

## President's Address

Dear AXAA Members and Friends,

I'd like at the outset to wish you all good health as the COVID-19 pandemic continues to profoundly affect our lives. This, after the devastating bushfires during the Australian summer, means 2019-2020 is a period that will always be etched in our memories. As I write this one of the lead news stories is that my home organisation, CSIRO, has launched initial trials of two COVID-19 vaccines, and hopefully these will progress to human trials in the coming months.

You are likely already aware that AXAA-2020 has been cancelled, an agonising decision for all involved but as the situation continues to worsen, it's clearly the only reasonable decision that could have been made. I'd like to thank all delegates and sponsors for your patience as we worked through various scenarios in the lead-up to the cancellation decision being made. I'd also like to thank all of those who contributed greatly to the organisation of AXAA-2020 as part of the Conference Committee, and I'd like to thank our Conference Secretariat, Tulips Meeting Management, for their efforts over the past two years since the planning for AXAA-2020 began.

I'd like to also thank the rest of AXAA National Council for your efforts over the past three years and, particularly, over the last three weeks. The election of a new National Council (for the period 2020-2023) was to take place at a General Meeting to be held at AXAA-2020, but this will be postponed until the latter part of 2020, or early in 2021 if necessary. The outgoing National Council can make three nominations for the new Council, and these were confirmed at a recent National Council meeting. They are: for President, Jessica Hamilton; for Treasurer, Sally Birch; and for Secretary, Anita D'Angelo. The AXAA National Council consists of a President, Vice-President, Secretary, Treasurer and not less than two other people, and nominations are also accepted from the AXAA membership, by email to the current AXAA Secretary Mark Styles, until one week before the date of the next General Meeting (TBA).

The presentation of three prestigious awards – the

Keith Norrish AXAA Award for Excellence in X-ray Fluorescence Analysis, the Bob Cheary AXAA Award for Excellence in Diffraction analysis, and the Malvern Panalytical Award for Excellence in Analysis by an Early Career Scientist – was also to take place at AXAA-2020. These awards will be presented at an event in the future. The selection process for the awards is nearing completion and recipients will be notified shortly.

Finally, whilst COVID-19 has had a significant impact on AXAA in the immediate term, AXAA is still very much alive and I look forward to engaging with you again at future AXAA events!

Nathan Webster  
AXAA President

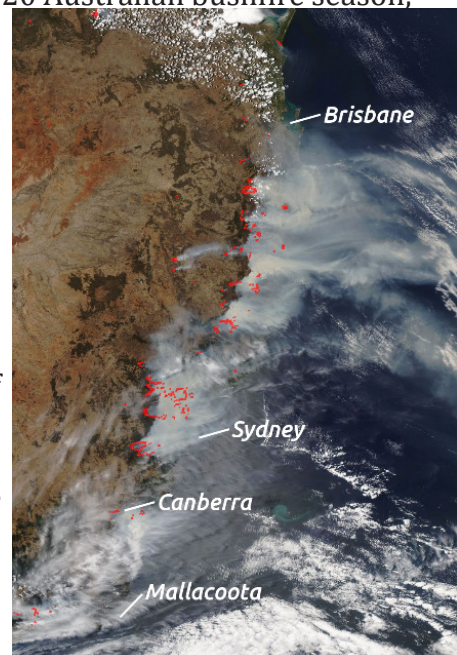
## Using XANES spectroscopy to quantify Cr(VI) formation in fire-impacted soil

*Prof. Ed Burton, Southern Cross University*

Much of the Australian continent is highly susceptible to fire due to being generally hot, dry and drought-prone with a dominance of flammable natural vegetation. This fire-prone nature was clearly apparent during the recent 2019-20 Australian bushfire season, which burnt almost 19 million hectares of land in eastern Australia (Figure 1).

During fires, surface soil temperatures of 100 to 700°C are common, with temperatures as high as 850°C occurring for brief periods. Temperatures of this magnitude can profoundly alter the geochemical characteristics of soil.

**Figure 1.** NASA satellite image showing bushfires across eastern Australia in Dec 2019.



However, at present, relatively little is known regarding potential role of fire in shaping the geochemistry of trace metals (such as chromium) in soil.

