tomography** [7804-62]
A. McNeil, R. S. Bradley, P. J. Withers, D. Penney, The Univ. of Manchester (United Kingdom)

Author Index

Conference Committee

Program Track Chair

Carolyn A. MacDonald, University at Albany (United States)

Conference Chair

Stuart R. Stock, Northwestern University (United States)

Program Committee

Felix Beckmann, GKSS-Forschungszentrum Geesthacht (Germany)

Graham R. Davis, Queen Mary University of London (United Kingdom)

Bert Müller, Basel University Hospital (Switzerland)

Erik L. Ritman, Mayo Clinic College of Medicine (United States)

Mark L. Rivers, The University of Chicago (United States)

Ge Wang, Virginia Polytechnic Institute and State University
(United States)

Stephen W. Wilkins, Commonwealth Scientific and Industrial Research
Organisation (Australia)

Session Chairs

- 1 Phase Contrast
Stuart R. Stock, Northwestern University (United States)
- 2 Synchrotron Tomography
Bert Müller, University Basel (Switzerland)
- 3 Biological Samples
Stephen W. Wilkins, Commonwealth Scientific and Industrial Research
Organisation (Australia)
- 4 Tube-based Tomography
Erik L. Ritman, Mayo Clinic College of Medicine (United States)
- 5 Analysis
Mark L. Rivers, The University of Chicago (United States)
- 6 Nanotomography
Graham R. Davis, Queen Mary, University of London (United Kingdom)

- 7 Reconstruction
Ge Wang, Virginia Polytechnic Institute and State University
(United States)
- 8 Nonconventional Alternatives
Felix Beckmann, GKSS-Forschungszentrum Geesthacht (Germany)
- 9 Natural Materials
Stuart R. Stock, Northwestern University (United States)
- 10 Fluorescence
Stuart R. Stock, Northwestern University (United States)
- 11 Session 11
Stuart R. Stock, Northwestern University (United States)

Introduction

The seventh conference in this series was marked by a slight change in format with Wednesday afternoon consisting of a plenary session joint between the various x-ray, gamma-ray and particle technology conferences. These four talks included one titled "4D X-ray Characterization of Metal Structures" by Dorte Juul Jensen of Risø National Laboratory (Denmark). This approach reconstructs polycrystalline specimens in a different fashion from most studies in this volume.

The diversity of applications underlined the mature interdisciplinary scope of the conference. Established groups continued the trend of more detailed and sophisticated analyses than in previous meeting, and new contributors (both early career and senior investigators) brought fresh ideas to the meeting. Papers describing advances in instrumentation and in reconstruction algorithms were met with great enthusiasm by the attendees.

I would like to thank the authors for their excellent contributions and the program committee for their very important help. Last, but not least, the SPIE staff provided exemplary support with the program development, the meeting itself and the proceedings.

Stuart R. Stock



The program committee after their mid-conference planning meeting. From the left, bottom row: Erik Ritman, Bert Müller, Graham Davis; top row: Mark Rivers, Felix Beckmann, Stuart Stock.



Members not in the group photo:
Ge Wang (top), Steve Wilkins (bottom).



Competition: Most Artistic Tomography-based Image

S. R. Stock¹, et al.

Department of Molecular Pharmacology and Biological Chemistry, Feinberg School of
Medicine, Northwestern University, 303 E. Chicago Ave., Chicago, IL USA

ABSTRACT

Each image submitted for the competition is presented briefly. Images derived from tomography data and from the studies presented in *Developments in X-ray Tomography VII* are eligible. The sole criterion for the contest is artistic impression. One image per presentation (oral or poster) will be accepted in the format of a powerpoint slide. No animations allowed. Information on the image (title, authors and their affiliations) should follow on a second slide. Each image will be posted at the poster session and again in an oral session; winners will be announced during the oral sessions on the day following the second presentation.

Keywords: Tomography, artistic, image, x-ray

The first “Most Artistic Tomography-based Image” competition contained ten entries. The rules were: One submission was allowed per abstract presented at the Conference for which this is the proceedings. Each submission must be an x-ray tomography-based image (radiograph, slice, 3D rendering, sonogram, no animation). Each submission must not have been published previously.

