

# **Matthew L. Whitaker**

## **COMPRES Beamline Scientist 2017-2018 Annual Report**

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### **CURRENT POSITIONS:**

Beamline Scientist, COMPRES High Pressure Multi-Anvil X-Ray Facilities, NSLS-II & APS;  
Research Assistant Professor in Mineral Physics Institute, Stony Brook U. July 1, 2011 – Present  
Co-Principal Investigator for COMPRES Multi-Anvil Program January 2017 – Present

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### **JOB DESCRIPTION:**

Responsibilities of the MAC beamline scientist include, but are not limited to, assisting users, managing support laboratories, developing high-pressure synchrotron techniques, and conducting independent research. The position also involves design, testing, and construction of new instrumentation and software development for data acquisition and analysis. This past year has focused primarily on the design, development, construction, and commissioning of the new multi-anvil cell facility at MAXPD of NSLS-II, as well as continued development and support of the multi-anvil facility at 6-BM-B of APS. COMPRES support – 100%.

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### **ACTIVITIES:**

Development, Construction, Commissioning & User Support of New Beamline MAXPD (55%)

- Preparation, brainstorming, and design for MAXPD at NSLS-II
- Hutch Layout and Equipment Approvals
- Coordination of EXTENSIVE Outside Help
- Organization of Equipment Transfer and Placement
- Building and Outfitting New Computer Control Workstations
- Work Planning and Task Management for Beamline Construction
- Coordinating and Obtaining Necessary Inspections and Certifications
- Press and Equipment Load Testing and Certification
- Building and Testing Sub-Systems @ Stony Brook
- Equipment Assembly and Alignment
- Electronics and Network Communications
- Design and Development of new EPICS Controls
- Testing of Experimental Equipment
- Alignment of Optical and Detector Systems
- Redesign and Successful Testing of Hydraulic Systems
- Redesign and Implementation of Data Acquisition Software and Protocols
- Primary Point of Contact for Safety and Operations for High Pressure
- Commissioning Milestone Details in MAXPD Timeline in MAC Annual Report

- Beamtime scheduling
- User training (official and unofficial)
- Student training and advising
- Sample preparation
- Experimental preparation
- Experiment design
- Experimental protocol
- Data collection and standardization
- MAXPD Kawai Cell Assembly Development Joint Project (Whitaker / Leinenweber)

#### Development, Maintenance, and User Support at 6-BM-B (25%)

- Beamtime scheduling
- User training (official and unofficial)
- Student training and advising
- Sample preparation
- Experimental preparation
- Experiment design
- Experimental protocol
- Data collection and standardization
- Data reduction and interpretation
- Manuscript assistance
- Repairing and rebuilding several failing computer components at beamline
- Extensive Travel and Long-Distance Support; “The Big Guns”
- DIA Cell Assembly Development Joint Project (M. Whitaker / K. Leinenweber)
  - Design Specifications
  - Cost Minimization
  - Materials Selection
  - Ordering and Receiving
  - Catalogue and Inventory
  - Experimental Testing and Comparison
  - Stock Maintenance
  - User Distribution

#### Beamline Development Projects (10%)

- Continued development of integrated acoustic velocity measurement system
- Ultrasonic interferometry data collection and analysis software and techniques
- Creation and refinement of spike heating protocol in MAC; more than just impacts!
- Designing and conducting first experiments coupling acoustics with deformation
- Designing and testing of materials and equipment for DT-25 implementation
- Standardization of cell assemblies and calibrations of standardized cells
- Interfacing and integrating with NSLS-II Controls Group for software development
- Design and development of software-automated data collection controls and protocols
- Redesign and fine-tuning of data reduction software (PLOT85)
- Authored several MATLAB scripts for processing and converting experimental data

### Proposals and Reports (5%)

- New Partner User Proposal to NSLS-II (May 31, 2017)
- Proposal to COMPRES for continuation of 6-BM-B (Sept. 11, 2017)
- COMPRES MAC Program Annual Report (Nov. 15, 2018)
- This Report (Dec. 1, 2018)
- Large Volume Research Coordination Network (Ongoing)
- Several Beamtime Proposals (listed below)