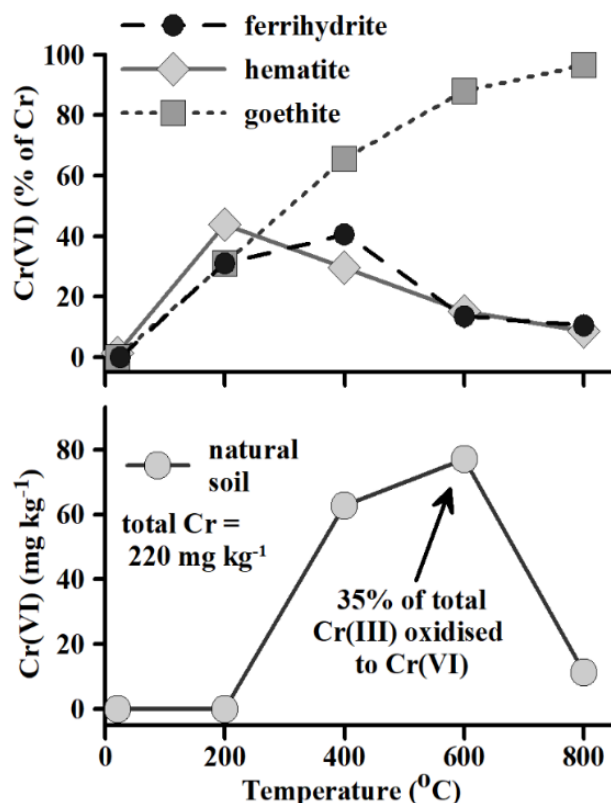
Chromium exists in soil as two main oxidation states, Cr(III) and Cr(VI), which display contrasting ionic charge, solubility, mobility and toxicity. Chromium(III) exists as a cation which is poorly soluble and immobile in the pH range of most soils. In terms of toxicity, Cr(III) is relatively benign and is actually essential for human nutrition. In contrast, Cr(VI) is a notorious cancer-causing toxin, which exists in soil pore-water as highly mobile oxyanions. As such, Cr(VI) is of widespread interest in the soil science and environmental geochemistry communities.

Chromium(III) is by far the dominant Cr oxidation state in unpolluted soil. This is partly because oxidation of Cr(III) to Cr(VI) by  $O_2$ , although thermodynamically viable, is exceedingly slow at ambient temperature. However, this reaction can occur rapidly at higher temperatures. For example, it is known that oxidation of Cr(III) to Cr(VI) occurs readily during coal burning and during industrial waste incineration. However, despite this knowledge, the potential for high-temperature formation of Cr(VI) in fire-impacted soil has been largely unexplored.

Recently, we applied Cr K-edge X-ray absorption near-edge structure (XANES) spectroscopy at the Australian Synchrotron to examine high-temperature Cr(VI) formation in soil materials. Our approach involved comparing the % abundance of Cr(VI) in known mixtures of Cr(VI)/Cr(III) to the height of the Cr(VI) XANES pre-edge peak for Cr(VI) [1].



**Figure 2.** Dr. Niloofar Karimian changing samples at the XAS beamline, Australian Synchrotron



**Figure 3.** Cr(VI) formation via heating of Cr(III)-bearing Fe-oxides (top panel) and a natural Ferrosol soil (0-5 cm) at up to 800 °C for 2 hours.

The use of this calibration approach revealed substantial Cr(VI) formation during heating of Cr(III)-bearing iron oxides and a natural iron oxide-rich soil at temperatures which occur in surface soil during fires (Figure 3). Overall, the results suggest that Cr(VI) can form readily in soil from pedogenic Cr(III)-bearing phases even during relatively low-temperature fires. This research is being extended to a series of studies on soil and water samples from fire-impacted landscapes through funding from the Australian Research Council (DP200101311) and through XAS beamtime at the Australian Synchrotron.

Further details of the research summarized here can be found in:  
 [1] Burton, E.D., Choppala, G., Karimian, N., Johnston, S.G. (2019) 'A new pathway for hexavalent chromium formation in soil: Fire-induced alterations of iron oxides' *Environmental Pollution* 247, 618-625.  
 [2] Burton, E.D., Choppala, G., Vithana, C., Karimian, N., Hockmann, K., Johnston, S.G. (2019) 'Chromium(VI) formation via heating of Cr(III)-Fe(III)-(oxy)hydroxides: A pathway for fire-induced soil pollution' *Chemosphere* 222, 440-444.



## Science meets Parliament 2019

*David Gozzard*

*Postdoctoral Fellow, Centre for Gravitational Astrophysics,  
Research School of Physics, The Australian National University*

Australia's politicians and scientists share the same goal, to improve the prosperity and quality of life of Australians and people around the globe, but we seem to speak different languages and have very different priorities. It is for that reason that I was keen to attend Science meets Parliament, to learn how to bridge the gap between our leaders and researchers.

Organized by Science and Technology Australia, with the aid of other institutions and volunteers, Science meets Parliament brings together Australia's leaders, decision makers, and STEM professionals to promote the role of science, technology, engineering, and mathematics and its importance in Australia. 2019 marked the 20<sup>th</sup> Science meets Parliament, indicating just how successful and strongly supported the event has become.

