

# Effects of African Dust on Coral Reefs

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# Outline

- We know that the deterioration of coral reefs began in the 1970s and has been accelerating ever since.
- Scientists point to the movement of African dust into the Caribbean as a contributor to the continued decline in health of coral reefs.
- Chemicals found in African dust have been shown to lead to several coral and human diseases.
- The irony of course is that humans are partly to blame for the increased toxicity of African dust.
- However, scientists are working on solutions to combat the negative effects of the dust and to restore health to the reefs.

# What has changed?

- Each year, Hundreds of millions of tons of dust are carried across the Atlantic ocean from the Sahara and Sahel regions in Africa. Only in the past 40 years has the transfer of dust from Africa to the Caribbean become a serious issue.
- Increased quantity and changed composition of dust.
- New toxins have emerged
  - Carcinogens
  - Neurotoxins
  - Endocrine disruptors
  - Immune system suppressors
  - Iron oxides



# What has led to the changes?

Increased quantity of dust

- Global climate change
- Regional meteorology
  - Desert wind patterns
- Human activity
  - Desertification
  - Changing land-use patterns

# What about the other changes?

## Change in make-up of particles

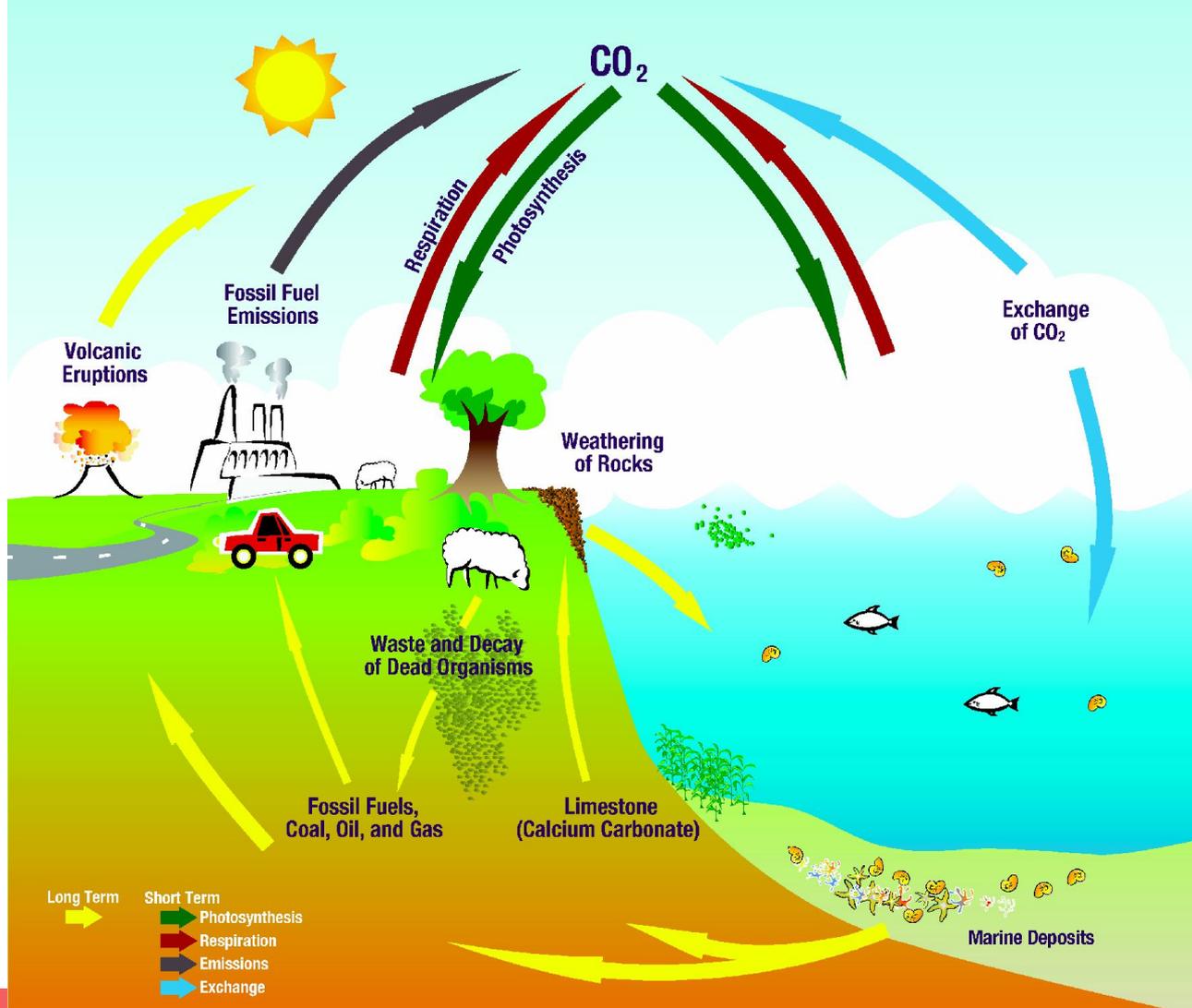
- Biomass combustion
- Burning fossil fuels & garbage
- Plastics in source region
- Use of pesticides at source region (they are used to protect from malaria and locusts in Africa)
  - Andrew Negri of the Australian Institute says pesticides reduce coral larvae's ability to settle on the ocean floor.