The ten entries were displayed first at the poster session, Monday evening before the oral sessions began on Tuesday. The entries were again presented at the end of Tuesday’s oral sessions. All of the entries (descriptions and author information first; image second) follow below (grayscale in the hard copy and color in the on-line versions of the proceedings). Immediately following the second presentation, the assembled attendees voted. The winners were announced at the end of the oral presentations on Wednesday. Three images were the attendees’ favorites; these appear first and are labeled with ribbons. It is interesting that all entries received significant support, demonstrating the range of artistic preferences of the voters and entrants. The ordering among the winners and among the other entries is random.

¹ s-stock@northwestern.edu



Mosquito



A. Rack*, T. Weitkamp*, A. Cecilia[^], D. Wegrzynek[“], E. Chinea-Cano[“],
P. Wobruschek[~], Ch. Strelitz[~]

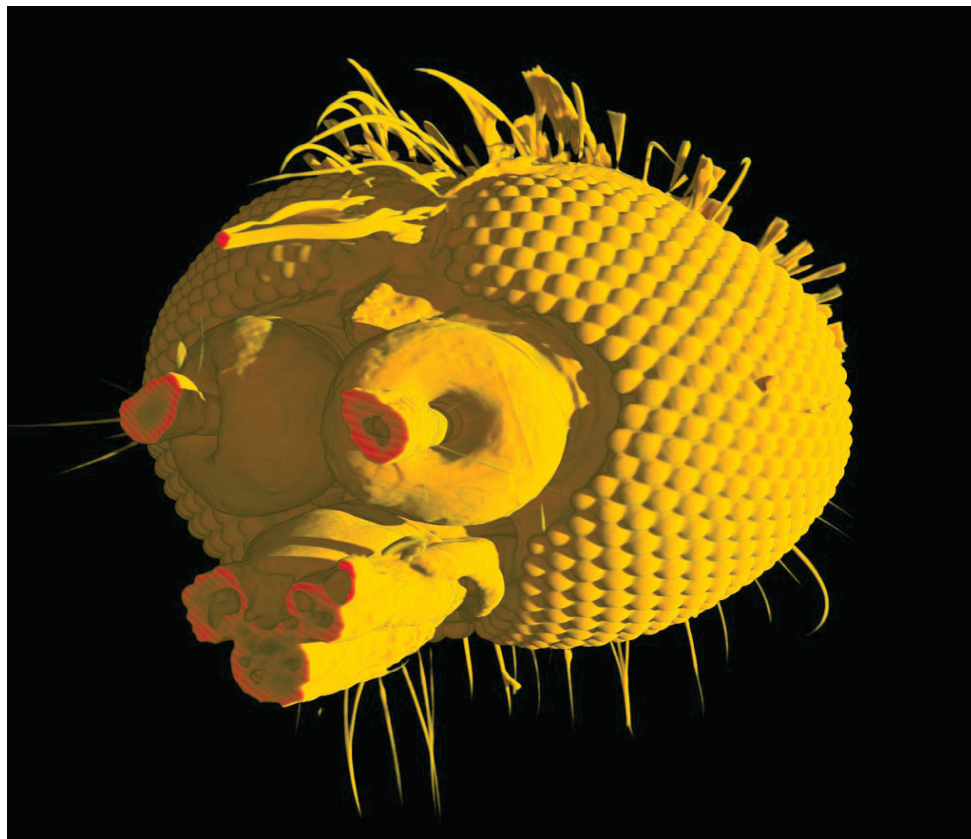
*European Synchrotron Radiation Facility, Grenoble, France

[^]Karlsruhe Institute of Technology – ANKA, Karlsruhe, Germany

[“]International Atomic Energy Agency, Vienna, Austria

[~]Technische Universität Wien, Vienna, Austria

Volume rendering showing the head of a malaria transmitting mosquito (genus *Anopheles*). Phase-sensitive microtomography recorded at the TopoTomo beamline of the ANKA light source (Germany) with a filtered white beam. Phase-retrieval performed *via* the ANKPhase software.

