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Erionite in New Zealand Assessing and Managing Risk: What We Now Know

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NEW ZEALAND

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Outline

What is Erionite

Erionite, Zeolite, Toxicity

Where is Erionite Found

Occurrence, Host Rock, Locations

Detecting Erionite

Rock, Soil, Air

Understanding Risk

Conclusions

Erionite

- IARC Group 1 Carcinogen
- Naturally occurring fibrous mineral
- Zeolite
- Occurs in a variety of elongated shapes including fibrous
- Morphology of erionite is primary reason toxicity

Zeolite Fibres

- Hydrated Aluminosilicates
- Altered Volcanics
- Form in Alkali Conditions
- 3D Network with open cavities in the forms of channels and cages
- > 40 Naturally Occurring
- > 200 Synthetic
- Only Erionite is known to be carcinogenic

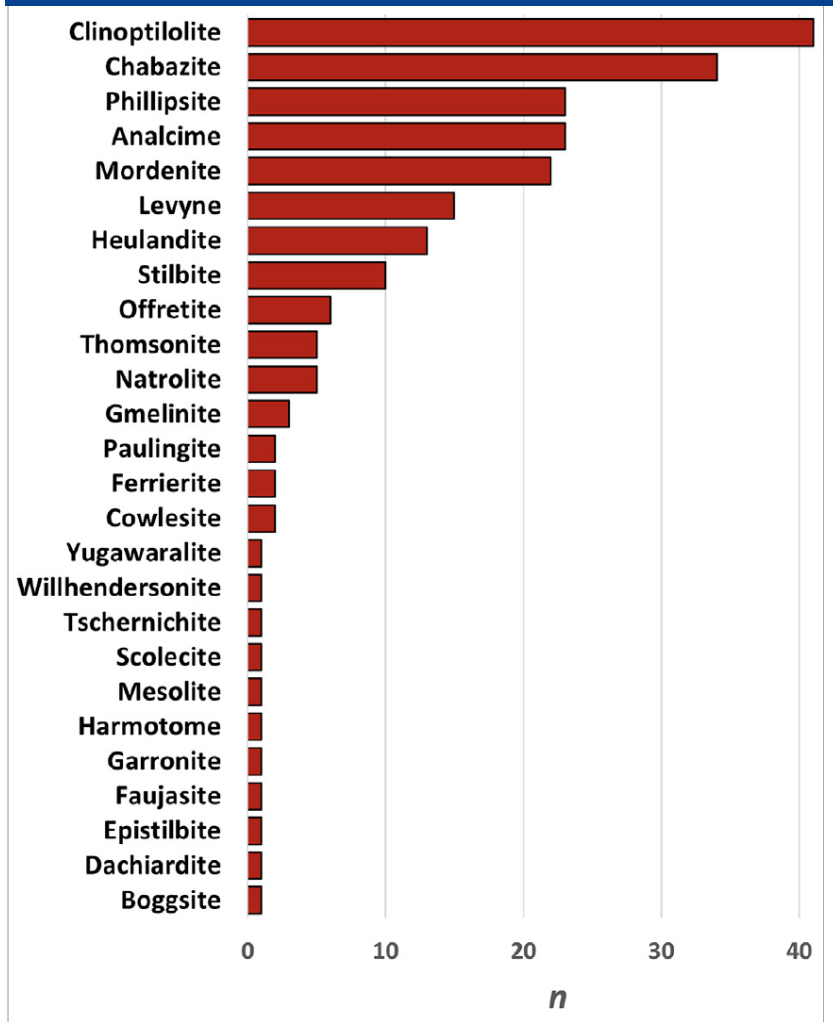
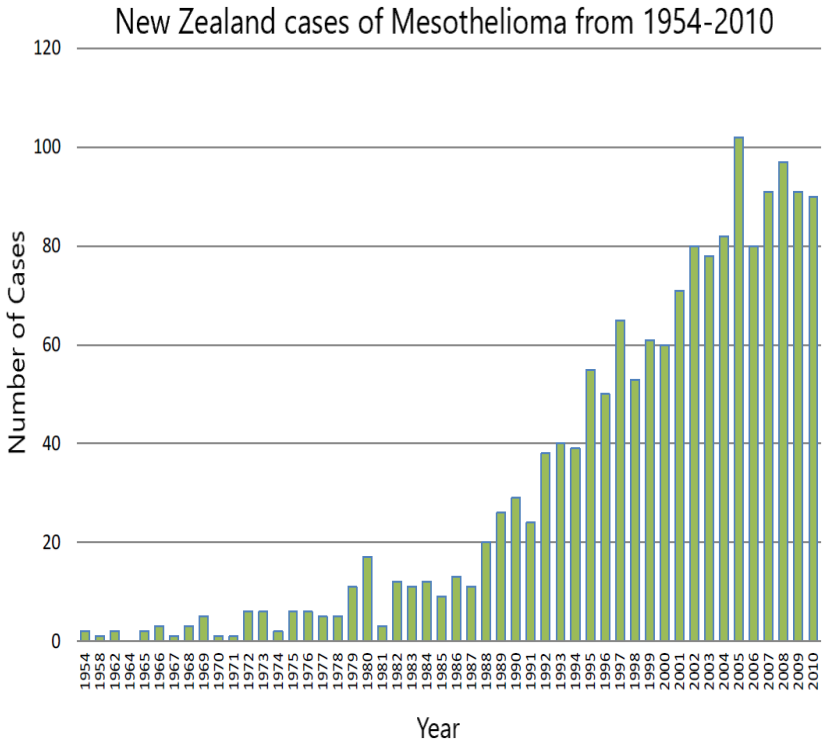


FIGURE 6
Frequency chart of other zeolites reported to occur alongside erionite, with clinoptilolite and chabazite being the most prevalent.