# Impact on the Virgin Islands

- Samples collected during dust periods from the Virgin Islands contain 2-8 times as many culturable microorganisms as did air samples collected during non-dust conditions.
- Fungus linked to sea-fan disease was found in the Virgin Islands during dust conditions and in soil from the Sahel region of Africa.
- Virginia Garrison of the USGS:
  - "I can watch a dust air mass [via] satellite coming out of Africa, across the Caribbean, and suddenly it peters out...Then it goes over the North Atlantic to Europe, picks up a pollution cloud, and then goes back to Africa. So where did this stuff come from?"
- Although we know that Africa contributes a huge amount of dust to the Caribbean, no one region is to blame.
  - "We're all responsible," she said. "We all have to watch what we're putting into the air."

# Other Impacts

- Creates an imbalance in the carbon cycle by carrying iron which is critical for algae growth, which out-competes coral for sunlight leading to increased coral death.
- Heavy metals such as arsenic, lead, and mercury have been found in the dust and soil. All of these can have harmful effects on human health.
- Gene Shinn of the USGS reports that asthma rates in the Caribbean are among the highest in the world.
  - "The incidence of asthma on Barbados and nearby Trinidad has increased 17-fold since 1973, and that was the first year that graphs showed a big spike in the dust record there."
- Asthma rates in Tampa Bay, Florida, have also been linked to African Dust
  - "About half the particles breathed in South Florida during summer months or  
The asthma epidemic in areas that are relatively free of industry correlates with  
flux of African dust."



**SCIENCE**

# Red dust plaguing coral reefs

Researchers at the U.S. Geological Survey are studying the possibility that iron-rich red dust traveling from Africa across the Atlantic may be harming coral reefs in South Florida and the Caribbean.

**Kicking up dust**

Each year, an estimated 100 million tons of iron-rich red dust is kicked up by wind-blown soil in the Sahel region of Africa. The dust is carried by wind-blown soil from the Sahel region of Africa across the Atlantic Ocean to the Caribbean and South Florida.



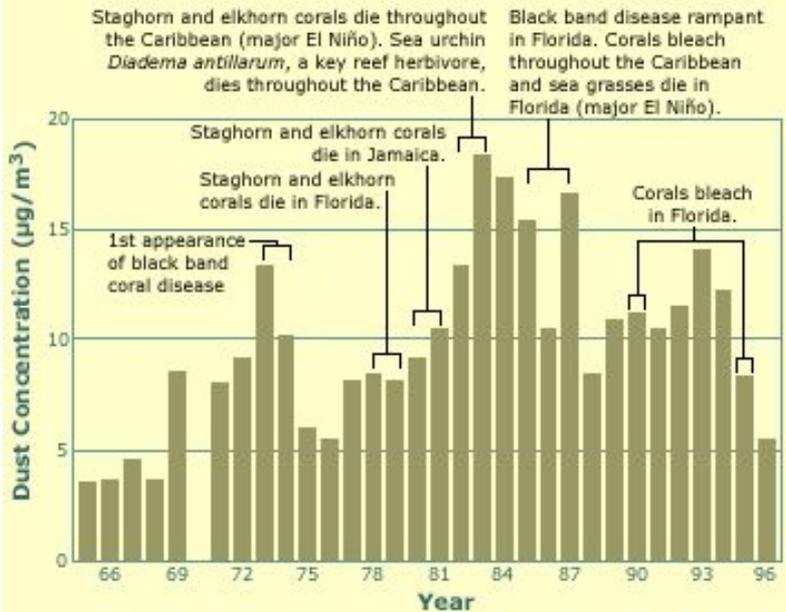
**A coral dilemma**

Since the 1970s, coral reefs throughout the Caribbean and South Florida have been suffering from a decline in health. The decline is caused by a combination of factors, including overfishing, pollution, and climate change. The decline is also caused by the arrival of red dust from Africa.