Spread over two intense days, Science meets Parliament gives researchers the opportunity to learn how our politicians and parliament work, and how to advocate for their field's recognition in Australia's political landscape. Day one focussed on science communication training, and featured keynote presentations from scientists and policy makers working at the coalface of Australian STEM policy and advocacy. Day two featured more presentations from STEM ambassadors and advocates, as well as panel discussions with parliamentarians and senior scientists. But the core of the event was the opportunity to meet and talk with our assigned parliamentarians and their staffers.

We heard from the likes of Chief Defence Scientist Professor Tanya Munro, Australia's Chief Scientist Dr Alan Finkel, and New Zealand's Chief Science Advisor Professor Gary Evans. It was interesting to learn the similarities and differences in science policy and application from the two sides of the ditch, the challenges that our countries are facing, and the priorities for spurring technological development and innovation. Politicians and policy makers are always looking to the future, trying to predict and head-off local or global changes that could impact our nation's prosperity. The key challenges in the coming years are

how to support our growing, but aging, population, how to maintain a competitive edge for Australian businesses and exports in an ever-changing world, and how to tackle climate change. Professor Fiona Wood, of spray-on skin fame, delivered a fascinating and inspiring opening address that touched on her experiences helping to change the way burns patients are treated across Australia, saving lives.

The science communication training gave us the opportunity to workshop and refine what we were going to advocate to our assigned parliamentarians. I have, for a long time, been very interested in science communication, even taking extra classes on science communication during my undergrad, so the techniques and ideas were familiar to me, but not to many of my fellow delegates. As with all science communication, regardless of your audience, it is imperative that you keep your message clear and concise and jargon free. Understand that effective communication is always a two-way street, be considerate of your audience, and respond to their needs. Find what they are interested in, and use that guide you in delivering your message. With limited time to talk to the busy politicians, we had to pick one clear idea and communicate it clearly, concisely and persuasively, without jargon or getting bogged down in unnecessary details. We learned that in the world of STEM advocacy, communicating the narrative of why we are doing our work is crucial and must not get lost in what we are doing. How does the local community, or Australia as a whole, benefit from what you are doing?

Day one ended with a gala dinner at parliament house attended by some of the politicians and parliamentary staffers we would be meeting the next day. This provided the opportunity to start to advocate, build a rapport, and work on our communication techniques in a more relaxed atmosphere.

Science meets Parliament gave delegates the opportunity to meet and network with around 200 STEM professionals from a diverse range of backgrounds, from academia, industry, and even self-employed scientists. I spoke to other physicists, as well as biologists, early-childhood researchers, epidemiologists, and more.

I put a neuroscientist in contact with a science journalism group, got a VR tour of ANSTO's research reactor, and learned some worrying facts about ticks from an entomologist from Murdoch University. With such diversity, there was a huge variety of goals and agendas, but everyone shared a passion for their field and a desire to raise its visibility in science policy and public debate. Meeting so many passionate scientists was, for me, a highlight of the event.

But the most exciting part of Science meets Parliament had to be meeting with our assigned parliamentarians. Each meeting included four STEM professionals from a variety of fields. Some groups worked together to convey a joint message, while others represented the individual challenges of their field. Some delegates were steeling themselves against the prospect of meeting MPs and Senators with more intimidating reputations. I was nervous, but looking forward to my scheduled meeting with David Smith, MP for Bean in Canberra's south, along with his senior staffer Bryce Wilson. The other scientists joining me in the meeting were Michael Tobar from physics at UWA, Daniel Rodwell from Australia's National Computational Infrastructure, and Sara Howden from the Murdoch Children's Research Institute. While we had not worked together beforehand to present a joint message, we found that we were largely united in our concerns for STEM in Australia and discussed, what we felt were, the major challenges facing Australian research including tertiary education, funding and job stability, the brain drain of talented scientists out of research in Australia (which was a widespread concern amongst delegates), and Australia's missed opportunities to capitalize on our nation's expertise and skills.

We found Mr Smith and Mr Wilson to be very receptive to our thoughts on these issues, keen to hear our opinions on how to tackle them, and also genuinely curious about our research. Prior to politics Mr Smith had worked in the public service and had experience as a policy officer, so he had been in our position, advocating for the needs and futures of the groups he represented. Mr Smith had also been Director of the ACT branch of Professionals Australia, a body that grew out of the Association of Professional Engineers and Scientists. During his parliamentary career he has served on committees looking into sectors including



**Figure 4.** Scientists meeting with David Smith MP (second from left); scientists l.t.r.: Sara Howden (MCRI), Daniel Rodwell (NCI), David Gozzard (ANU), Michael Tobar (UWA).

publics works and electric vehicles. Mr Wilson had been a high school teacher before becoming a political staffer, so had a great deal of experience in the challenges facing secondary education from the classroom to the policy level.