### Other Responsibilities/Activities (5%) – Including, but not limited to:

- Maintaining records and data mining for COMPRES Beamline Annual Report
- Support Laboratory Management – Includes facilities at NSLS-II, APS, and SBU
- Server Administration and Wiki Creation for Large Volume RCN Effort
- Graduate student supervision
  - Melissa L. Sims (co-advisor w/ T.D. Glotch): Ph.D. Defense 11/30/2018
  - Melinda J. Rucks (co- advisor w/ T.D. Glotch): Ph.D. Defense 05/01/2019
- Undergraduate Thesis Supervision
- High School Research Advisor – Monroe Woodbury District
- High School Research Advisor – Dobbs Ferry School District
- Weekly staff meetings; MPI, XPD, Large Volume RCN, X-ray CT in XPD-D

### REFERREED PUBLICATIONS (2017-2018):

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Dobson, D.P., Hunt, S.A., Schardong, L., Thomson, A.R., Ezad, I.S., Bailey, E., Pamato, M., Walker, A.M., Lord, O.T., Marquardt, K., Melai, C., **Whitaker, M.L.**, Weidner, D.J. (**submitted**) Pressure-Induced Grain Boundary Stiffening and Suppression of Anelasticity in Silicate Minerals. *Proceedings of the National Academy of Sciences*.

Hunt, S.A., **Whitaker, M.L.**, Bailey, E., Mariani, E., Stan, C.V., and Dobson, D.P. (**submitted**) The effect of Silicon coordination on the rheology of SiO<sub>2</sub> polymorphs. *G<sup>3</sup>: Geochemistry, Geophysics, Geosystems*.

Bejina, F., Bystricky, M., Terce, N., **Whitaker, M.L.**, Chen, H. (**in press**) Bulk Modulus of Fe-Rich Olivines Corrected for Non-Hydrostaticity. *Comptes rendus Geoscience*. DOI 10.1016/j.crte.2018.06.002

Li, L., Weidner, D.J., **Whitaker, M.L.**, Triplett, R.S. (**2018**) Ultrasonic Acoustic Wave Velocities of Neighborite (NaMgF<sub>3</sub>) Across Orthorhombic to Cubic Phase Boundary at High P-T. *Physics of the Earth and Planetary Interiors*, 283, 38-42. DOI 10.1016/j.pepi.2018.08.002

Rucks, M.J., **Whitaker, M.L.**, Glotch, T.D., Parise, T.D., Jaret, S.J., Catalano, T., Dyar, M.D. (**2018**) Making Tissintite: Mimicking Meteorites in the Multi-Anvil. *American Mineralogist*, 103(9), 1516-1519. DOI 10.2138/am-2018-6539

Li, L., **Whitaker, M.L.**, Weidner, D.J. (**2018**) Elastic Wave Velocity Measurement Using Ultrasonic System with Two Reflectors. *Review of Scientific Instruments*, 89(8), 086105. (**Editor's Pick**) DOI 10.1063/1.5041802

Cheung, C.S.N., Weidner, D.J., Li, L., Meredith, P.G., Chen, H., **Whitaker, M.L.**, and Chen, X. (**2018**) Stress Distribution During Cold Compression of Rocks and Mineral Aggregates Using X-ray Diffraction at Beamline 6-BM-B of the Advanced Photon Source. *Journal of Visualized Experiments*. (135), e57555, DOI 10.3791/57555

Weidner, D.J., Li, L., **Whitaker, M.L.**, and Triplett, R.S. (2018) Ultrasonic Acoustic Velocities During Partial Melting of the Mantle Peridotite, KLB-1. *Journal of Geophysical Research: Solid Earth*, 123(2) 1252-1261. DOI 10.1002/2017JB014753

Cheung, C.S.N., Weidner, D.J., Li, L., Meredith, P.G., Chen, H., **Whitaker, M.L.**, and Chen, X. (2017) Stress Distribution During Cold Compression of a Quartz Aggregate Using Synchrotron X-Ray Diffraction: Observed Yielding, Damage and Grain Crushing. *Journal of Geophysical Research: Solid Earth*, 122(4) 2724-2735. DOI 10.1002/2016JB013653

**Whitaker, M.L.**, Baldwin, K.J., and Huebsch, W.R. (2017) DIASCoPE: Directly Integrated Acoustic System Combined with Pressure Experiments – A new method for fast acoustic velocity measurements at high pressure. *Review of Scientific Instruments*, 88, 034901. DOI 10.1063/1.4977596

#### CONFERENCE PROCEEDINGS AND EXTENDED ABSTRACTS (2017-2018):

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Rucks, M.J., **Whitaker, M.L.**, Glotch, T.D., Parise, J.B. (2018) Formation of Tissintite and its Implications for Impact Studies. Lunar and Planetary Science Conference, XLIX, Abstract #2534.