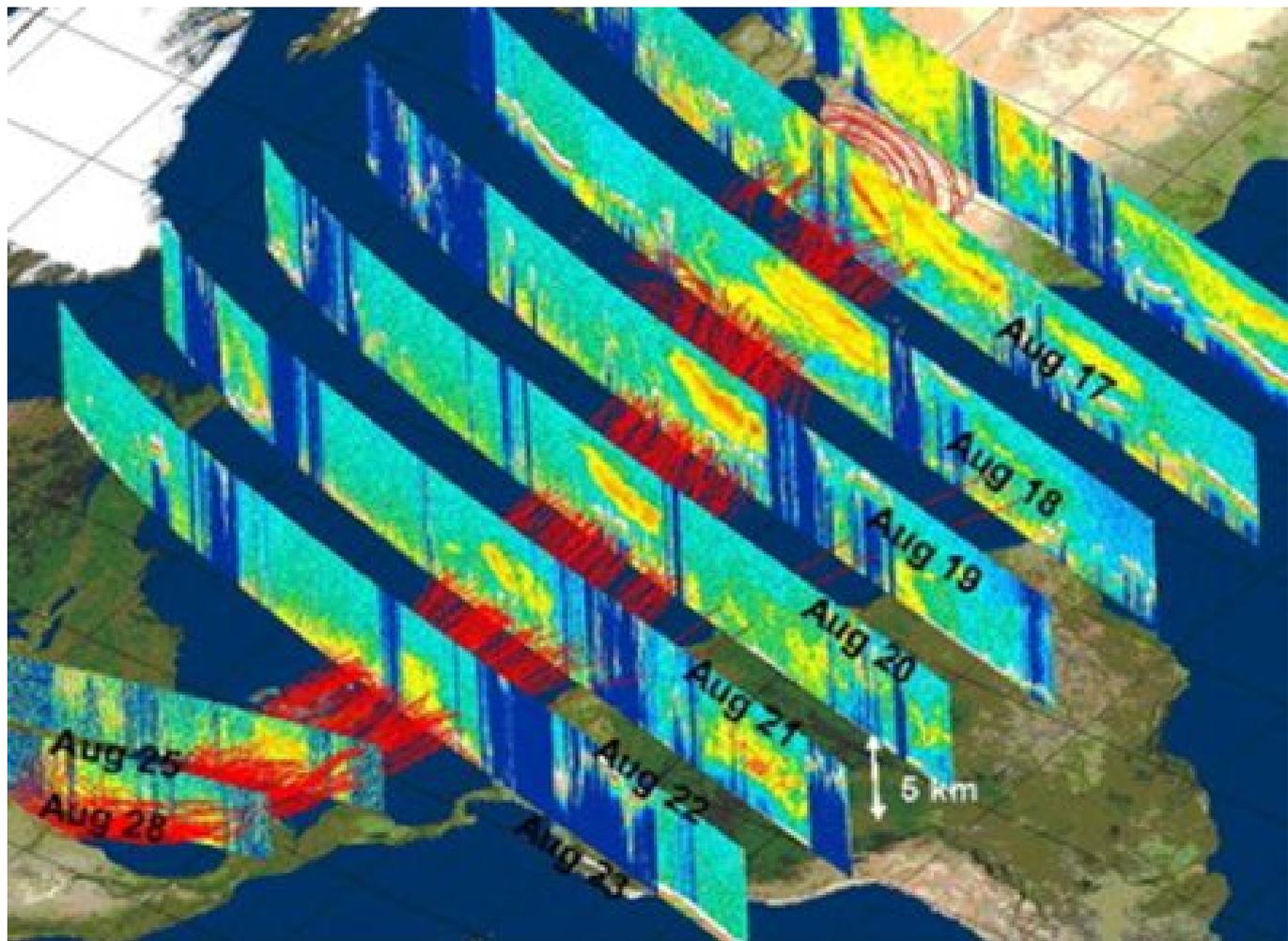
**Other diseases**

Staghorn and elkhorn corals die throughout the Caribbean (major El Niño). Sea urchin *Diadema antillarum*, a key reef herbivore, dies throughout the Caribbean.



