Blaise A.F. Mibeck, Senior Scientific Investigator

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Principal Areas of Expertise

Research and Development, Measurement and Instrumentation, Problem Solving, X-ray Powder Diffraction (XRPD), X-ray Fluorescence (XRF), Quantitative Phase Analysis, Non-ambient XRD, Scanning Electron Microscopy and Energy Dispersive Spectroscopy (SEM-EDS), Polarized Light Microscopy, Data and Image Analysis, Design and Construction of Scientific Apparatus, and Material Science.

Professional Experience

2023-present: Senior Scientific Investigator, X-ray Crystallography, Triclinic Labs

Technical Leadership & Instrumentation:

- Subject Matter Expert responsible for troubleshooting and maintaining 4 XRD systems and 1 SEM-EDX instrument
- Spearheaded complete implementation of XRF capability, including method development and staff training
- Developed and tested variable humidity/temperature XRD chamber for pharmaceutical and materials applications
- Designed equipment modifications using 3D printing and outsourced CNC machining to enhance analytical capabilities
- Identified and qualified alternative suppliers for X-ray tubes, sample holders, and material processing equipment

Software & Quality Systems:

- Updated and performed major revisions to GMP computational software with full validation documentation
- Developed cleaning protocols for XRD sample holders and standardized procedures for investigating out-of-specification results
- Conducted pilot studies evaluating quantitative phase analysis methods for geotechnical materials
- Developed software to track SEM-EDX use, automate image preparation for reporting, and curating results

Training & Communication:

- Provided training on XRD theory/alignment, XRF sample preparation/operation, and SEM-EDX theory/operation
- Organized internal communication by establishing PXRD, XRF, and SEM-EDX email distribution lists
- Mentored junior scientists on advanced analytical techniques and data analysis and interpretation

Client Services & Business Development:

- Personally authored **68 proposals** and **37 technical reports** for diverse applications, including medical device characterization, forensic analysis, and regulatory compliance
- Assisted with reporting on many other projects, and served as primary scientific contact for complex client projects requiring XRPD, XRF, and SEM-EDS expertise
- Conducted detailed analysis of out-of-specification medical devices and specialized contaminant investigations
- Developed strategic guidance on PXRD expansion opportunities, contributing to business growth and competitive positioning

2002-2023: Research Scientist, EERC, UND (21 years)

Research Productivity: Directly contributed to **33 Abstracts, 57 Articles, 51 Proposals, and 51 Final Reports** across diverse energy and materials research programs.

NMARL Leadership: Managed comprehensive analytical capabilities including XRD, XRF, SEM-EDS, and optical microscopy. Reduced 50-sample set throughput from 6 weeks to 3 weeks using Project Network Diagrams. Developed methods for fuel cell contamination detection, proton exchange membrane characterization, and coal-derived graphite analysis. Maintained >10TB digital asset collection and designed laboratory database systems.

Applied Geology Innovation: Established in-house geological characterization capabilities, including 400,000-lb load frame refurbishment. Developed proppant testing methods, automated microscopy labeling, and quantitative XRD phase analysis (transforming qualitative to quantitative capabilities). Designed/built functional gas pycnometer and custom permeability apparatus. Implemented machine learning for CCSEM rare-earth element classification.

Mercury Research Excellence: Led Bench Scale Flue Gas Simulator for 5 years with record productivity (1,117 samples tested, 294 citations from 14 publications). Developed/patented mercury chloride testing method (US Patent 7829047). Operated emission monitors aboard aircraft flying through power plant plumes.

Industrial Partnerships: Managed multi-year relationship with Marvin Windows & Doors, growing from small projects to major research contracts and blanket purchase agreements. Led chromium surface concentration analysis, enabling a successful legal case against the supplier.

Technical Innovation: Designed laser-induced fluorescence mercury detection system, developed microwave absorption characterization methods, and created advanced image analysis workflows using Python and machine learning for unconventional reservoir characterization.

Aug 2011 – Jun 2012: Adjunct Lecturer (Introduction to DC and AC Electronic Circuits), University of North Dakota, Department of Technology

2002-2003: Research Instrumentation Technician, EERC, UND

My responsibilities included installing, maintaining, repairing, and operating instruments and equipment used in field-, pilot-, and bench-scale testing. I also participated in research, including assisting with test programs, adapting equipment for nonstandard applications, and developing new sampling technologies. I was often sent to power plants on short notice and was responsible for the daily maintenance and calibration of mercury continuous emission monitors.

2001-2002: NASA Space Grant Graduate Fellowship recipient

I cooperated with the EERC on behalf of the High-Altitude Balloon Group in the initial design and operation of a balloon-borne mercury detection mission. Many balloon missions reached altitudes over 100,000ft.

2000-2001: Graduate Research Assistant, Department of Space Studies, UND

I pursued improved methods for low-cost high-altitude scientific ballooning for basic research and education; designed electronics for global positioning systems (GPSs), Geiger counter, temperature/pressure sensors, microcontrollers, communication and tracking electronics, Single Board Computers, cameras, and various digital and analog devices; and performed georectification on balloon imagery via collection and use of field GPS data and GIS software.

1999-2000: Graduate Teaching Assistant, Department of Space Studies, UND

I maintained the astronomical observatory-supporting asteroid and comet Internet telescope (ACIT) operations.

1996-1999: Graduate Research Assistant, Department of Physics, UND

I designed, built, and tested a cryostat for performing in situ low-temperature x-ray diffraction (LTXRD); I determined the low-temperature structure of a thallium-based superconductor, $Tl_2Ba_2CuO_{6+x}$. I regularly volunteered for education and public outreach activities as a UND Society of Physics Students member.

1991-1996: Laboratory Assistant, Department of Physics, Lake Forest College, Lake Forest, Illinois

During the school year, I assisted in research, maintained teaching equipment, and interacted with various equipment manufacturers and technical support services. In the summers, I conducted independent research projects on low-energy atomic beams.

Education

M.S., Physics, University of North Dakota, 1999
B.A., Physics, Lake Forest College, Lake Forest, Illinois, 1996

Software/Programming Languages

X-ray Crystallography: Rigaku Smart Lab II, MDI Jade, Bruker EVA and TOPAS, PDF, and COD structure databases
Languages: Python, Java, Visual Basic
Image Analysis: ImageJ, OpenCV, Sci Kit Learn, NumPy
Data Analysis: Excel, Para View, Origin, Weka
Database: MS Access, PostgreSQL
CAD: AutoCAD and Fusion 360, Free Cad, Eagle PCB, and KiCad

Licenses/Certificates/Training

Polarized Light Microscopy, Hooke College of Applied Microscopy - 2025
ICDD Virtual XRD Clinic - 2020
Bruker Operator and Maintenance Training - 2010
UND Radiation Safety Training

Selected Publications

Google Scholar