Our meeting had been scheduled for half an hour, but Mr Smith and Mr Wilson gave us more than an hour of their time (with Mr Smith having to dash to the chamber occasionally for a quick vote), discussing the issues we had raised. We learned that changes in support and funding for secondary education and TAFE are more immediate priorities than tertiary education for both the government and opposition, and we pushed our argument that tertiary education must not be left behind at this time. We discussed solidifying announcements dates for ARC and other government funding to reduce employment uncertainty that has caused a recent exodus of brilliant researchers, and changes to visa rules to make it easier to attract top international researchers and retain them.

While any singular meeting might not have been able to cause immediate policy shift or discussion, this was only one the nearly 250 meetings the 200 delegates participated in that day. Science meets Parliament has a long-term goal, to generate broader and more consistent political support for science and technology in Australia.

All of us were encouraged to keep in contact with our MPs, and some delegates left their meetings with further meetings and discussions already scheduled. Many MPs even provided further advice for getting a delegate's proposal onto a state or federal political agenda.

The final day closed with drinks and canapés during which the main topic of conversation between the scientists was their experiences meeting their assigned parliamentarians. Nearly everyone I spoke to reported how engaged and interested their politicians were. Some politicians turned out to be huge nerds, wanting to go into the details about anything from gene editing to dark matter.

Science meets Parliament was a fascinating introduction to the machinations of science and technology policy and advocacy in Australia, and an insight into the life and people on Capital Hill. I'm sure it is an understatement to say that running a country is a hard job, and I'm sure many of us have times when we feel our government should be doing things differently, but Science meets Parliament gives delegates a new perspective on government, and an insight into how to influence discourse and push for change. Politicians' time and attention is in high demand, and they have the daily job of working out how best to use legislation to guide the country and where best to invest the country's limited financial and human resources. I left Science meets Parliament with a lot of notes for ideas to push, things to think about, opportunities to discuss with colleagues, and a plan to make sure I invite David Smith and other MPs to tour our lab.

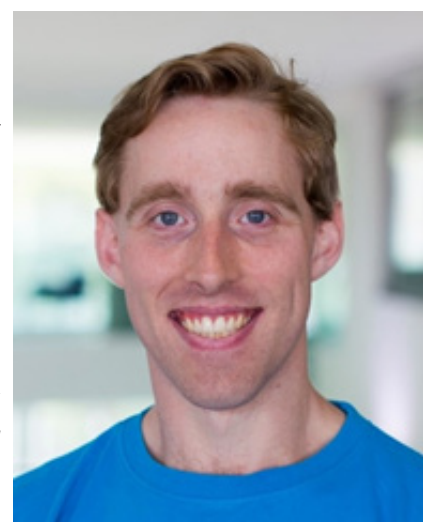
I strongly encourage anyone who is interested in promoting any and all aspects of STEM in Australia to apply to attend Science meets Parliament in the future. Even if Science meets Parliament is not your sort of thing, take a few minutes to consider what you would say and how you would say it if you went to an event and got a moment to chat with your local MP, or anyone else influential. If you have an event coming up, such as the opening of a new lab, or a press conference about your work, invite your MP down. They will almost certainly be interested in taking a look. Most of them are very interested in anything and everything that is going on in their electorate and want to know what they can do to support it. Science meets Parliament is just one day. Continuing to reach out to and talk with

our MPs will help to ensure that the importance and impact of research and evidence-based policy is a part of their everyday decision making.

I am extremely grateful to the AIP for sponsoring my place at the meeting, as well as to Science and Technology Australia, the organizers, volunteers and speakers who made the event a success.

### **About the author**

*Dr David Gozzard is a postdoctoral researcher at the Australian National University working on optical phased arrays, and laser sensors and communications systems. He completed his PhD at the University of Western Australia working on the SKA telescope. He has recently been awarded a Forrest Fellowship and will be returning to Western Australia to work on ground-to-space laser links.*



### **Do you have a story to share with AXAA?**

The newsletter is seeking science stories and community news for the next issue in August. Please contact Jessica Hamilton at [auxray@gmail.com](mailto:auxray@gmail.com) if you would like to make a submission.

Previous newsletters and the AXAA submission guidelines can be found [here at our website](#).

To advertise with AXAA, please also see our [submission guidelines](#) for our rates.



## Inviting publications to a Special Issue of Mineralogical Magazine

Mineralogical Magazine has just opened a new Special Issue dedicated to the memory of Dr Frank Reith of the University of Adelaide and awaits submissions. When these papers are published, they can be shared freely by authors and readers.