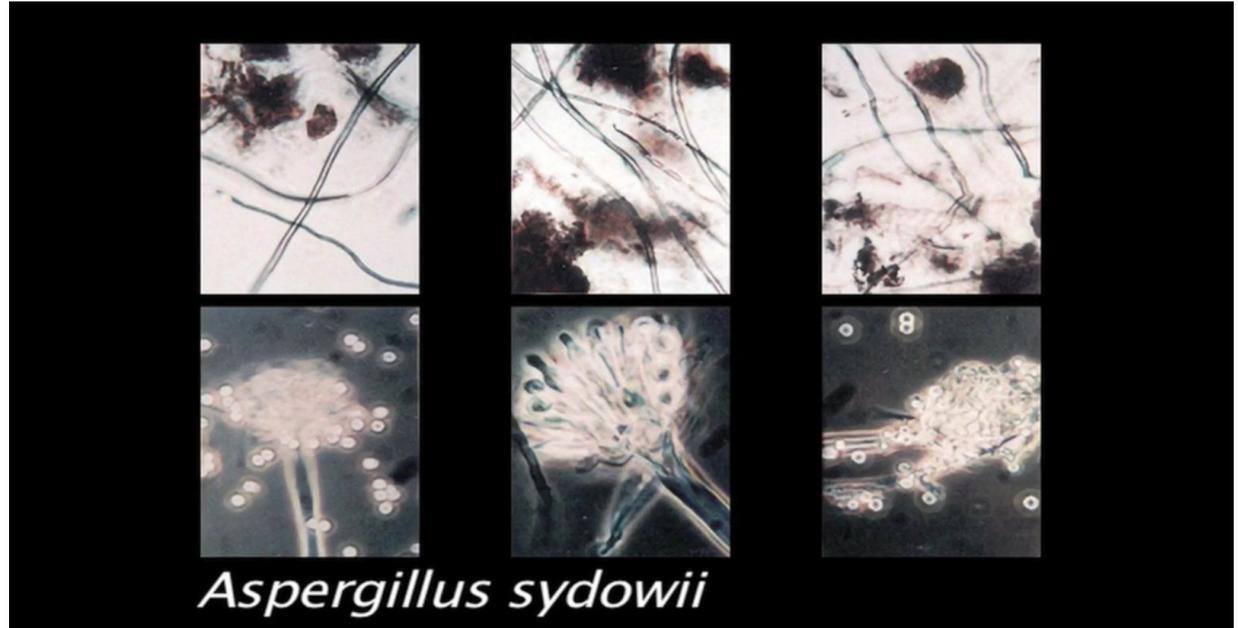
# Current Research



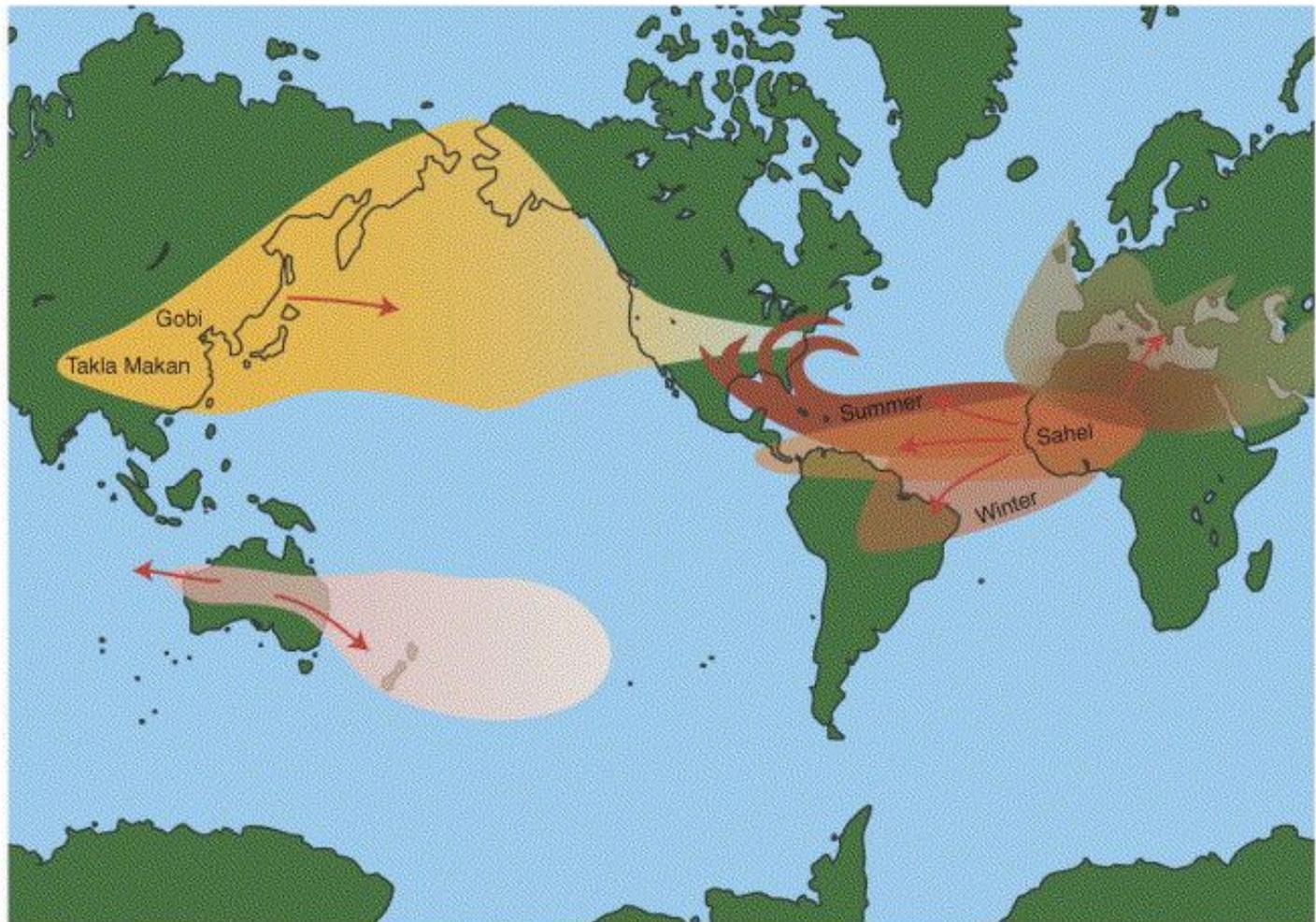


# Coral Diseases Linked to African Dust

- Sea-fan disease
- black band disease
- white plague
- white pox
- bacterial induced bleaching
- pink-spot disease