Rucks, M.J., Glotch, T.D., **Whitaker, M.L.**, and Parise, J.B. (2017) Preliminary Investigation of Tissintite Formation Using *in situ* Synchrotron X-Ray Diffraction and Multi-Anvil Techniques. Lunar and Planetary Science Conference, XLVIII, Abstract #2427.

#### ABSTRACTS (2017-2018):

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**Whitaker, M.L.**, Rucks, M.J., Sims, M.L., Jaret, S.J. (2018) New, Novel, and Non-Traditional: Development of Unorthodox Experimental Techniques to Study Materials at High Pressures. Abstract at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec.

Chen, H., **Whitaker, M.L.**, Baldwin, K.J., Huebsch, W.R., Vaughan, M.T., and Weidner, D.J. (2018) APS 6BM-B Beamline: A Dedicated Large Volume High Pressure Facility for Mineral Properties Research in Earth Science. Abstract at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec.

Rucks, M.J., **Whitaker, M.L.**, Glotch, T.D., Parise, J.B. (2018) Investigation of Tissintite Formation and its Implications for Impact Studies. Abstract at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec.

Sims, M.L., Rucks, M.J., Lobanov, S., Young, J., Pakhomova, A., Konopkova, Z., Liermann, H.-P., Hrubciak, R., **Whitaker, M.L.**, Glotch, T.D., Ehm, L. (2018) Strain Rate and Temperature Effects on Kinetics of Phase Transitions in Albite. Abstract at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec.

Weidner, D.J., Li, L., **Whitaker, M.L.**, Chen, H., Triplett, R.S. (2018) Simultaneous mHz and MHz Elastic Moduli Measurements at High P & T. Abstract at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec.

**Whitaker, M.L.**, Baldwin, K.J., Huebsch, W.R., Vaughan, M.T., Weidner, D.J., Triplett, R.S. (2018) MAXPD: COMPRES Multi-Anvil Facility at Beamline XPD-D at NSLS-II. COMPRES 2018 Annual Meeting. (Talk)

Burnley, P.C., **Whitaker, M.L.**, Traylor, T., Kaboli, S., Reynoso, D. (2018) Ultrasonic P and S wave velocity measurements on polycrystalline olivine during deformation using the DIASCoPE and D-DIA apparatus at APS 6-BM-B. COMPRES 2018 Annual Meeting.

Chen, H., **Whitaker, M.L.**, Baldwin, K.J., Huebsch, W.R., Vaughan, M.T., and Weidner, D.J. (2018) COMPRES Multi-Anvil Facility at Beamline 6-BM-B of the Advanced Photon Source. COMPRES 2018 Annual Meeting. (Talk)