Toxicity

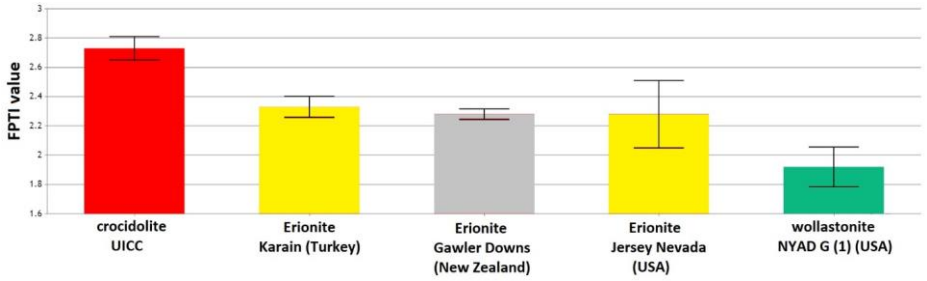
- Erionite is linked to malignant mesothelioma
- Epidemic in Turkey in late 1970s
- ~ 50% of deaths in Karain
- 800x more carcinogenic than asbestos
- NZ Cases of MM have been increasing since 1980s

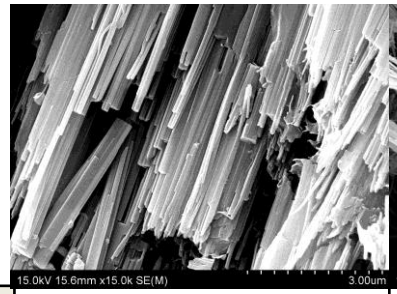


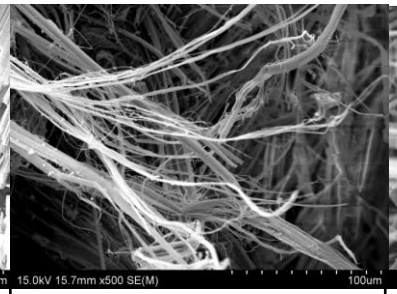
Gluckman (2015)

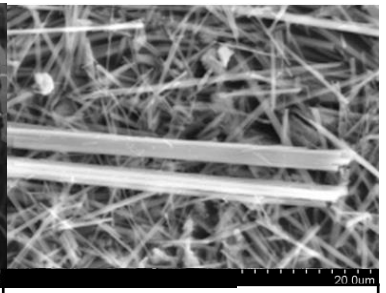
Toxicity

- Dependent on morphometric, chemical and biodurability parameters
- THP-1 M0 Macrophages resulted in 90% cell death and 80% cell death after 7 days
- Fiber Potential Toxicity Index









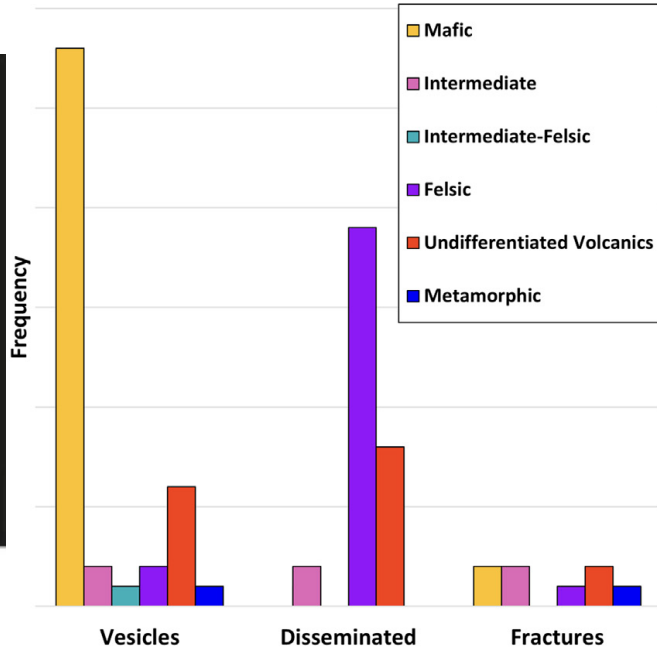
Location	Kaipara, New Zealand	Gawler Downs, New Zealand	South Africa
Mineral	Erionite	Erionite	Crocidolite
Biodurability	181 years	181 years	66 years
Respirable	Yes	Yes	Yes
Cell Viability	50 ug / ml	50 ug / ml	50 ug / ml
24 hours	29%	47%	23%
72 hours	39%	75%	41%
7 days	72%	89%	52%