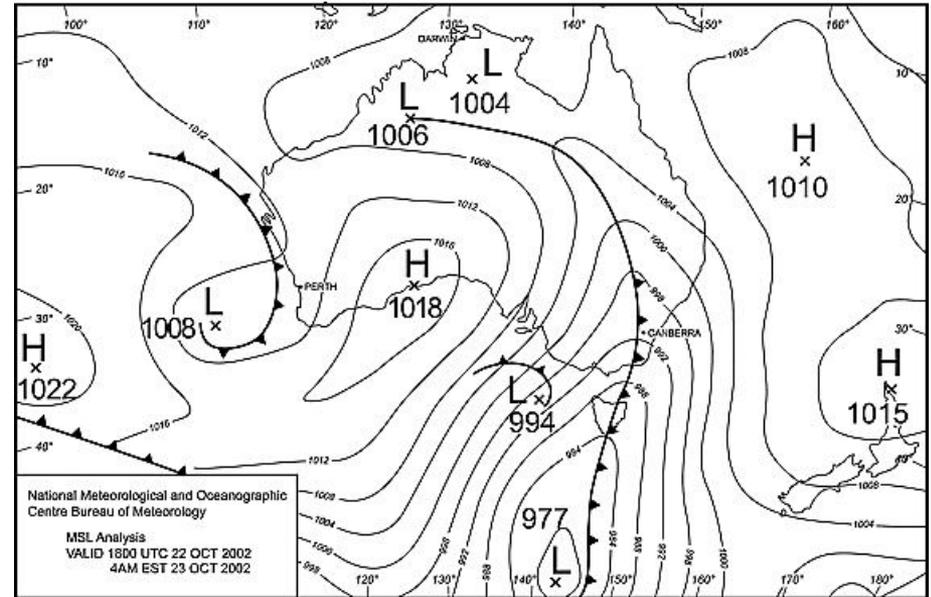


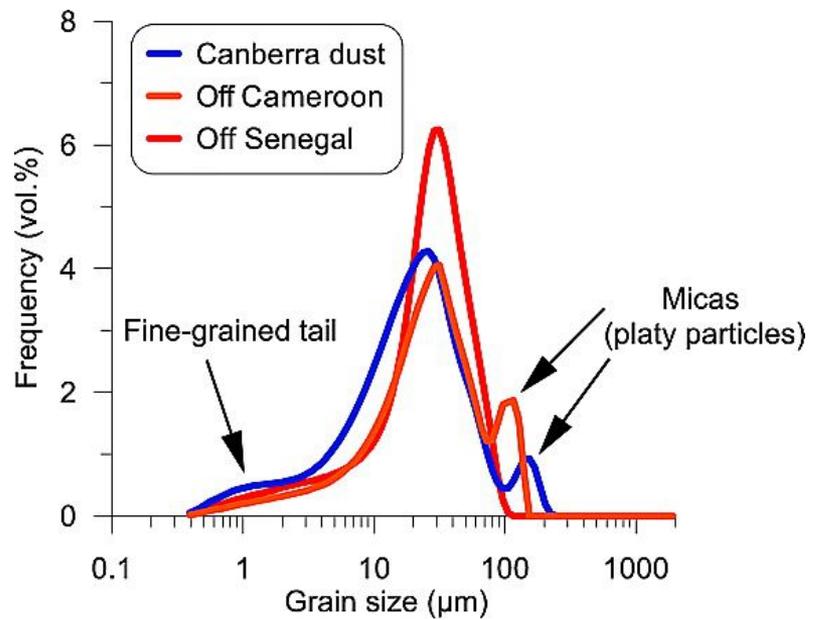
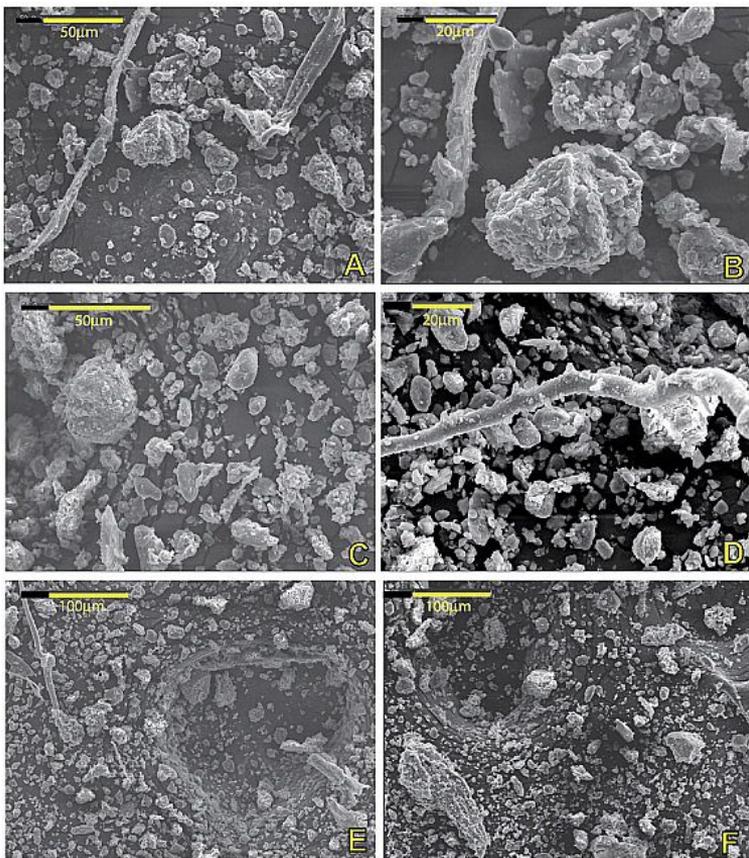