- Gwanmesia, G.D., James, A., Dai, L., **Whitaker, M.L.**, Triplett, R.S. (2018) Elasticity of Polycrystalline  $\beta$ - $\text{Mg}_2\text{SiO}_4$  Containing 0.73 wt. %  $\text{H}_2\text{O}$  to 10 GPa and 600 K by Ultrasonic Interferometry Technique Combined with Synchrotron X-Radiation. COMPRES 2018 Annual Meeting.
- Rucks, M.J., **Whitaker, M.L.**, Glotch, T.D., Parise, J.B. (2018) Tissintite formation using in-situ synchrotron-based multi-anvil techniques and its implications for impact events. COMPRES 2018 Annual Meeting.
- Sims, M., Jaret, S.J., Rhymer, B., Smith, J.S., **Whitaker, M.L.**, Glotch, T.D., Ehm, L. (2018) Deformation in olivine during rapid compression as an analogue for shock processes. COMPRES 2018 Annual Meeting.
- Weidner, D.J., Li, L., **Whitaker, M.L.**, Chen, H., Triplett, R.S. (2018) Simultaneous mHz and MHz Elastic Moduli Measurements at High P & T. COMPRES 2018 Annual Meeting.
- Whitaker, M.L.**, Rucks, M.J., Sims, M.L., Jaret, S.J. (2018) New and Improved Non-Traditional Experimental Techniques to Study Materials at High Pressures. COMPRES 2018 Annual Meeting.
- Bejina, F., Bystricky, M., Terce, N., Meunier-Mili, N., **Whitaker, M.L.**, Chen, H. (2018) Sound Velocities of Fayalite at High Pressure and High Temperature. Abstract #137, 56th European High Pressure Research Group Meeting, Aviero, Portugal, 2-7 September, 2018.
- Gwanmesia, G.D., James, A., Lidong, D., **Whitaker, M.L.**, Triplett, R.S. (2018) Elasticity of Polycrystalline  $\beta$ - $\text{Mg}_2\text{SiO}_4$  Containing 0.73 wt. %  $\text{H}_2\text{O}$  to 10 GPa and 600 K by Ultrasonic Interferometry Technique Combined with Synchrotron X-Radiation. Abstract at 2018 Goldschmidt Conference, Boston, MA, 12-17 Aug.
- Sims, M., Jaret, S.J., Rhymer, B., Smith, J.S., **Whitaker, M.L.**, Glotch, T.D., Ehm, L. (2018) Deformation in olivine during rapid compression as an analogue for shock processes. Abstract at International Union of Crystallography High Pressure 2018 Workshop, Honolulu, HI, July 29 – August 2, 2018.
- Whitaker, M.L.**, Rucks, M.J., Sims, M.L., Jaret, S.J. (2018) New Non-Traditional Experimental Techniques to Study Materials at High Pressures. Abstract at 2018 American Crystallographic Association Annual Meeting, Toronto, Ontario, Canada, 20-24 Jul. (Talk)
- Rucks, M.J., **Whitaker, M.L.**, Glotch, T.D., Parise, J.B. (2018) Investigation of Tissintite Formation and its Implications for Impact Studies. Abstract at 2018 American Crystallographic Association Annual Meeting, Toronto, Ontario, Canada, 20-24 Jul. (Talk)
- Sims, M.L., Rucks, M.J., Lobanov, S., Young, J., Daly, K., Pakhomova, A., Konopkova, Z., Liermann, H.-P., Hrubciak, R., **Whitaker, M.L.**, Glotch, T.D., Ehm, L. (2018) Strain-Rate and Temperature Effects on Kinetics and Phase Transitions for Albite and Olivine Composition. Abstract at 2018 American Crystallographic Association Annual Meeting, Toronto, Ontario, Canada, 20-24 Jul. (Talk)
- Bejina, F., Bystricky, M., Terce, N., **Whitaker, M.L.**, Chen, H. (2018) Bulk Modulus of Fe-rich Olivines. Experimental Mineralogy, Petrology and Geochemistry 16 (EMPG XVI), Clermont-Ferrand, France, 17-21 Jun.
- Chen, H., **Whitaker, M.L.**, Baldwin, K.J., Huebsch, W.R., Vaughan, M.T., Weidner, D.J. (2017) APS 6-BM-B Large Volume High Pressure Beamline: A Workhorse for Rock and Mineral Physics. Abstract MR41A-0388 at 2017 Fall Meeting, AGU, New Orleans, LA., 11-15 Dec.
- Triplett, R.S., Weidner, D.J., **Whitaker, M.L.**, Chen, H., Li, L. (2017) Development of Capabilities for New Experimental Studies on the Elasticity and Rheology of Lower Mantle Minerals. Abstract MR31A-0435 at 2017 Fall Meeting, AGU, New Orleans, LA., 11-15 Dec.
- Weidner, D.J., Li, L., **Whitaker, M.L.**, Triplett, R.S. (2017) Effect of Phase Transformations on Seismic Velocities. Abstract DI11B-08 at 2017 Fall Meeting, AGU, New Orleans, LA., 11-15 Dec. (Talk)

Bejina, F., Bystricky, M., Terce, N., Meunier-Mili, N., **Whitaker, M.L.**, Chen, H. (2017) Elastic Properties of Fayalite. High Pressure Mineral Physics Seminar 9 (HPMPS9) Abstract #163319, St. Malo, France, 24-28 Sep.

Rucks, M.J., Glotch, T.D., **Whitaker, M.L.**, and Parise, J.B. (2017) Investigation of Tissintite Formation Using *in situ* Synchrotron X-Ray Diffraction and Multi-Anvil Techniques. 80<sup>th</sup> Annual Meeting of the Meteoritical Society, LPI Contrib. No. 1987, Abstract #6325.