Where is Erionite Found

- Altered volcanic rocks
- Ash beds, Basalts, Andesites

- Hydrothermal altered vs diagenesis
- Localised

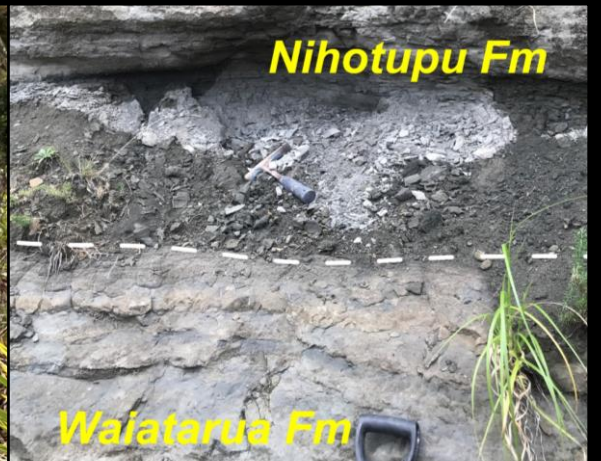
Disseminated Cavities Veins



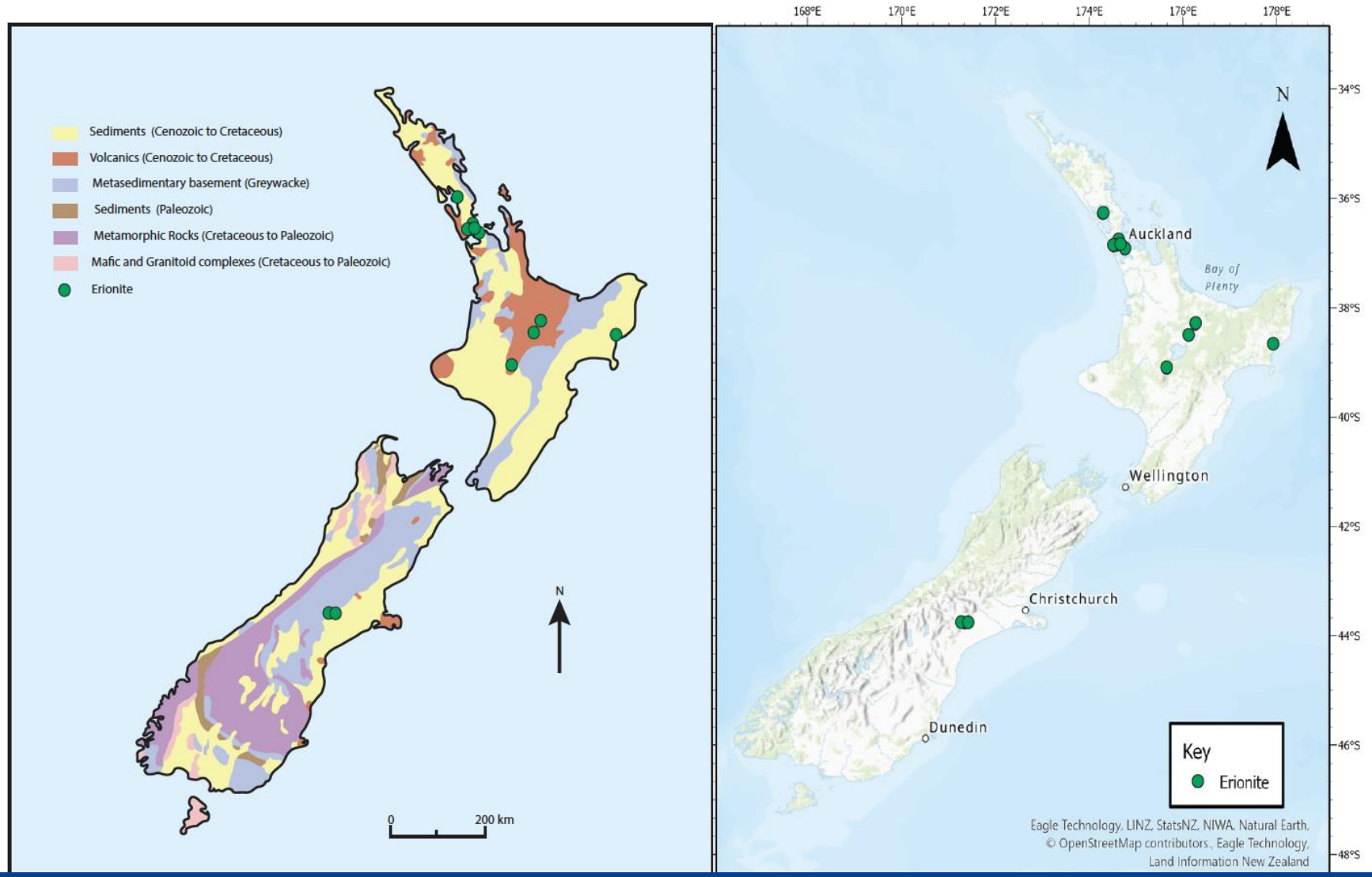
Rhyolitic Ash Layer

Andesitic Flows

Basaltic Volcanics