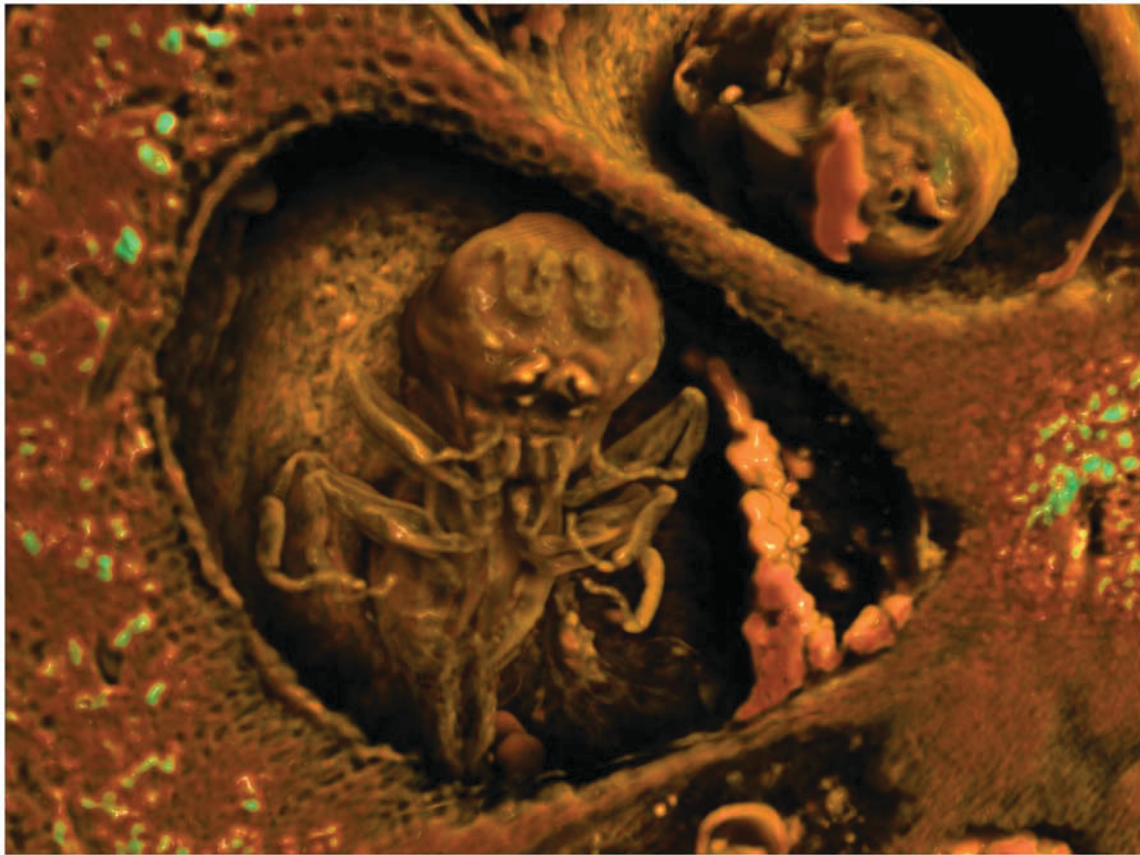


The one that didn't get away!

Graham R Davis and David Mills
Queen Mary University of London



A partially developed gall wasp inside an intact oak gall; scanned on the MuCat 2 scanner and rendered with Drishti.