Hunt, S.A., Dobson, D.P., Bailey, E., Ezad, I.S., Pamato, M.G., Schardong, L., Thomson, A.R., Lord, O.T., Walker, A.M., **Whitaker, M.L.** (2017) The effect of sintering pressure on the anelastic properties of pyrope. COMPRES 2017 Annual Meeting.

Li, L., Weidner, D.J., **Whitaker, M.L.**, and Triplett, R.S. (2017) Ultrasonic Acoustic Wave Velocities of Neighborite (NaMgF<sub>3</sub>) Across Orthorhombic and Cubic Phase Boundary at High P-T. COMPRES 2017 Annual Meeting.

Weidner, D.J., Li, L., **Whitaker, M.L.**, and Triplett, R.S. (2017) P Wave and S Wave Acoustic Velocities of Partial Molten Peridotite at Mantle P-T and MHz Frequencies. COMPRES 2017 Annual Meeting.

**Whitaker, M.L.**, Baldwin, K.J., and Huebsch, W.R. (2017) DIASCoPE: A New Method for Fast Acoustic Velocity Measurements at High Pressure – Changing the Paradigm from Product to Process. COMPRES 2017 Annual Meeting.

Rucks, M.J., **Whitaker, M.L.**, Glotch, T.D., and Parise, J.B. (2017) Investigation of Tissintite Formation Using *in situ* Synchrotron-Based Multi-Anvil Techniques at Beamline 6-BM-B of APS. COMPRES 2017 Annual Meeting. (Talk)

Triplett, R.S., Weidner, D.J., **Whitaker, M.L.**, and Chen, H. (2017) Anvil Development for the DT25 Press and Mineral Physics Applications. COMPRES 2017 Annual Meeting.

**Whitaker, M.L.**, Rucks, M.J., Sims, M.L., and Jaret, S.J. (2017) Necessity is the Mother of Invention – New Non-Traditional Experimental Techniques That Suggest Insanity is its Father. COMPRES 2017 Annual Meeting.

Chen, H., **Whitaker, M.L.**, Baldwin, K.J., Huebsch, W.R., Vaughan, M.T., and Weidner, D.J. (2017) COMPRES Multi-Anvil Facility at Beamline 6-BM-B of the Advanced Photon Source. COMPRES 2017 Annual Meeting. (Talk)

**Whitaker, M.L.**, Baldwin, K.J., Huebsch, W.R., Vaughan, M.T., and Weidner, D.J. (2017) COMPRES Multi-Anvil Facility at Beamline XPD-D at NSLS-II. COMPRES 2017 Annual Meeting. (Talk)

Rucks, M.J., **Whitaker, M.L.**, Glotch, T.D., and Parise, J.B. (2017) Tissintite: An Experimental Investigation into an Impact-Induced, Defective Clinopyroxene. Abstract at American Crystallographic Association Annual Meeting, New Orleans, LA, 26-30 May.

#### USER-FRIENDLY/SOFTWARE DEVELOPMENTS (2017-2018):

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- ❖ Redesigned, coded, and streamlined user control interface at 6-BM-B and MAXPD
- ❖ Created and refined new universal user script for 6-BM-B that can automate large portions of experiments and data collection (w/ Ken Baldwin)
- ❖ PLOT85 Data Analysis Software (w/ Ken Baldwin): Improved functionality dealing with ultrasonic data, automated data handling, and eliminated many bugs and instabilities
- ❖ Generated Python and MATLAB scripts for processing data collected during experiments
- ❖ Developed, implemented, and refined control protocol for spike heating of pressurized samples from room T to >1500 K in less than 1 sec.
- ❖ Added as contributing member to xpdAcq software coding team

## USERS ASSISTED (2017-2018):

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Kenneth Baldwin (SBU)  
Frederic Bejina (Toulouse)  
Pamela Burnley (UNLV)  
Haiyan Chen (SBU)  
Cecilia Cheung (UW-Madison)  
Eric Dooryhee (NSLS-II)  
Isra Eman\* (UCL)  
Sanjit Ghose (NSLS-II)  
Jennifer Girard (Yale)  
Gabriel Gwanmesia (Delaware U.)  
William Huebsch (SBU)  
Simon Hunt (UCL)  
Alwin James\* (SBU)  
Shirin Kaboli (UNLV)  
Li Li (SBU)