We plan to cover all areas of Reith's research such as:

- Geomicrobiology and (bio)geochemistry of metals;
- Biosensors and Bio-indicators for exploration;
- Bacterial interaction with metals;
- (Bio)Mineralogy and geology of metal deposits;
- Hydrogeochemistry of metals;
- Ecotoxicology of metals;
- Sulphide mineralogy and hydrothermal alteration;
- Soil (bio)geochemistry and mineralogy.

Submissions encouraged by 30th September 2020.

Editors:

*Stuart Mills (Principal Editor, Mineralogical Magazine)*

*Jeremiah Shuster (Guest Editor)*

*Janice Kenney (Guest Editor)*



## Inviting Nominations for AXAA National Council Positions

Would you like to get involved in AXAA?

We are seeking a new National Council (3 year term). If you would like to nominate yourself for a position or as a general council member, please email Mark Styles at [mark.styles@csiro.au](mailto:mark.styles@csiro.au).

The new National Council will be elected at the next AGM, which has been postponed until either late 2020 or early 2021. The outgoing National Council's three nominations are for President, Jessica Hamilton; for Treasurer, Sally Birch; and for Secretary, Anita D'Angelo.



## Australian Synchrotron made available for COVID-19 research

ANSTO has ceased neutron and synchrotron user operations for the foreseeable future. Experiments will be postponed to a future date. During the shutdown, instruments will be made available for critical research only, such as research related to the COVID-19 virus.

To see how the Australian Synchrotron is contributing to drug and vaccine development, check out these news features:

ANSTO video on the MX beamline: [https://www.youtube.com/watch?time\\_continue=1&v=d3DhtOSvV6I&feature=emb\\_title](https://www.youtube.com/watch?time_continue=1&v=d3DhtOSvV6I&feature=emb_title)

Feature on Sky News: <https://www.facebook.com/57886636727/posts/10157149406011728/?vh=e&d=n>



## AXAA Website and Contacts

Please visit our website, [www.axaa.org](http://www.axaa.org), for further information, or follow us on Twitter [@axaa\\_org](https://twitter.com/axaa_org).

### NATIONAL COUNCIL PRESIDENT:

Nathan Webster  
CSIRO Mineral Resources, Box 10, Clayton South,  
VIC 3169  
Telephone: (03) 9545 8635  
e-mail: [nathan.webster@csiro.au](mailto:nathan.webster@csiro.au)

### NATIONAL COUNCIL VICE PRESIDENT:

Vanessa Peterson  
Australian Centre for Neutron Scattering (ANSTO),  
Locked Bag 2001, Kirrawee DC NSW 2232  
Telephone: (02) 9717 9401  
e-mail: [vanessa.peterson@ansto.gov.au](mailto:vanessa.peterson@ansto.gov.au)

### NATIONAL COUNCIL SECRETARY:

Mark Styles  
CSIRO Manufacturing, Private Bag 10, Clayton  
South, VIC 3169  
Telephone: (03) 9545 8179  
e-mail: [mark.styles@csiro.au](mailto:mark.styles@csiro.au)

### NATIONAL COUNCIL TREASURER:

Sally Birch  
CSIRO Mineral Resources, Locked Bag 2, Glen  
Osmond SA 5064  
Telephone: (08) 8303 8487  
e-mail: [sally.birch@csiro.au](mailto:sally.birch@csiro.au)

### NATIONAL COUNCIL COMMUNICATIONS EDITOR:

Jessica Hamilton  
Australian Synchrotron (ANSTO), 800 Blackburn  
Road, Clayton, VIC 3168  
Telephone: (03) 8540 4297  
e-mail: [hamiltoj@ansto.gov.au](mailto:hamiltoj@ansto.gov.au)

### NATIONAL COUNCIL MEMBERS:

Natasha Wright (CSIRO, VIC)  
Gordon Thorogood (ANSTO, NSW)  
William Rickard (Curtin University, WA)  
Talitha Santini (University of Western Australia,  
WA)  
Brianna Ganly (CSIRO, NSW)

## AXAA Membership

All registered participants of the AXAA-2017 conference are automatically granted AXAA membership for 3 years. Alternatively, new memberships can be obtained free of charge, by making an application to the National Council.

Candidates should send the membership form from the [AXAA website](http://www.axaa.org), and a short statement about how they intend to contribute to the organisation, to the National Council Secretary Mark Styles.

## AXAA Resource Centre

There are a range of resources available on the [AXAA website](http://www.axaa.org), including video recordings of the two Public Lectures at AXAA-2017, tips for Rietveld Analysis, Clay Analysis, XRF tips, and more. We welcome further contributions to our Resource Centre.

## Next AXAA Newsletter

The next issue of the AXAA Newsletter will be distributed in August 2020. Please feel free to send contributions for the newsletter to Jessica Hamilton at [ausxray@gmail.com](mailto:ausxray@gmail.com). Any comments or feedback about the Newsletter are welcome.