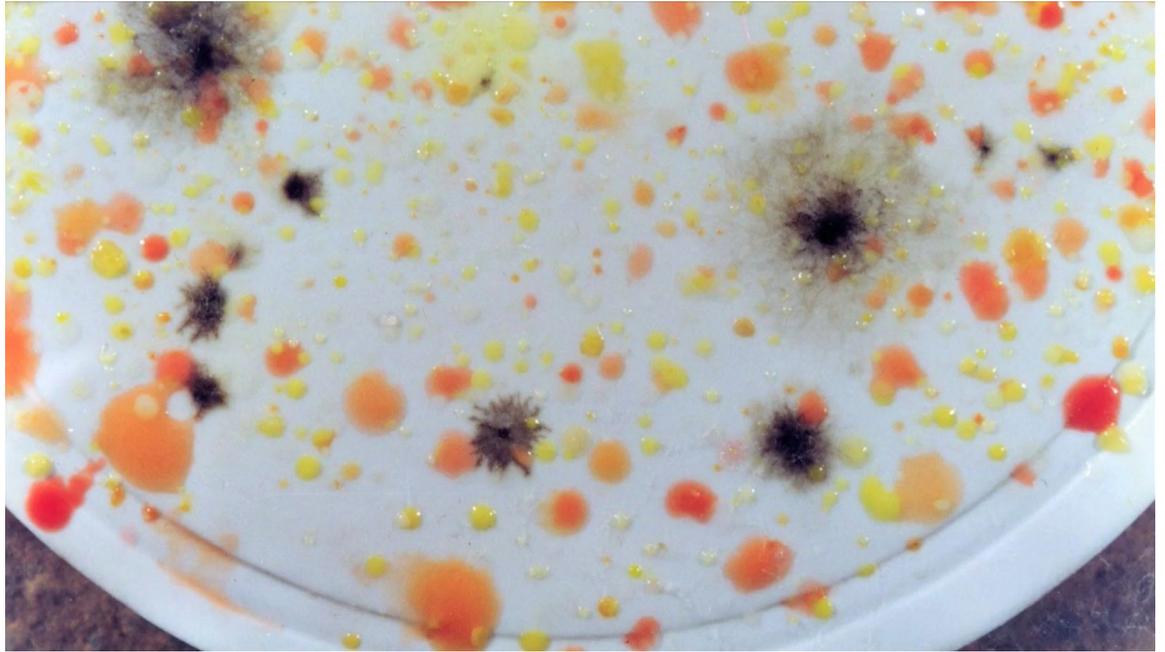
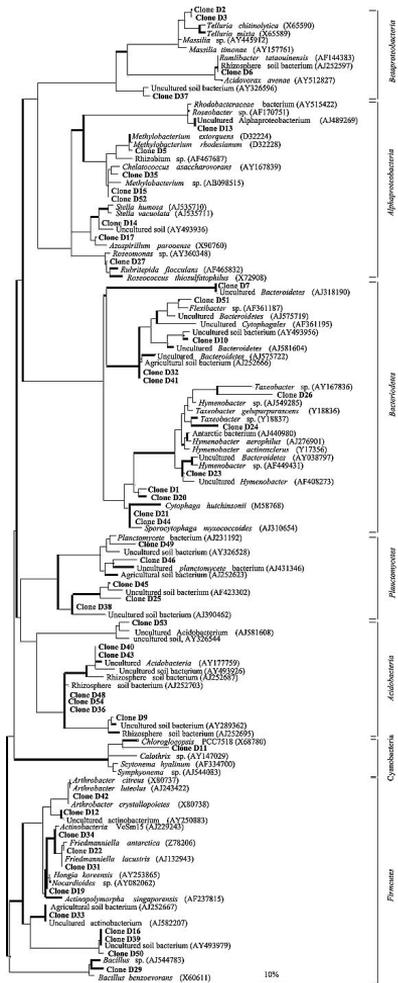


# Methods of Analysis