Anwar Mohuiddin (Yale)  
Martha Pamato (UCL)  
Sulgiye Park\* (Stanford)  
Eric Quackenbush\* (SBU)  
Paul Raterron (Lille)  
Melinda Rucks\* (SBU)  
Melissa Sims\* (SBU)  
John Sinsheimer (NSLS-II)  
Andrew Thomson (UCL)  
Richard Triplett\* (SBU)  
John Trunk (NSLS-II)  
Michael Vaughan (SBU)  
Donald Weidner (SBU)  
Hui Zhong (NSLS-II)

\*denotes student

## PROPOSALS (2017-2018):

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- ❖ Effect of Partial Melting on Elastic Properties of Rocks at Mantle Conditions. NSF-EAR Proposal, \$600,000, 3 yr. Status: Successful. (Weidner, Whitaker, Li)
- ❖ Multi-Anvil High Pressure Synchrotron Facilities Operated by COMPRES (NSF Sub-Award from UNM) FY 2017-2018 (\$452,729); FY 2018-2019 (\$408,789). (co-Principal Investigator)
- ❖ Workshop on *in situ* studies of high pressure Earth processes in Large Volume Apparatus. COMPRES 2017 Infrastructure Development Grant, \$25,000, 1 yr. Status: Successful (co-Principal Investigator)
- ❖ Proposal to COMPRES for Continuing Support of 6-BM-B, \$213,166. Status: Accepted (co-Principal Investigator)
- ❖ COMPRES Partner User Proposal for XPD at NSLS-II. Status: Pending (co-Principal Investigator)

## NSLS-II BEAMTIME PROPOSALS (2017-2018):

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- ❖ Mechanical properties of CaSiO<sub>3</sub>-perovskite and MgSiO<sub>3</sub>-perovskite at Mid-mantle Conditions. (P.I. – Richard Triplett) NSLS-II Beamtime Proposal: MAXPD. (2019-1)
- ❖ The Anelasticity of Magnesium and implications for the Earth's inner core. (P.I. – Martha Pamato) NSLS-II Beamtime Proposal: MAXPD. (2019-1)
- ❖ The rheology and relative strength of the Earth to 660 km depth. (P.I. – Simon A. Hunt) NSLS-II Beamtime Proposal: MAXPD. (2019-1)
- ❖ NSLS-II Pair Distribution Function School 2018. (P.I. – A. Milinda Abeykoon) NSLS-II Beamtime Proposal: PDF and XPD
- ❖ Determination of Pressure Efficiencies and Thermal Gradients in Standardized Multi-Anvil Cell Assemblies. (P.I. – Matthew L. Whitaker) NSLS-II Beamtime Proposal: MAXPD.
- ❖ Deformation Properties of Stishovite at High Pressure and Temp. (P.I. – Donald J. Weidner) NSLS-II Beamtime Proposal: MAXPD.
- ❖ Ca- rich plagioclase at extreme conditions: an *in situ* case study of the formation of tissantite. (P.I. – Melinda J. Rucks) NSLS-II Beamtime Proposal: MAXPD.