## A Day in the Life of an X-ray / Neutron Scientist

We are seeking posts for our 'Day in the Life' series. If you'd like to contribute, or know someone who might be interested, please contact National Council Communications Editor Jessica Hamilton at [ausxray@gmail.com](mailto:ausxray@gmail.com).

W:[www.axaa.org/a-day-in-the-life.html](http://www.axaa.org/a-day-in-the-life.html)



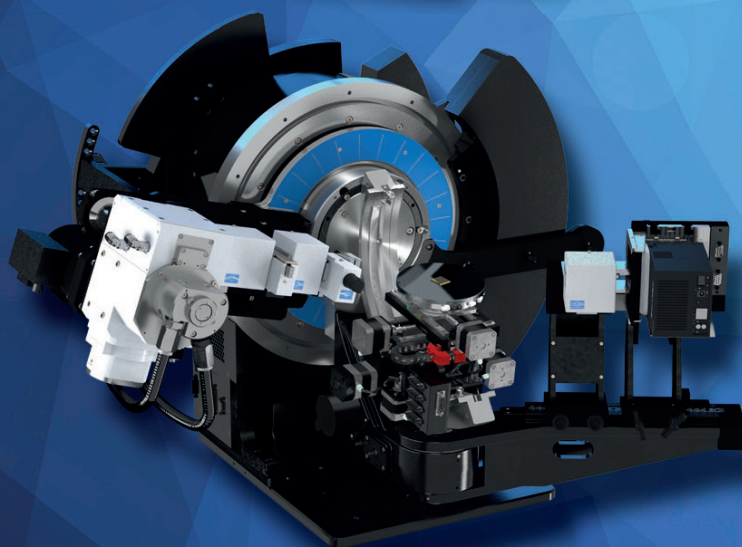
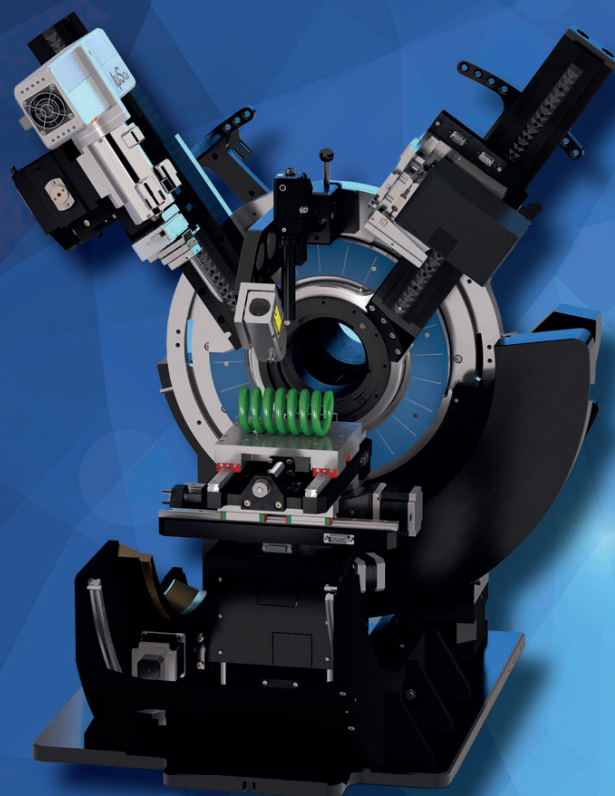




