

An Indian-Australian research partnership

Project Title: Interactions between volcanic and aeolian activity on the western Victorian basalt plains, SE Australia

Project Number IMURA1265

Monash Main Supervisor
 (Name, Email Id, Phone) A/Prof Kat Fitzsimmons
 Kathryn.fitzsimmons@monash.edu *Full name, Email*

Monash Co-supervisor(s)
 (Name, Email Id, Phone) Dr Sophia Tsang
 Sophia.tsang@monash.edu

Monash Head of Dept/Centre (Name,Email) Prof Andrew Mackintosh
 Andrew.mackintosh@monash.edu *Full name, email*

Monash Department: School of Earth, Atmosphere and Environment

Monash ADGR
 (Name,Email) Prof Peter Betts
 Peter.betts@monash.edu *Full name, email*

IITB Main Supervisor
 (Name, Email Id, Phone) Prof George Mathew
 gmathew@iitb.ac.in *Full name, Email*

IITB Co-supervisor(s)
 (Name, Email Id, Phone) *Full name, Email*

IITB Head of Dept
 (Name, Email, Phone) Prof. M. Radhakrishna
 mradhakrishna@iitb.ac.in *Full name, email*

IITB Department: Department of Earth Sciences

Research Clusters:

Highlight which of the Academy's CLUSTERS this project will address?
 (Please nominate JUST one. For more information, see www.iitbmonash.org)

5 Earth Sciences and Civil Engineering
 (Geo, Water, Climate)

Research Themes:

Highlight which of the Academy's Theme(s) this project will address?
 (Feel free to nominate more than one. For more information, see www.iitbmonash.org)

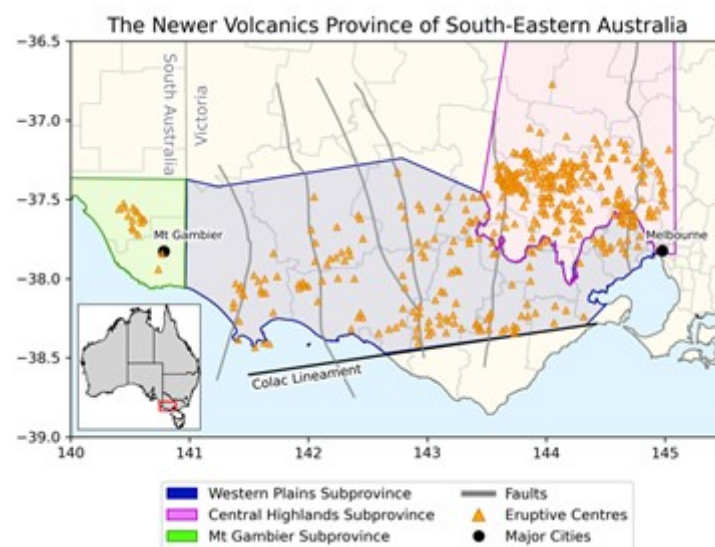
6 Sustainable Societies

The research problem

The landscapes of India and Australia have a number of things in common: vast deserts, tropical savannahs – and fertile **volcanic soils**. The Deccan Traps of India and the western Victorian volcanic plain of Australia count amongst the **world's top three largest volcanic plains**; their soils nourish the agricultural production for millions of people. Both also abut major coastal and desert regions – it is hypothesised that **strong winds have further fertilised these volcanic soils through the addition of aeolian (wind-blown) sediment**, yet the interaction between volcanic and aeolian systems has rarely been the subject of study.

While the Deccan Traps have been extensively investigated, surprisingly little data have been generated from the western Victorian volcanic plains (known as the Newer Volcanics Province) with respect to the age of volcanic activity, and the nature and timing of interaction with aeolian deposition. The proposed research programme will develop a comprehensive timeline for landscape evolution in the southwestern part of the Newer Volcanics Province (hypothesised to be the most recently active area – Figure 1), generating chronological data for volcanism and aeolian deposition.

Figure 1. Map of eruptive centres and activity zones in the Newer Volcanics Province/western Victorian volcanic plain, southeastern Australia, where the project will be focussed.



Since volcanic activity is known to have occurred over the time since people arrived in the region, the data generated will also provide a valuable conventional scientific perspective to complement Indigenous histories, while also providing important context to revise hazard assessments in a volcanic field which is potentially active and could erupt again in future.

The methodologies applied in this project will tap into significant expertise held by Indian (and specifically IITB) researchers in these sorts of environments, complemented by Monash colleagues, and will facilitate meaningful comparisons with respect to landscape evolution and management between the Deccan Traps and western Victorian volcanic plains.

Project aims

The aims of the project are to:

1. Generate a comprehensive chronology of volcanic activity in the southern part of the western Victorian volcanic plains, using analytical tools hosted at IITB.
2. Generate a comprehensive chronology of aeolian depositional history and contribution to volcanic soils in this region, using analytical tools hosted at Monash.
3. Investigate the source of the aeolian sediment being transported to the field region, using provenance based analytical tools hosted at IITB.
4. Develop a landscape evolution model of the region through time, and hypothesise changes expected in future, and in doing so to update assessments of future volcanic risk in the region
5. Compare the new results with existing data with across similar regions, such as the Deccan Traps and other large volcanic provinces.

How skills/experience of the IITB and the Monash supervisor(s) support the proposed project

The proposed project aims to answer a meaningful scientific question relevant to society while using the specific and complementary expertise of the IITB and Monash supervisors. The theme also explores common environmental and natural hazard issues found in India and Australia.