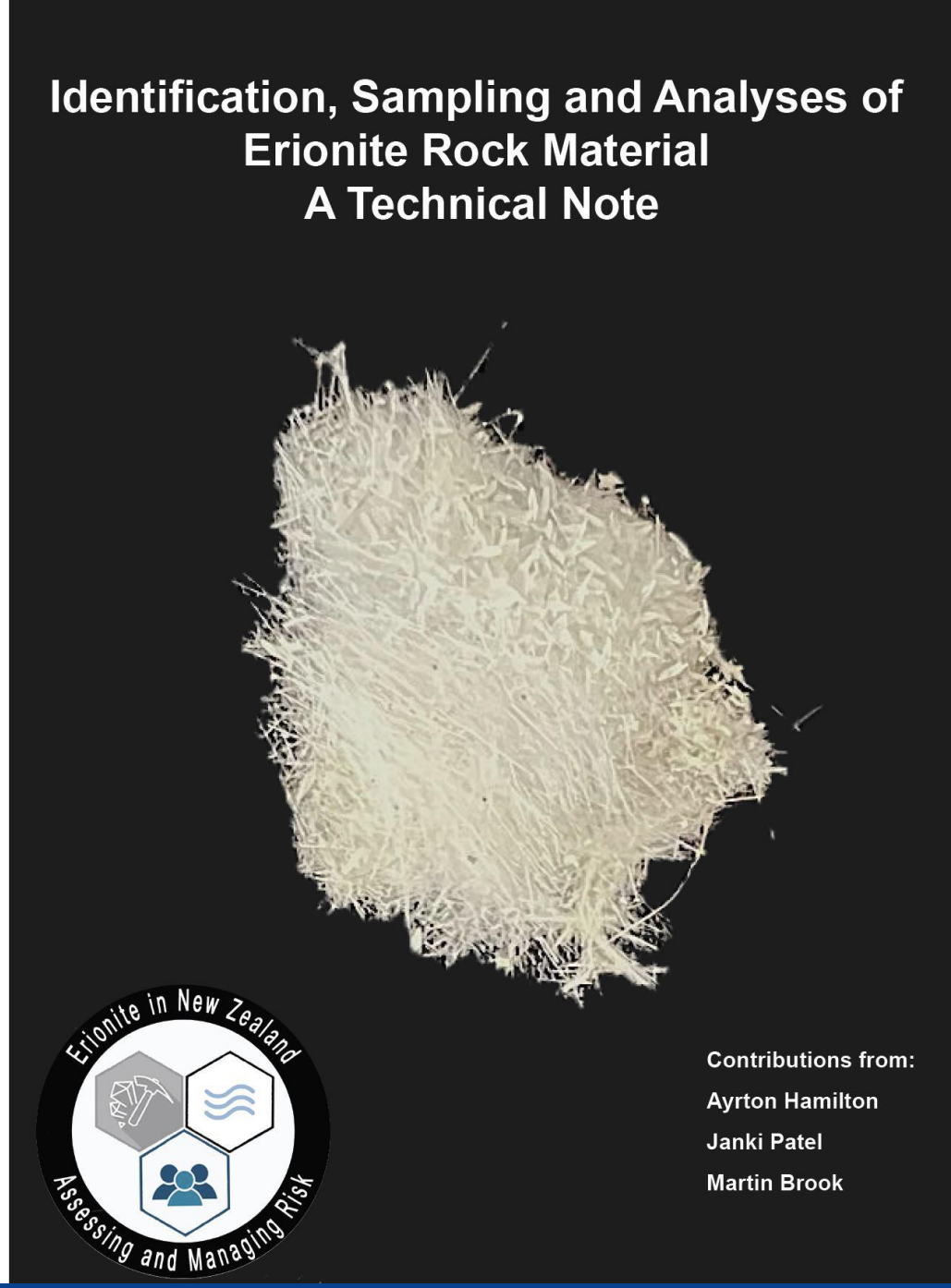
Where is Erionite Found



Detecting Erionite

- Notoriously difficult to identify and quantify

- Variety of methods use
  - X-Ray Powder Diffraction (XRD)
  - Scanning Electron Microscopy (SEM)
  - Transmission Electron Microscopy (TEM)
  - Energy Dispersive Spectroscopy (EDS)