Grating interferometry of a human cerebellum



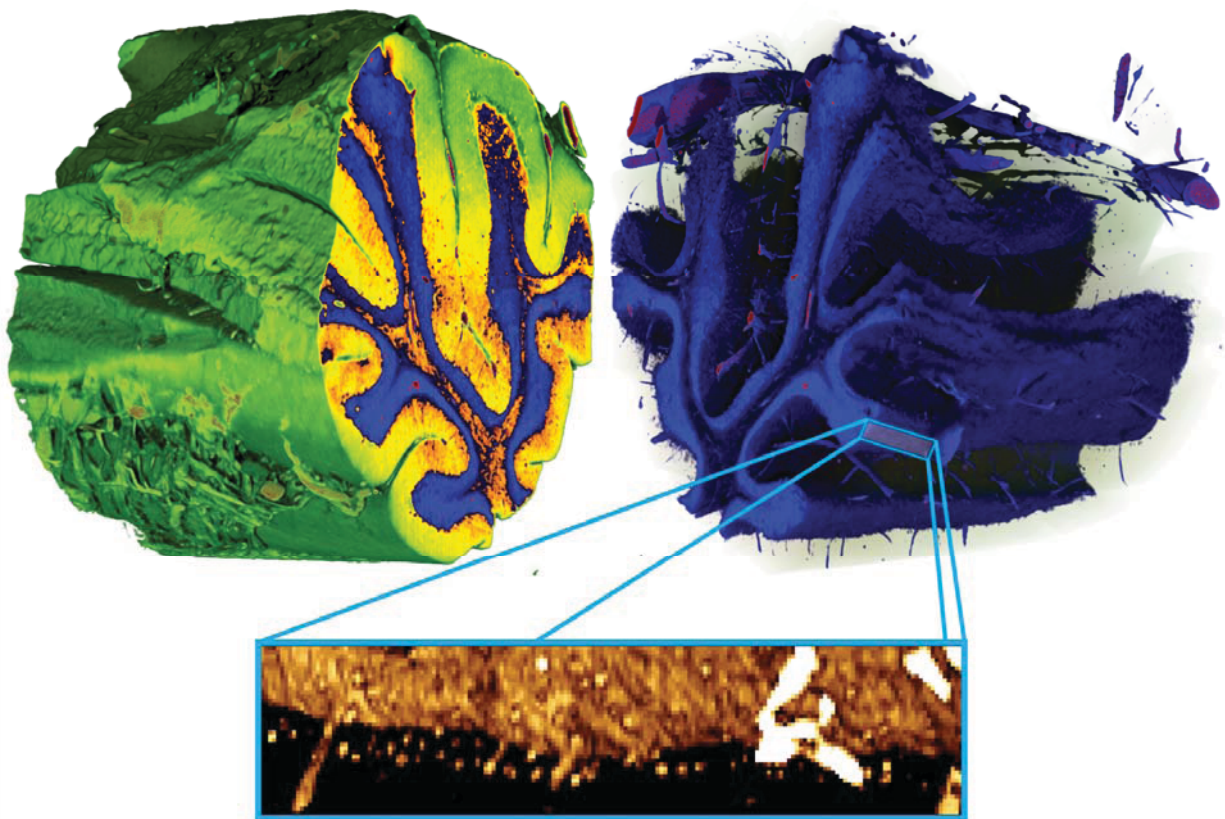
Georg Schulz*

*Biomaterials Science Center,

University of Basel, Basel, Switzerland



The 3D rendering shows grating based phase contrast results of a part of a human cerebellum measured at ID19, ESRF, France. Beside the blood vessels one can differentiate between white (orange) and grey matter which can be divided into stratum moleculare (blue) and stratum granulosum (yellow, green). Furthermore, the golden image below shows a 3D visualization of individual Purkinje cells what was arranged without the application of any staining agents.



DROSOPHILA MELANOGASTER

Luca Poletto

National Council for Research - Institute for Photonics and
Nanotechnologies, Padova, Italy

Tomography of a *Drosophila Melanogaster*: external view.
Recorded with a tube-based microCT system, 25 kV, 800 projections, 10
 μm resolving element.