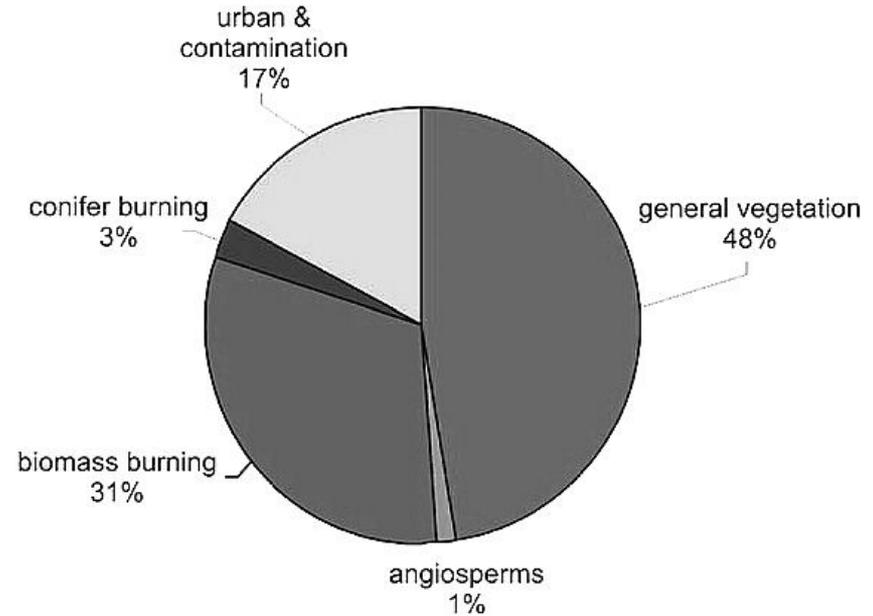
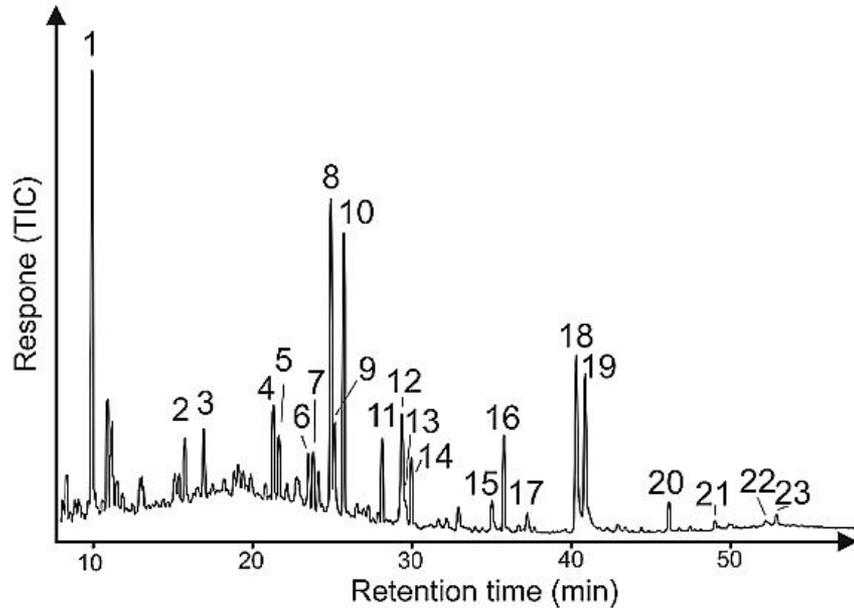
Australian Dust Event 2002