Rock

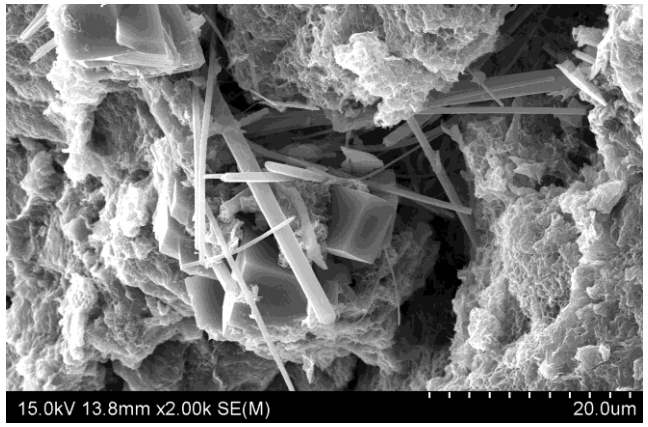
- Different Species

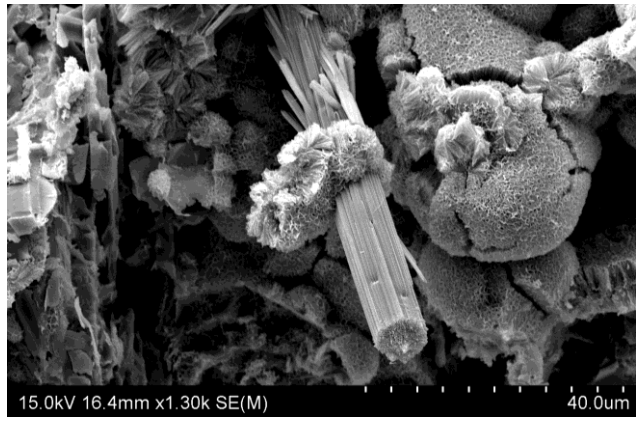
  K, Na and Ca

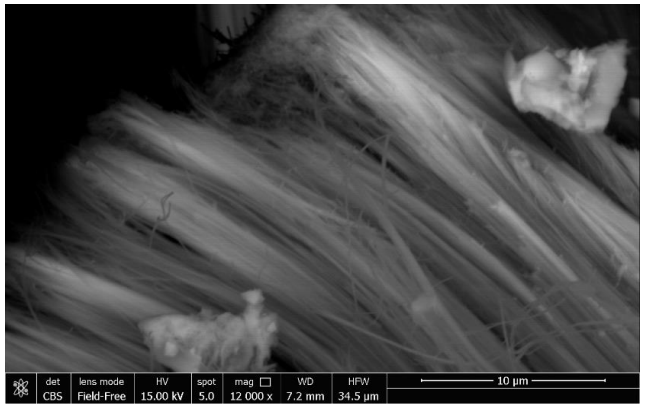
- Different Morphologies

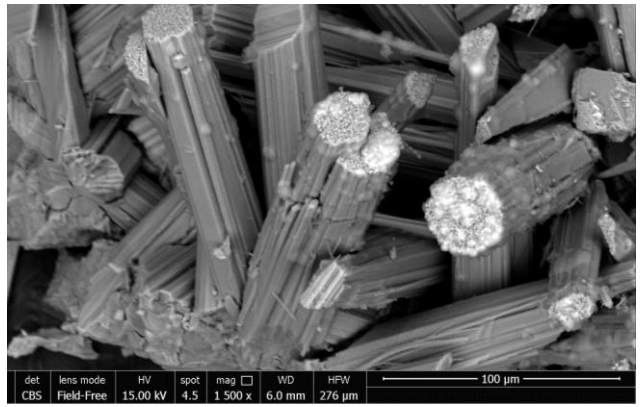
  Bundles, Clusters, Woolly Mass