Bone

K. M Hannah^{1,2}, C. D. Thomas³, J. G. Clement³, F. De Carlo⁴, A. G. Peele^{1,2}

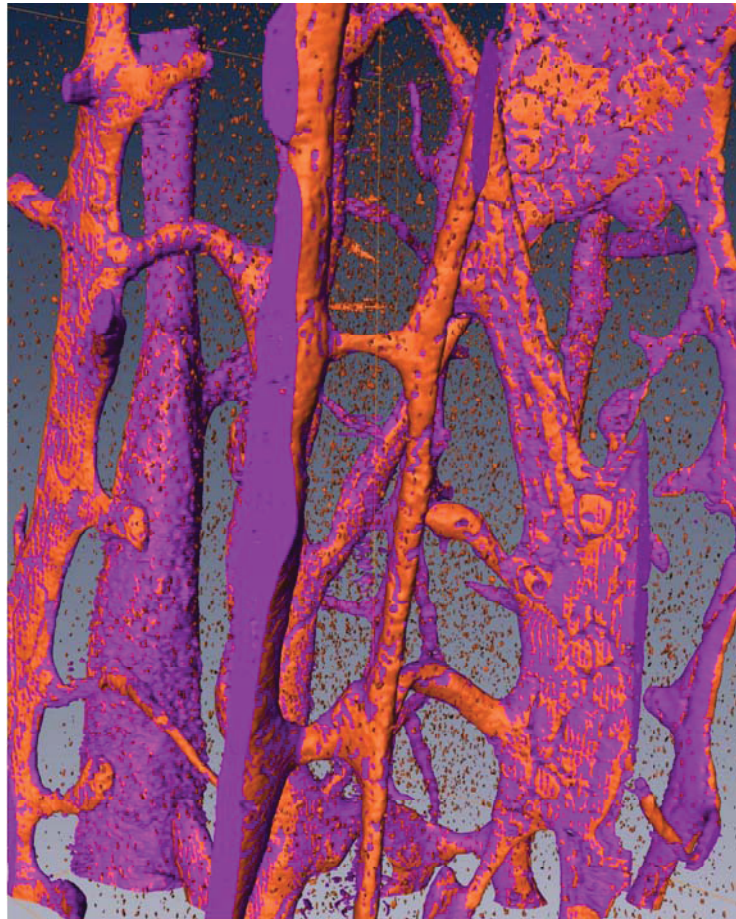
1. Australian Research Council Centre of Excellence for Coherent X-ray Science
2. Department of Physics, La Trobe University, Victoria 3086, Australia
3. Melbourne Dental School, The University of Melbourne, Victoria 3010, Australia
4. Advanced Photon Source, Argonne National Laboratory, Argonne, Illinois 60439, USA

Description

A 3D rendered image of a section of human femur. Visible are the Haversian canals (large features) and surrounding osteocyte lacunae (small features). Data obtained at 2BM, Advanced Photon Source, Image created using Amira V4.1.

Acknowledgements

The authors acknowledge the support of the Australian Research Council through the Centre of Excellence for Coherent X-ray Science, The authors also acknowledge the Australian Synchrotron Research Program, which is funded by the Commonwealth of Australia under the Major National Research Facilities Program. Use of the Advanced Photon Source was supported by the U.S. DOE, Basic Energy Sciences, Office of Science under Contract No. W-31-109-Eng-38. We are grateful to the mortuary staff and the staff of the Donor Tissue Bank of the Victorian Institute of Forensic Medicine for their assistance in the collection of the series of bone specimens from which this sample was taken, and particularly grateful to the next-of-kin of the donor for permission to remove bone for research purposes.