The main IITB supervisor, Prof George Mathew, is an international leader in geo-thermochronology, with expertise in Ar-Ar, Fission Track (FT) and luminescence dating (TL/OSL) systematics. He oversees the Ar-Ar geochronology, FT and X-ray diffraction (XRD) laboratories at IITB. He will facilitate access to additional IITB facilities required for the project, such as LA-ICPMS for zircon dating and other equipment for mineralogical characterisation. He has published extensively on geo-thermochronology and active tectonic aspects.

The main Monash supervisor, A/Prof Kat Fitzsimmons, is an international leader in aeolian geochronology and geomorphology, with specific research expertise in the western Victorian region. She is currently overseeing the construction of a new luminescence dating laboratory (to be completed in 2026) at Monash and runs sedimentology facilities there. Her existing connections with Indigenous Land Councils and other stakeholders in the proposed project region will ensure the success of the project's field component (sample collection) and the communication of results to local communities. She has published extensively on luminescence geochronology of aeolian systems, including multiple papers on the proposed field region and the interaction between volcanic and aeolian landscape systems there.

The Monash co-supervisor, Dr Sophia Tsang, has expertise in volcanic hazards with a particular focus on distributed volcanic fields. She is building a new research group focused on community-engaged research in the Newer and Older Volcanic Provinces of Victoria, Australia. In addition to her volcanic hazards and community engagement journal articles and science reports, her recent publications have focussed on lava flow impacts in hypothetical eruptions and guidance on best practices when creating volcanic hazard maps.

So far, the IITB and Monash supervisors have not jointly published in this area; however, this would be a natural outcome of the project.

What is expected of the student when at IITB and when at Monash?

The student would begin their project at IITB, undertaking important training in the main analytical methods and a literature search on the methodologies, environmental context and region.

Approximately 6 months into the programme, the student would transfer to Monash, where they would conduct the fieldwork with the supervision team, as well as perform luminescence dating and sedimentological characterization of aeolian sediment collected in the field. The stay at Monash would be about 6-12 months and would produce data for the first joint publication.

The student would then return to IITB and begin the analysis of volcanic materials collected in the field, which would require the remainder of the project time. At least two further publications would result from these activities.

A final meeting of IITB and Monash partners would take place in person in the field region, in order to communicate results to community stakeholders. This activity will enable plans for future collaborative research and funding applications.

Expected outcomes

The project would generate the following outcomes:

- *Joint publications: at least three joint publications would be led by the PhD student, so launching their research career; additional publications between the partners are highly likely*
- *Future collaboration and research connections between IITB and Monash: the results will facilitate future joint funding applications and research projects between the partners*
- *Benefits for society: the research project will generate data relevant for local communities through an updated assessment of volcanic risks in the region, a better understanding of the contribution of coastal and desert-derived wind-blown sediment to the soils in the region, and major scientific insights into the evolution of a dramatically changing landscape for Indigenous people*

How will the project address the Goals of the above Themes?

The project will address the Goal of a sustainable society in several ways:

- 1. A better understanding of volcanic activity in the western Victorian plains will enable us to more robustly assess the risk of volcanism to people living in the region;*
- 2. Quantification of the contribution (and timing) of aeolian sediments to the soils in this region will enable a better understanding of potential wind and dust hazards in an agricultural region susceptible to drought and thereby increasing vulnerability to dust storms;*
- 3. Our insights into the evolution of the volcanic landscape and its impacts on ancient Indigenous societies enriches our understanding of the long-term (Aboriginal) human history of the region, so contributing to meaningful exchange between conventional and Indigenous scientists.*

How well the IITB and the Monash supervisor(s) know each other

Prof Mathew and A/Prof Fitzsimmons have been in email contact for several months and recently discussed the potential project over zoom. We are connected through a mutual alumnus who is now based at IIT Gandhinagar.

Potential RPCs from IITB and Monash

Provide names of the potential research progress committee members (RPCs) and describe why they are most suited for the proposed project

IIT Bombay, India

*Prof. Hetu Sheth is an expert with several decades of experience in **Igneous Petrology and Volcanology**. Prof. Malay Mukul is an expert in the field of **Fold-Thrust Belt Structural Geology Neotectonics and Tectonic Geomorphology***

Additional colleague in India:

Prof. Ashok K. Singhvi, Honorary Scientist, Physical Research Laboratory, Ahmedabad is an expert in luminescence dating at both theoretical and application levels

Monash:

Prof Andy Tomkins has experience in igneous petrology, Australian field geology, and can assist with understanding the volcanic systems

E/Prof Ray Cas has expertise in volcanic systems and clastic sedimentology

Capabilities and Degrees Required

Required: Degree in Earth sciences, geology, or physical geography. At least some fieldwork and laboratory experience required.

Desired: Capabilities/experience in Quaternary science, geomorphology, geochronology (Ar-Ar, FT and luminescence dating)

Necessary Courses

- 1. Spectroscopic methods in Earth Sciences*
- 2. Isotope Geochemistry*
- 3. Igneous Petrology and Volcanology*

Potential Collaborators

Prof Ian McNiven – Monash University (archaeologist)

Gunditjmirring Traditional Owners Aboriginal Corporation

Eastern Maar Aboriginal Corporation

Prof. Hetu Sheth – IIT Bombay (Volcanology specialist)

Dr. Naveen Chauhan, Physical Research Laboratory Ahmedabad (Luminescence Dosimetry and

Luminescence Dating)

Keywords relating to this project to make it easier for the students to apply.

Volcanic activity, aeolian deposits, geomorphology, geochronology, Quaternary science