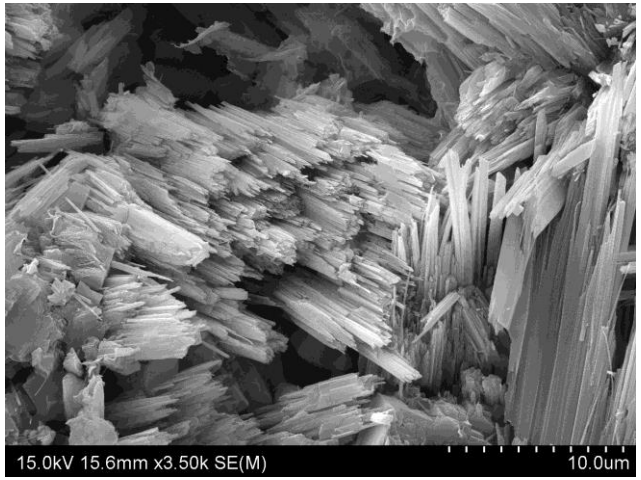
- Different Concentrations

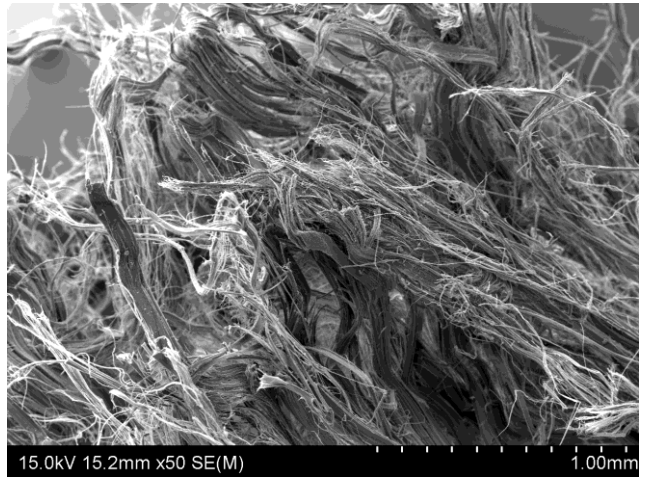






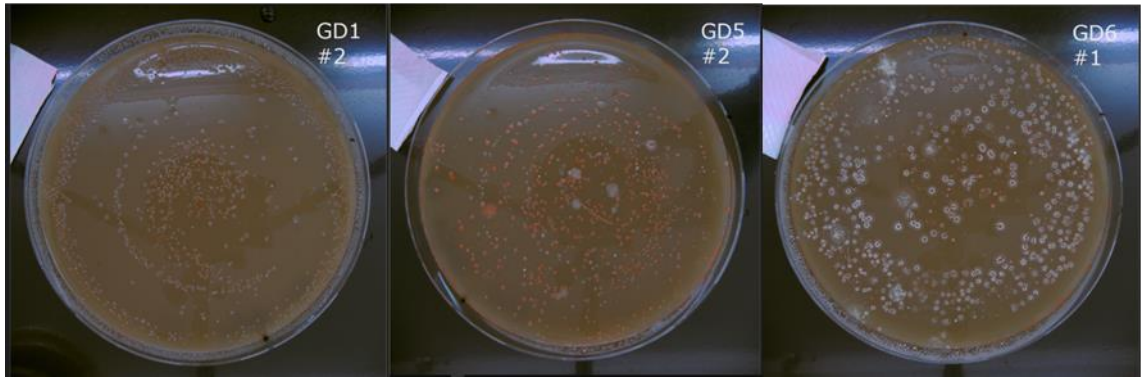


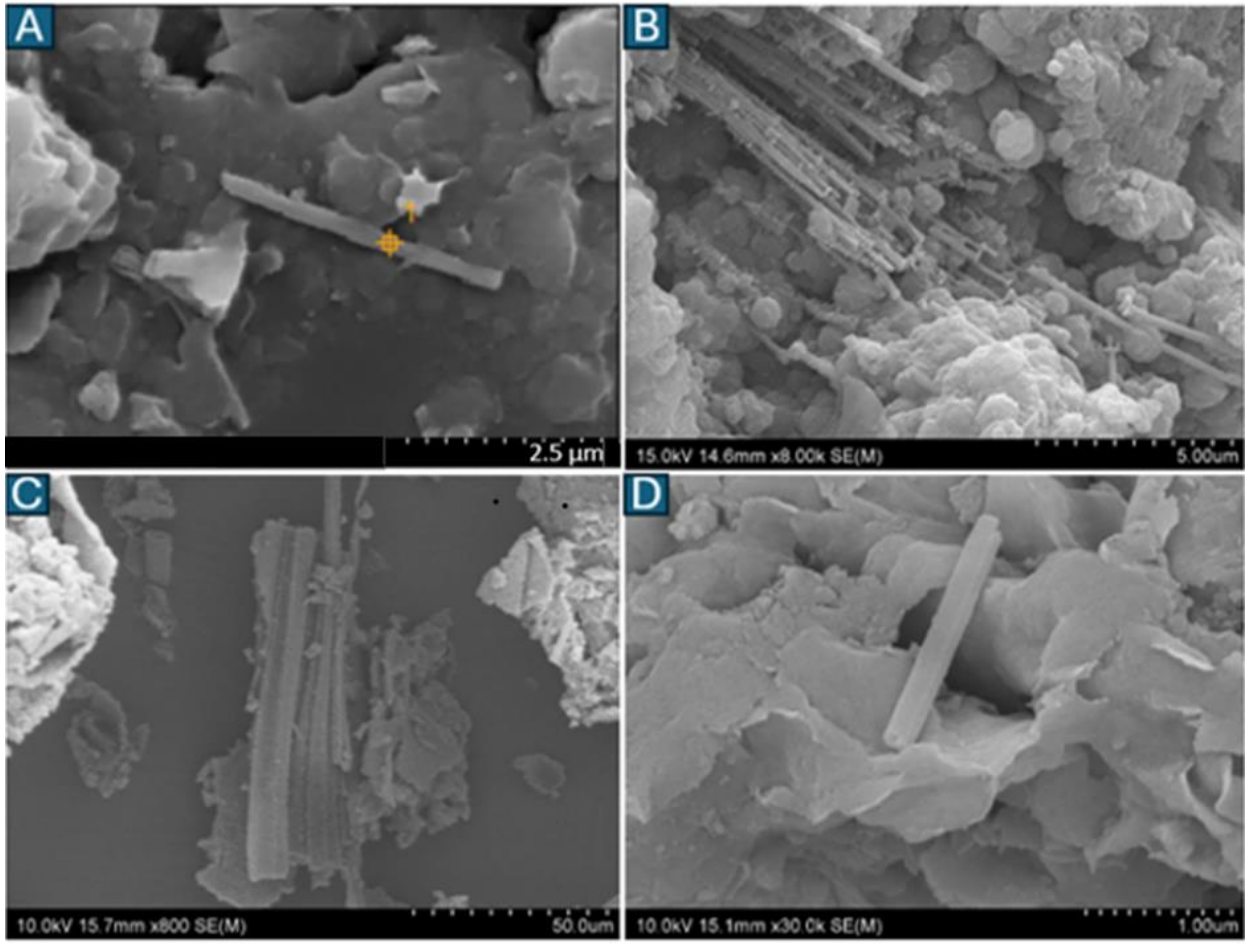




Soil

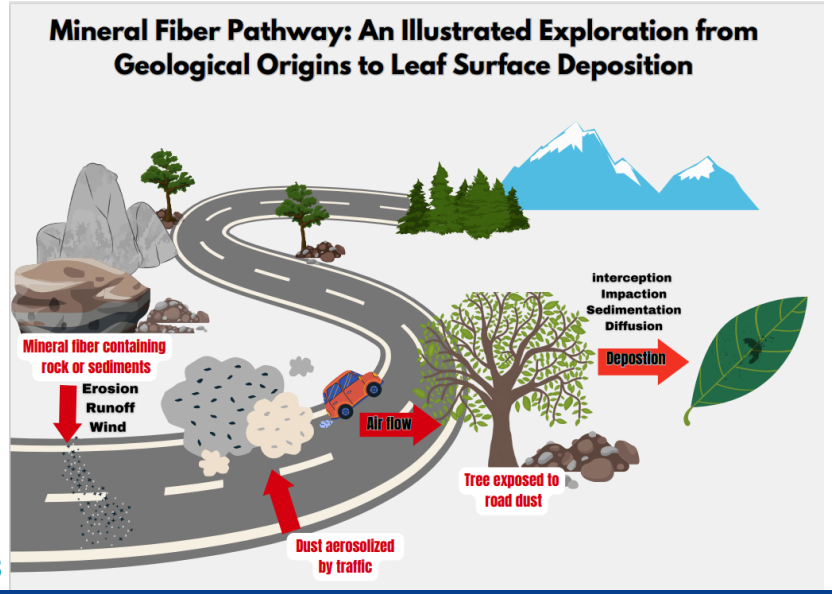
- Found near outcrops
- Biological influence
- Chemical