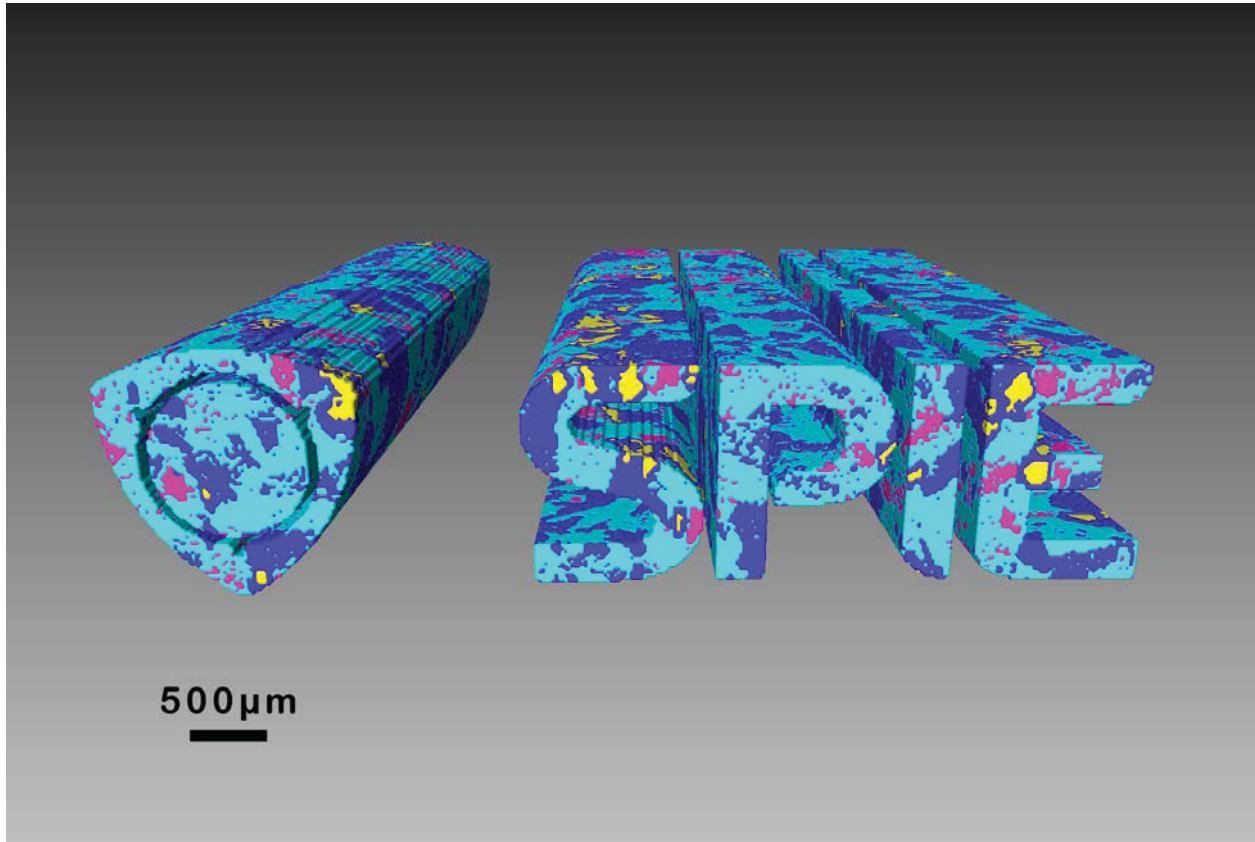


spierock

D.M. Stevenson*

*Beckman Institute for Advanced Science & Technology,
University of Illinois at Urbana-Champaign, USA

Three dimensional surface rendering from segmented x-ray tomography data of igneous rock, obtained on tube-based microCT system. The SPIE logo was used as a volume mask across the entire dataset to create the final surface. The four colorized portions in the masked sample correspond to the four distinct mineral phases within the rock: Pyrite, Plagioclase, Pyroxene + Olivine, and void space (porosity).