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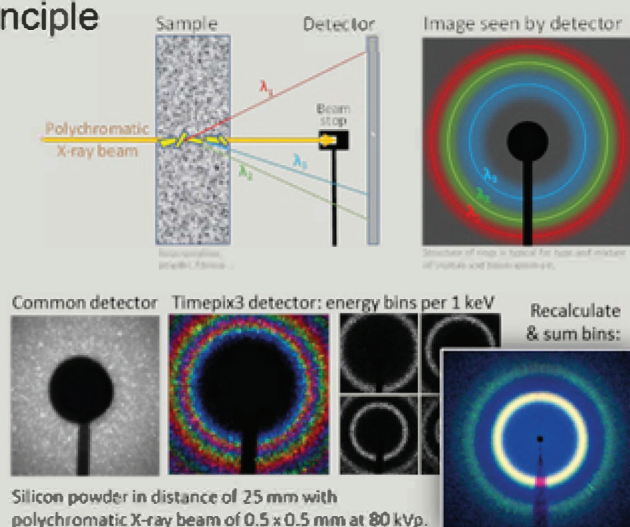
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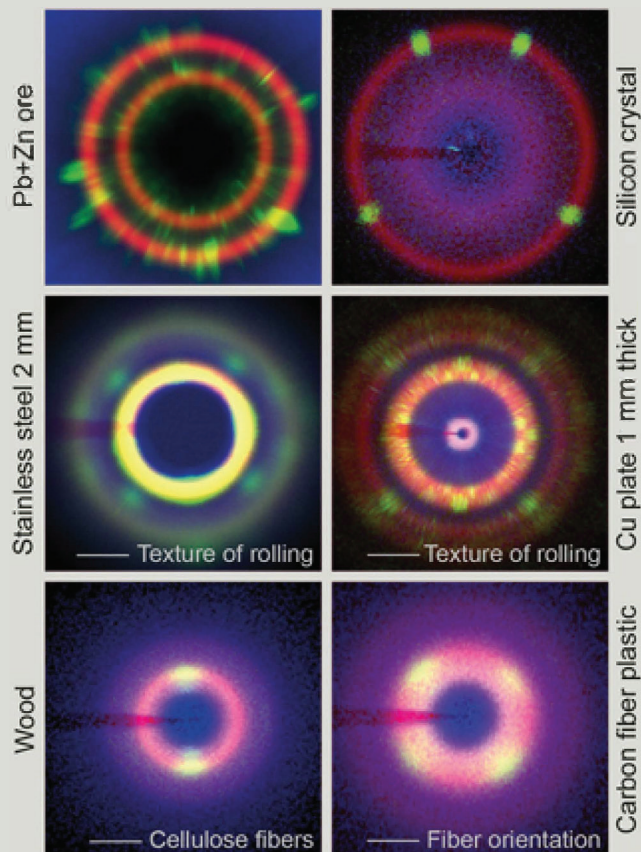
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## Examples