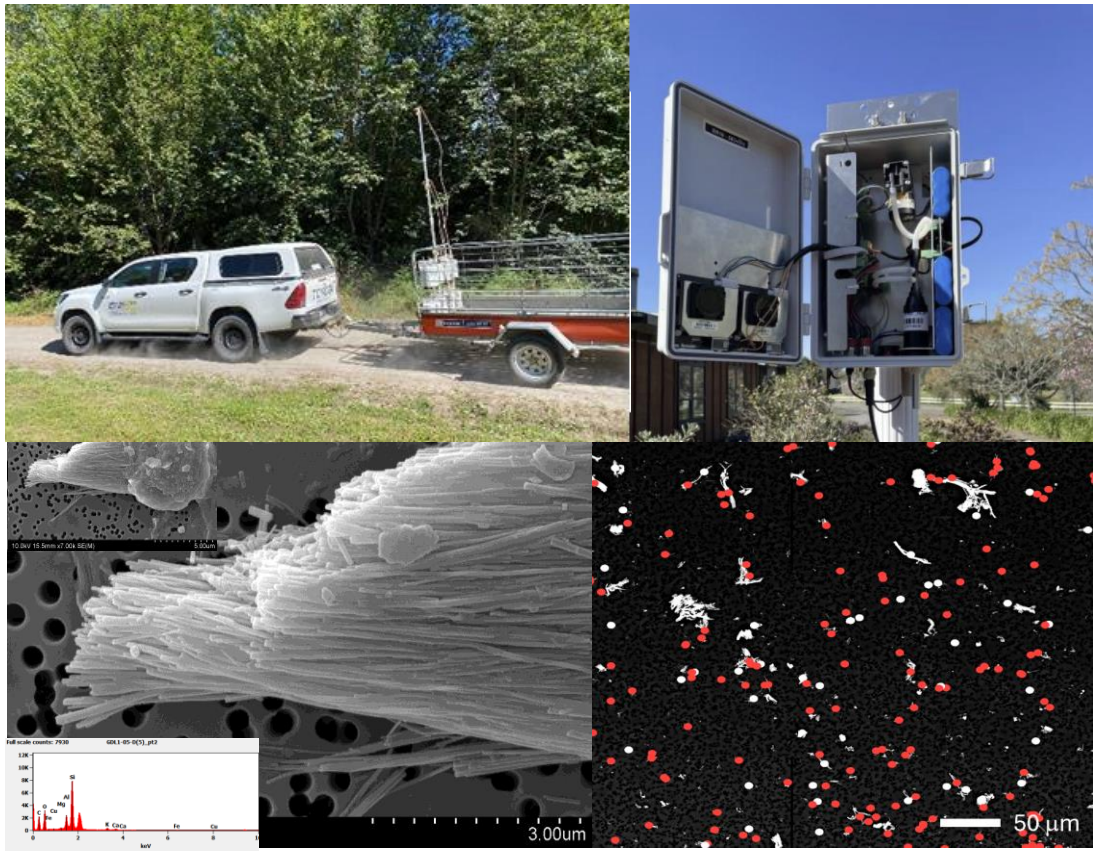




Air

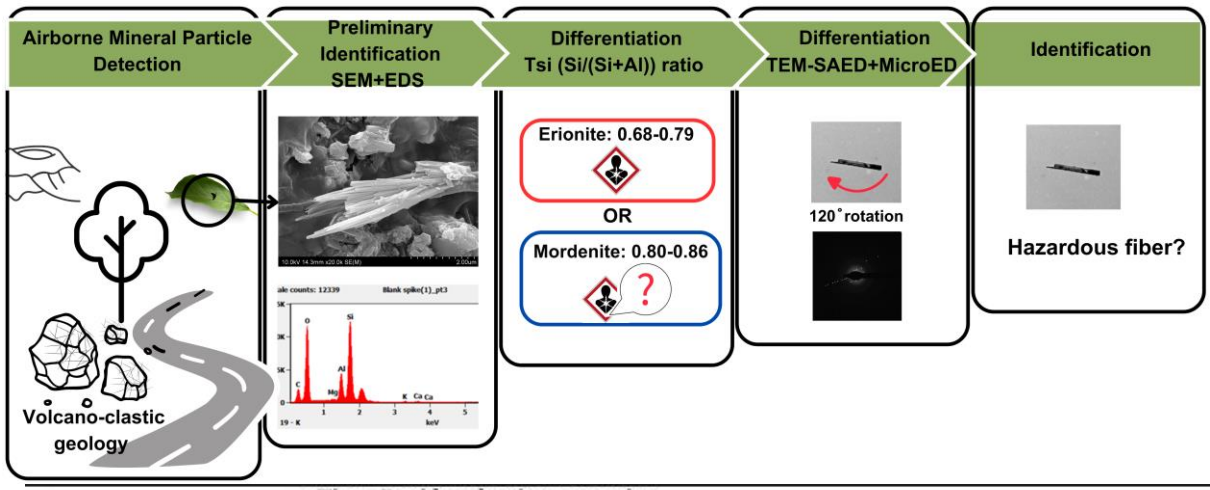
- Fixed monitors
- Occupational
- Resuspended road dust
- Leaves
- Erionite detected small and elongated

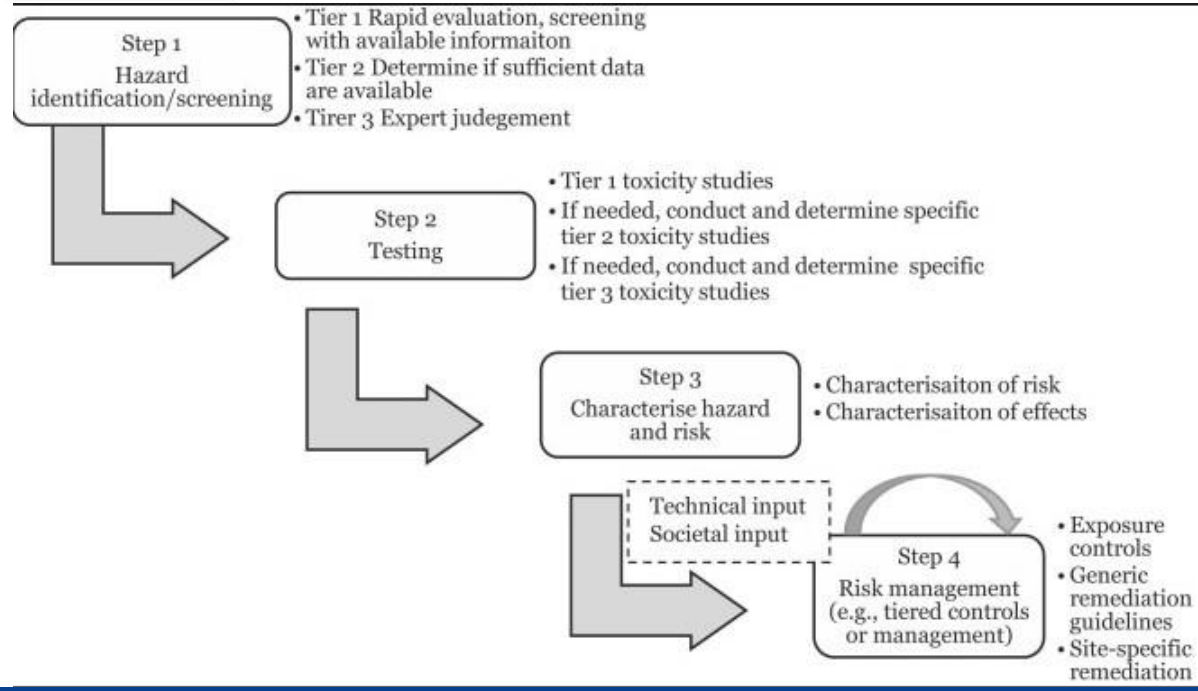




Risk

- Known toxic substance
- Occurs naturally in a variety of geological environments
- Often highly localised
- Detected in rock, soils and air
- Only hazardous when disturbed





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More information can be found at

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- Thank you
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