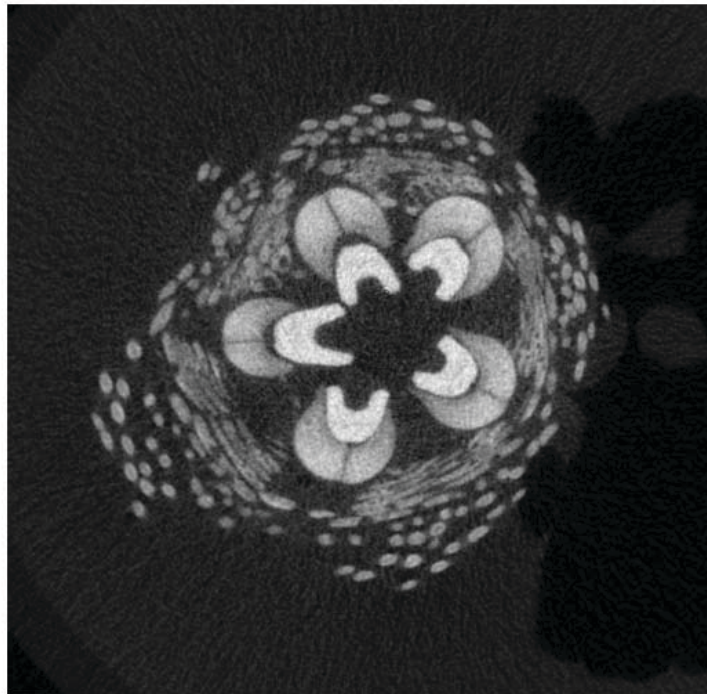


Fivefold

S.R. Stock*

*Feinberg School of Medicine, Northwestern University,
Chicago, IL, USA

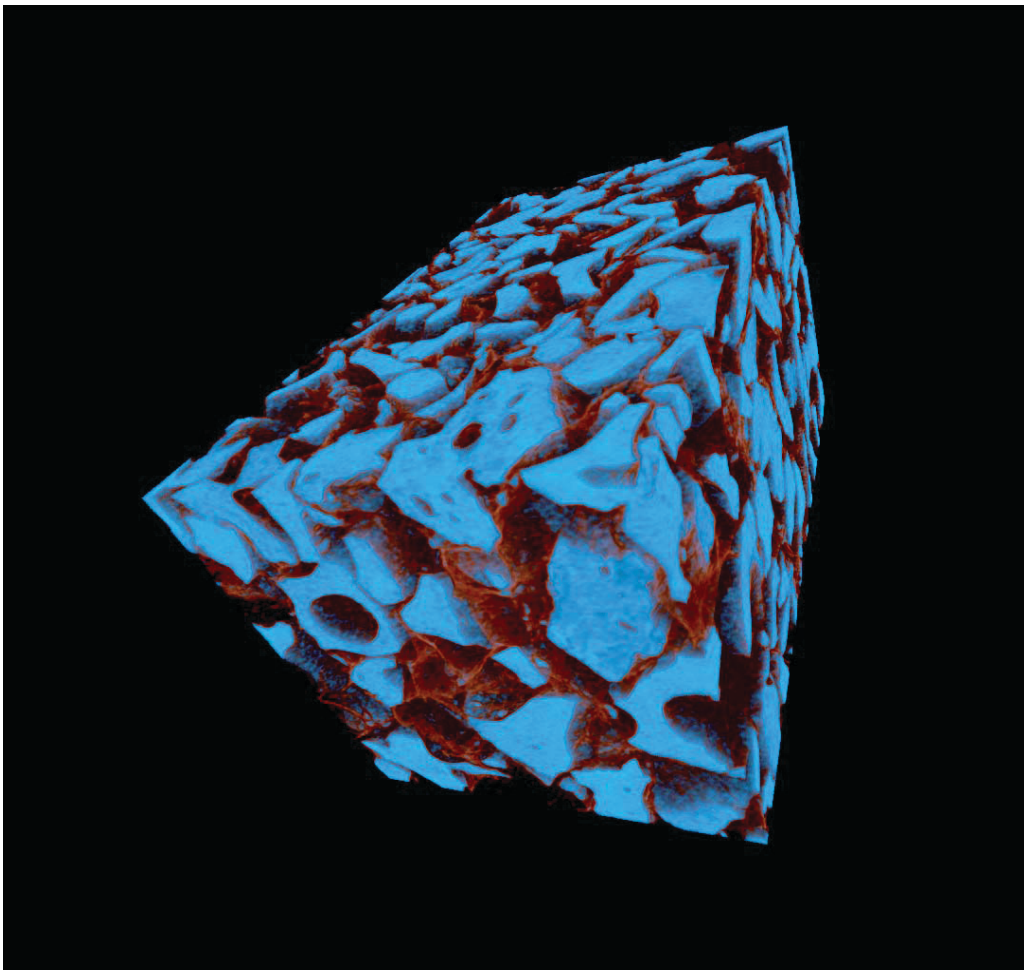
Slice showing the body plates and oral region including
teeth of the sea urchin *Eucidaris tribuloides*. Recorded
with a tube-based microCT system.



embedded

Sebastian Frlless* and Michael Bufler
*Gloor Instruments AG, Switzerland

bone shreds embedded in a highly interconnective network
of a biological matrix. scanned on a tube-based commercial
highresolution microCT system