- ❖ From Test Sites to Meteorites – Examining Impact-Induced Effects on Geologic Samples. NSLS-II Beamtime Proposal: TES.
- ❖ Short Course: Introduction to X-ray Absorption Spectroscopy. (P.I. – Anatoly Frenkel) NSLS-II Beamtime Proposal: QAS.
- ❖ Comparative Study of Wadsleyite, Ringwoodite and Olivine Rheology II. (P.I. – Paul C.M. Raterron) NSLS-II Beamtime Proposal: MAXPD.
- ❖ Routine Setup and Testing for Beamline 28-ID-2 (XPD). (P.I. – Eric Dooryhee) NSLS-II Beamline Commissioning Proposal: XPD.
- ❖ Diamondoids-to-diamond phase transition: finding the ultimate precursor for diamond synthesis. (P.I. – Sulgiye Park) NSLS-II Beamtime Proposal: MAXPD.
- ❖ Ca-rich plagioclase at extreme conditions: an *in situ* case study of the formation of tssintite. (P.I. – Melinda J. Rucks) NSLS-II Beamtime Proposal: MAXPD.
- ❖ Mechanical Properties of CaSiO<sub>3</sub> perovskite. (P.I. – Richard Triplett) NSLS-II Beamtime Proposal: MAXPD.
- ❖ Commissioning of High Pressure Multi-Anvil Press System at XPD-D; Part III. (P.I. – Matthew L. Whitaker) NSLS-II Beamtime Proposal: MAXPD.
- ❖ Comparative Study of Wadsleyite, Ringwoodite and Olivine Rheology. (P.I. – Paul C.M. Raterron) NSLS-II Beamtime Proposal: MAXPD.
- ❖ Commissioning of High Pressure Multi-Anvil Press System at XPD-D; Part II. (P.I. – Matthew L. Whitaker) NSLS-II Beamtime Proposal: MAXPD.
- ❖ Wadsleyite and Ringwoodite Rheology and Strength Contrast with Olivine. (P.I. – Paul C.M. Raterron) NSLS-II Beamtime Proposal: MAXPD.
- ❖ Commissioning of High Pressure Multi-Anvil Press System at XPD-D. (P.I. – Matthew L. Whitaker) NSLS-II Beamtime Proposal: MAXPD.
- ❖ First Light and Beam Characterization in 28-ID-D Hutch. (P.I. – Eric Dooryhee) NSLS-II Beamtime Proposal: MAXPD.

#### APS BEAMTIME PROPOSALS (2017-2018):

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- ❖ In situ acoustic study during phase transition from olivine to spinel in fayalite-rich system. (P.I. – Jihua Chen) APS Beamtime Proposal: 6-BM-B.
- ❖ Sound Wave Velocities and Elasticity of Hydrated Mantle Minerals at High Pressures and High Temperatures II. (P.I. – Gabriel Gwanmesia) APS Beamtime Proposal: 6-BM-B.
- ❖ Ca-rich plagioclase at extreme conditions: an *in situ* case study of the formation of tssintite IV (P.I. – Melinda J. Rucks) APS Beamtime Proposal: 6-BM-B.
- ❖ Exploratory synthesis of novel photocatalysts at high pressure. (P.I. – Alwin James) APS Beamtime Proposal: 6-BM-B.
- ❖ Elasticity of nonrecoverable perovskite minerals at mid-mantle conditions II. (P.I. – Richard S. Triplett) APS Beamtime Proposal: 6-BM-B.
- ❖ Acoustic Velocities and Thermoelastic Properties of Iron Sulfide and Iron Phosphide *in situ* at Extreme Conditions. (P.I. – Matthew L. Whitaker) APS Beamtime Proposal: 6-BM-B.
- ❖ Expanding the Available Pressure Range Attainable in Acoustic Velocity Studies at 6-BM-B (P.I. – Matthew L. Whitaker) APS Beamtime Proposal: 6-BM-B.
- ❖ Effect of coexisting high and low pressure phases on elastic properties at MHz frequencies (P.I. – Donald J. Weidner) APS Beamtime Proposal: 6-BM-B.



- ❖ Ca-rich plagioclase at extreme conditions: an in situ case study of the formation of tissintite III (P.I. – Melinda J. Rucks) APS Beamtime Proposal: 6-BM-B.
- ❖ Identification of Plagioclase Phases and Phase Transitions by Time-Resolved Fast-Compression Powder Diffraction (P.I. – Melissa L. Sims) APS Beamtime Proposal: 16-ID-B
- ❖ Investigation of jadeite behavior at high temperature and pressure (P.I. – Melissa L. Sims) APS Beamtime Proposal: 6-BM-B.
- ❖ Examination of low strain behavior of olivine polycrystals as a function of pressure using the D-DIA apparatus (P.I. – Pamela C. Burnley) APS Beamtime Proposal: 6-BM-B.
- ❖ Sound Wave Velocities and Elasticity of Hydrated Mantle Minerals at High Pressures and High Temperatures. (P.I. – Gabriel Gwanmesia) APS Beamtime Proposal: 6-BM-B.
- ❖ Elasticity of nonrecoverable perovskite minerals at mid-mantle conditions. (P.I. – Richard S. Triplett) APS Beamtime Proposal: 6-BM-B.
- ❖ Structure Determination of synthetic tissintite (P.I. – Melinda J. Rucks) APS Beamtime Proposal: 11-ID-B.
- ❖ Reexamining in situ Pressure Markers Using Ultrasonics: A Standardless Approach. (P.I. – Matthew L. Whitaker) APS Beamtime Proposal: 6-BM-B.
- ❖ Expanding the Available Pressure Range Attainable at 6-BM-B (P.I. – Matthew L. Whitaker) APS Beamtime Proposal: 6-BM-B.
- ❖ Ultrasonic velocities in non-recoverable perovskite structured minerals at high P and T (P.I. – Richard S. Triplett) APS Beamtime Proposal: 6-BM-B.
- ❖ Ca-rich plagioclase at extreme conditions: an in situ case study of the formation of tissintite II (P.I. – Melinda J. Rucks) APS Beamtime Proposal: 6-BM-B.
- ❖ Quantitative rheology experiments from a sinusoidal stress field at high P and T (P.I. – Donald J. Weidner) APS Beamtime Proposal: 6-BM-B.
- ❖ Acoustic Velocities and Thermoelasticity of Olivine at High Pressure and Temperature (P.I. – Matthew L. Whitaker) APS Beamtime Proposal: 6-BM-B.
- ❖ In situ Measurement of Acoustic Velocities and Thermoelastic Properties of Iron/Light-Element Alloys at High Pressures and Temperatures (P.I. – Matthew L. Whitaker) APS Beamtime Proposal: 6-BM-B.
- ❖ Acoustic velocities in partially molten rocks at pressure and temperature (P.I. – Donald J. Weidner) APS Beamtime Proposal: 6-BM-B.