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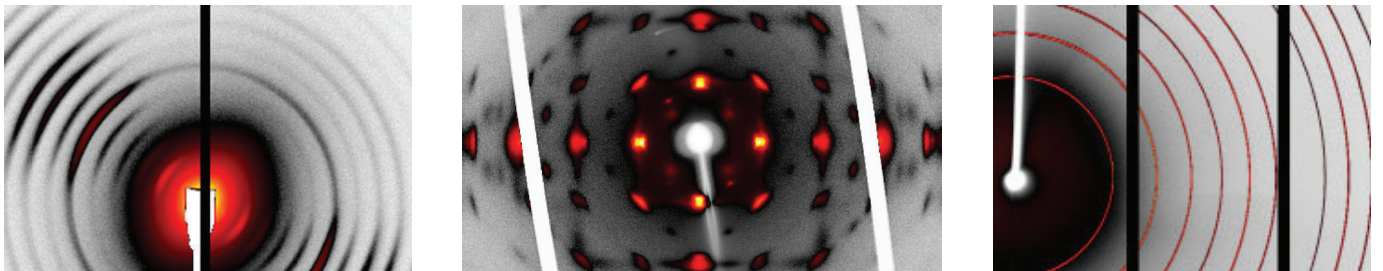
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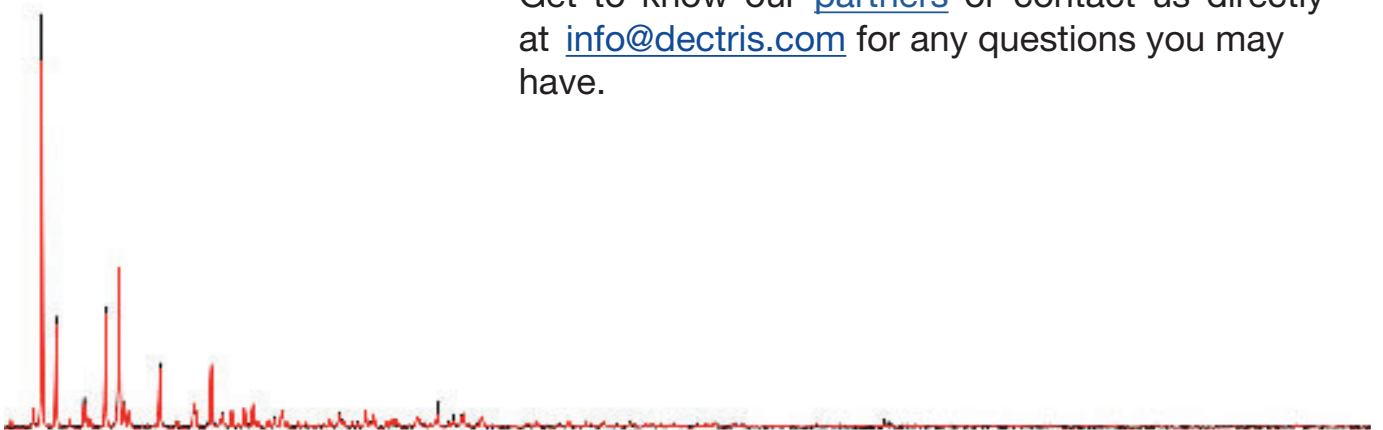
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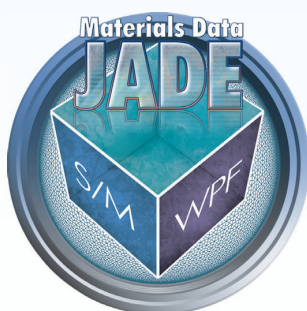
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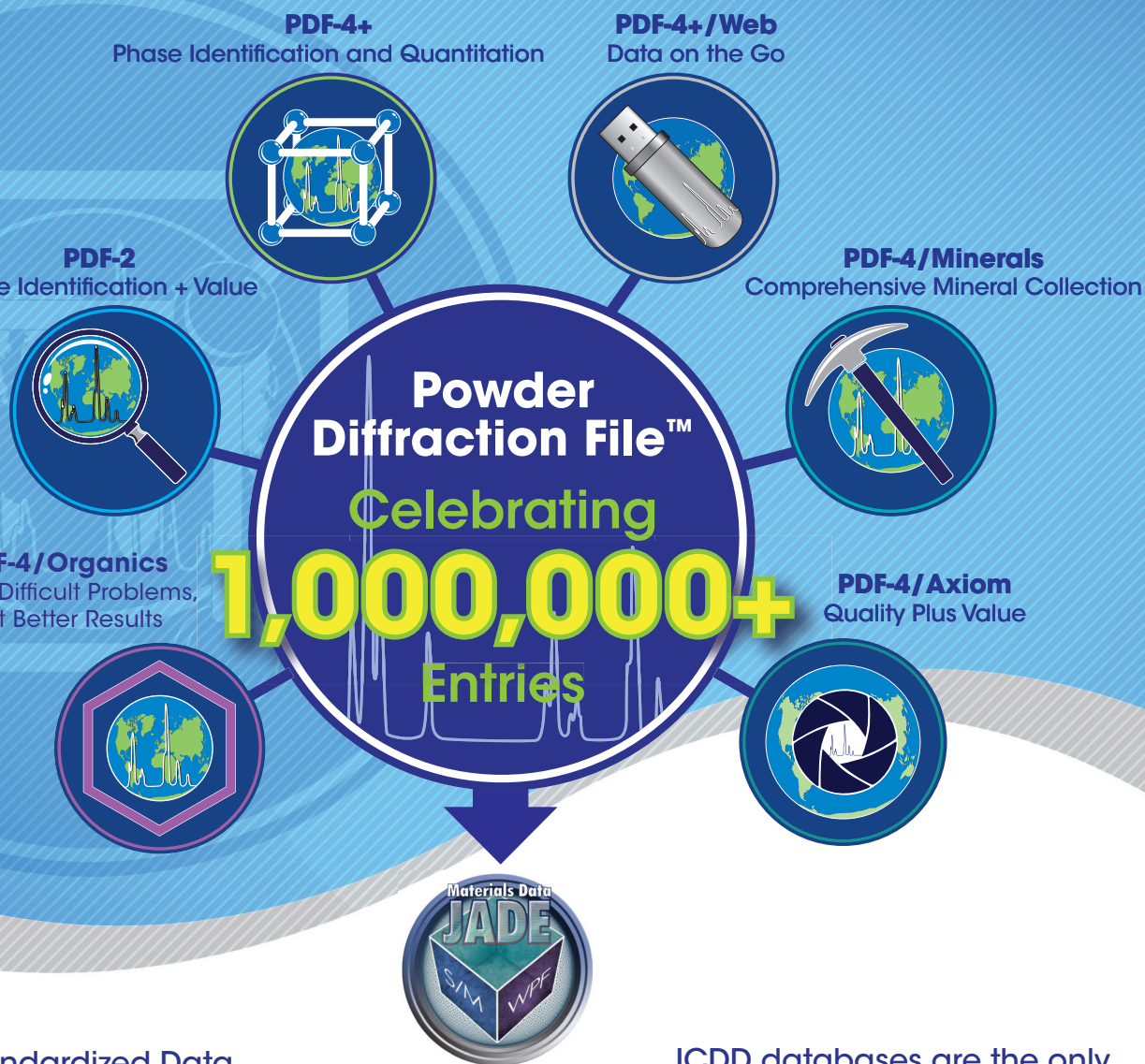


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**Victoria & Tasmania**

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**Western Australia**

Ph: (08) 9302 1911  
[rowewa@rowe.com.au](mailto:rowewa@rowe.com.au)

**New South Wales**

Ph: (02) 9603 1205  
[rowensw@rowe.com.au](mailto:rowensw@rowe.com.au)

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