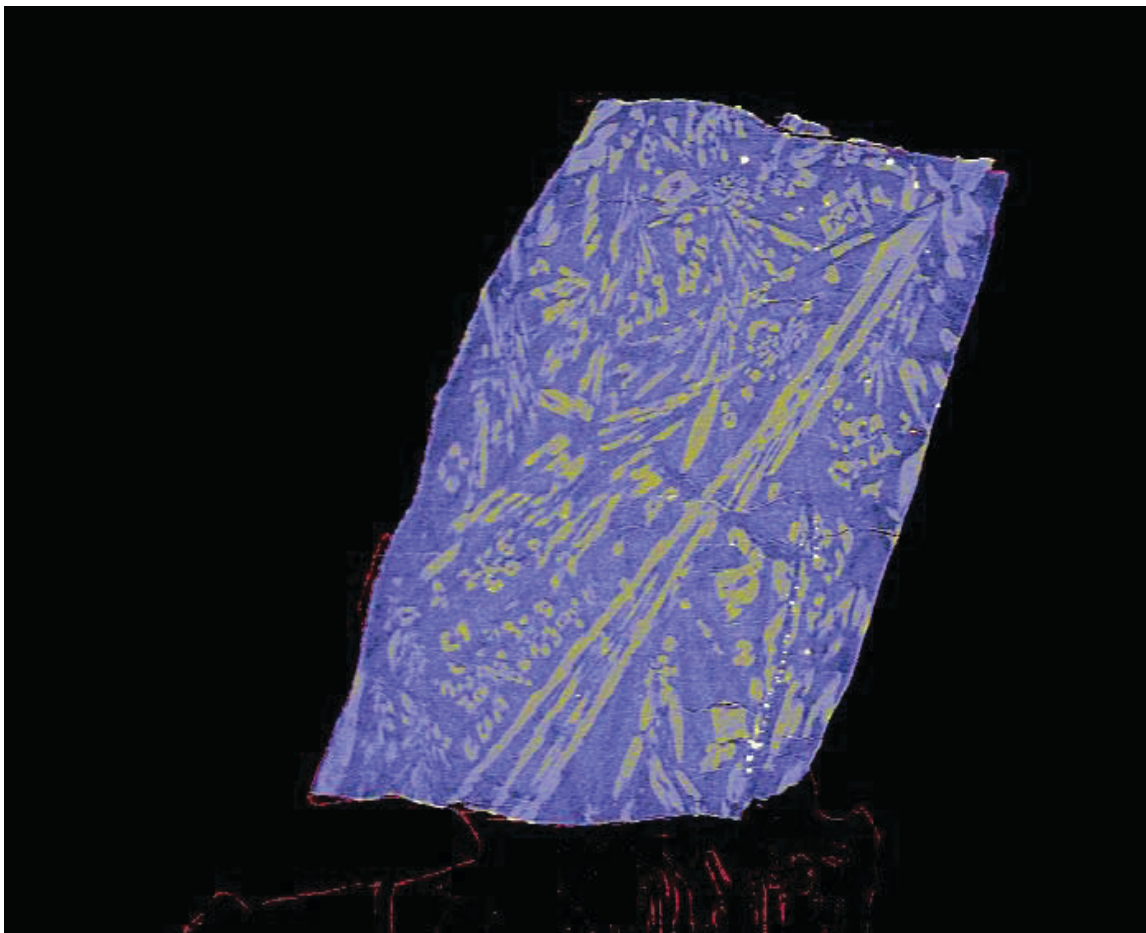


liquidus quenched

Mark L. Rivers

University of Chicago, Chicago, IL, USA

A piece of glass was synthesized at high-pressure and high-temperature. It was cooled below the liquidus, so crystals began to grow, and then it was quenched. The sample is about 3mm in size.



Sandstone microstructure cake

Sherry Mayo & Sam Yang
CSIRO Materials Science & Engineering Division
Private Bag 33, Clayton, Victoria 3169, Australia

3D view of a data-constrained modelling reconstructed microstructure of a sandstone sample consists of quartz and calcite. The construction was based on X-ray CT images taken at 35 and 45 keVs respectively.