#### EDUCATION, OUTREACH, & WORKSHOPS (2017-2018):

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- ❖ We held a successful COMPRES-sponsored workshop on future directions for large volume synchrotron-based research at APS in late September. Details about this workshop can be found in the MAC Facility Report.
- ❖ This workshop has led to a group of investigators coming together to work on a proposal for the formation of a Research Coordination Network.
- ❖ Whitaker has created a wiki-based server and web archive for this RCN, which can be found at [www.largevolumercn.net](http://www.largevolumercn.net).
- ❖ Experiments making use of the new technical developments led by Whitaker at 6-BM-B, including the DIASCoPE and planetary impact/petrology experiments, now account for half of the proposal pressure at the beamline.

- ❖ Whitaker became a General User at NSLS-II at the PDF (Pair Distribution Function) beamline and at the TES (Tender Energy Spectroscopy) beamline. He is the P.I. on a successful proposal that was granted beamtime at TES.
- ❖ Whitaker continued his efforts as a member of the COMPRES Multi-Anvil Cell Assembly project, designing and testing 3 new cell assemblies in 2018.
- ❖ Whitaker's Ph.D. student Melissa Sims successfully defended her dissertation on 11/30/2018. His second student, Melinda Rucks, is presently scheduled for a tentative defense date of 05/01/2019.
- ❖ Whitaker has been an author on 10 refereed publications (7 published, 3 submitted or in press), 2 extended abstracts, and 35 conference abstracts in 2017-2018.
- ❖ Whitaker attended the following workshops as either an attendee, speaker, or convener:
  - Thermodynamic modeling with alphaMELTS and other MELTS software – December 2018
  - EXAFS 2018: X-ray Absorption Spectroscopy Short Course @ BNL - November 2018
  - NOBUGS: New Opportunities for Better User Group Software Conference, BNL – October 2018
  - COMPRES Next Generation Synchrotron Techniques in Multi-Anvil Research (*Co-Organizer, Speaker*) – September 2018
  - PDF School 2018: NSLS-II Pair Distribution Function School – September 2018
  - Synchrotron Infrared Spectroscopy on Materials in Extreme Environments – May 2018
  - Hands-On Data Acquisition and Analysis Tutorial (NSLS-II DAMA) – May 2018
  - COMPRES Software Toolkits for Mineral Physics Workshop – July 2017
- ❖ Whitaker's band, Rock Nation, is the "Headliner" for the Middle Country School District's "Rock and Read" program, where he has written several songs and performed shows for elementary school children as part of their literacy program – 2017 – Present
- ❖ Research Mentor, Intel High School Science Research Program – 2015 – Present

#### INVITED TALKS, COLLOQUIA & PUBLIC LECTURES (2017-2018):

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| ❖ Advanced Photon Source User Science Seminar Series, Argonne National Laboratory | June 22, 2018 |
| ❖ Los Alamos National Laboratory, Los Alamos, New Mexico                          | June 14, 2018 |