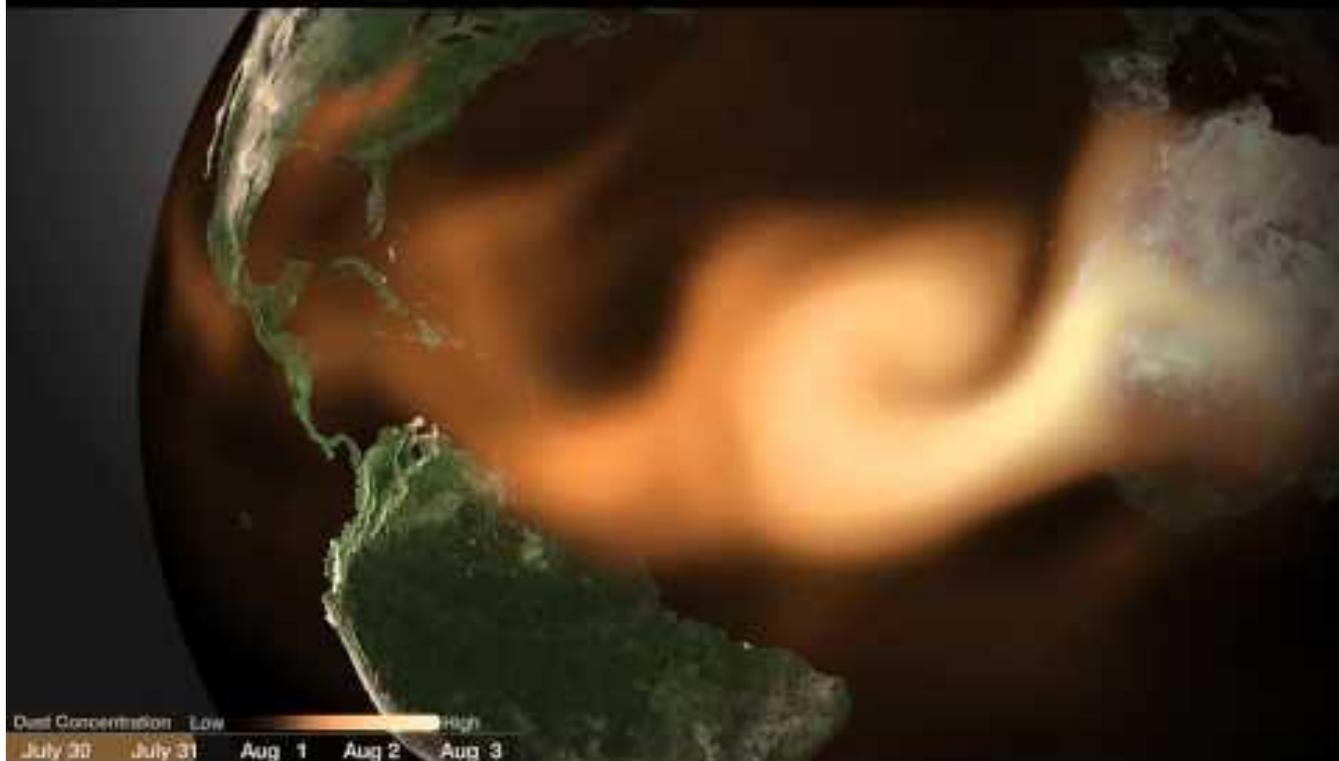






# Lipid Analysis





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