

Investigating the sciences used by First Nations people in the production of pigments and dyes

Warning – Aboriginal and Torres Strait Islander teachers and students are advised that this curriculum resource may contain images, voices or names of deceased people.

GLOSSARY

Terms that may need to be introduced to students prior to teaching the resource:

biodiversity: the variety of species of plants, animals and microorganisms, their genes and the ecosystems they comprise.

Buthalak: the Yolngu name for both light and dark yellow pigment found in rocky areas near the coast of Arnhem Land.

ceremony: a gathering of First Nations people to practise stories, songs, dances and customs used for significant celebrations, such as initiations and marriages.

chemistry: a branch of science concerned with the substances of which matter is composed, the investigation of their properties and reactions, and the use of such reactions to form new substances.

commodity: a raw material or agricultural product that can be bought and sold.

Country: the lands that Aboriginal and Torres Strait Islander Peoples belong to, as well as a belief system. It's a relationship with all living things that are part of a landscape and includes everything within that landscape; rocks, trees, creeks, animals, plants, medicines, sacred sites, songs, stories, dance and art, as well as all people, ancestral spirits and community connections: past, present and future. Country sustains First Nations Peoples and must be cared for and respected by and for every generation that is and will be.

exploited: made use of and benefitted from.

extraction: the action of removing something.

Gamanungku: Yolngu name of a bright white pigment that's found along the coast of Arnhem Land, in rocky places or washed up in the sand.

greenhouse emissions: any gases released into the earth's atmosphere that trap heat.

intertwined: to be connected so as to be difficult to separate.

iron oxides: chemical compounds composed of iron and oxygen.

lore: the learning and transmission of customs, traditions, kinship and heritage. Lore is the knowledge of First Nations Peoples and is transmitted by oral tradition from generation to generation. Much lore is told through Dreaming stories.

minerals: usually solid, inorganic chemical compounds, that have a crystal structure and form naturally by geological processes.

ochres: iron oxides used for paint; one of the most treasured materials of First Nations people.

oral traditions: a way of recording information across time without the use of writing; for example, verbally (stories and songs) or physically (dance and art).

paradigm: a typical example or pattern of something.

physics: a branch of science concerned with the nature and properties of matter and energy.

pigment: the natural colouring matter of animal or plant tissue.

quarry: a place, typically a large, deep pit, from which stone or other materials are or have been extracted.

segregated: separated or divided.

sustainability: using resources in a way that allows for them to replenish; to continue use into the future.

Wajarri People: First Nations people from the mid-west region of Western Australia.

weathering: the process of wearing away or being worn away by long exposure to water, gases and organisms.

Yirritja People: First Nations people from north-eastern Arnhem Land.

Our History

Earliest scientists and inventors

First Nations people are some of the world's earliest scientists and inventors, and for thousands of years have been developing highly sophisticated sciences (Briscoe 2016). First Nations people have been sharing knowledge within communities for generations. This includes the sharing of natural resource management and the **physics** and **chemistry** behind mining **minerals** to produce **ochres** and other substances (Nurragunnawali n.d.).

There's a strong and deep connection between First Nations people and **Country**. Within this exists a complex interconnection between the physical, chemical and biological sciences, and the social sciences more widely, because of the deep and timeless relationship between Country and First Nations people (Nurragunnawali n.d.).

"The land and the people are one, 'cause the land is also related," explains Dhanggal Gurruwiwi, a Galpu Elder from Nhulunbuy in the Northern Territory. "In our kinship system, as a custodian I'm the child of that land," she says (Australians Together 2019).

As stated by Angie Abdilla (Palawa woman and Indigenous science educator), "within an Indigenous **paradigm**, Indigenous sciences are not **segregated** but part of all aspects of our culture and **lore**" (Briscoe 2016). Science is embedded in every part of living and not removed as a separate entity to explain certain phenomena, but rather a way of life.

Trading routes across the continent

First Nations Peoples developed trading routes across the continent, dispersing goods, information, technologies and cultures thousands of kilometres away from their origins. These trades weren't, and aren't, just about physical objects, but include songs, dances, stories, rituals and ceremonies, which connect the people to Country. A strong economy existed where people traded their commodities for items they didn't have. For thousands of years, in many regions throughout Australia, red ochre has been, and remains, an important **commodity** and the most highly prized and important **pigment** for use in **ceremony**, cosmetics, body and artefact decoration, and rock painting (Kerwin 2010).

Mineral use and ochres

Different minerals produce different coloured ochres, depending on the composition and geological conditions. The distribution and location of valuable rock deposits is well known to many First Nations people, and the ochre deposits **exploited**, were of high quality. The most valuable ochre having properties such as reflectiveness, which create the shimmering effect under fire light, and its low acidity that does not irritate the skin. These properties of ochre are highly sought after, for their exact same use, by industries such as the cosmetic industry (ACARA 2019).

Indigenous mining

After identifying the locations of these valuable rock sources, First Nations people developed sophisticated **extraction** techniques to **quarry** and mine the ochre. There are several hundred recorded Indigenous mineral and rock extraction sites across Australia, such as Wilgie Mia in Western Australia. Wilgie Mia is well known for its rich deposits of red, yellow and green ochre. In the Creation story of the **Wajarri People**, Wilgie Mia was created when Marlu, a red kangaroo, was speared. Marlu's blood made the red ochre, his liver the yellow ochre and his gall the green ochre. In 2011, Wilgie Mia was included on the National Heritage List.

The Wound

The impact of colonisation on the sharing of Indigenous sciences

As ochre was traded across the continent, so were Indigenous science knowledges between communities. But, under oppressive colonial government policies, Indigenous science traditions have suffered significantly since. These policies separated First Nations Peoples from their cultures and communities, which impacted the **oral traditions** of First Nations Peoples and the preservation of knowledges (Nurragunnawali n.d.).

The colonists actively discouraged First Nations People from engaging in cultural practices, such as ceremonial gatherings, in which the use of ochre as body paint held great cultural significance. Different coloured ochres are worn for meaningful purposes. For example, in some cultures, like that of the **Yirritja People**, white pigment, called **Gamanungku**, is used for funerals and men's initiation. When a Yirritja person's Wawa (brother) or Yupa (sister) passes away, a stripe of **Buthalak** (a yellow pigment) is painted around their lower leg during the funeral ceremony (Milminy djarrk 2018).

Exploitation of minerals for commercial use

The minerals used to make ochres, such as **iron oxides**, are widely sought after and commercially mined throughout Australia and exported overseas. Many of the sites where these minerals are found, hold spiritual and cultural significance to First Nations people. Mining has caused the destruction of spiritual sites of First Nations people, such as the 46 000-year-old rock shelters at Western Australia's Juukan Gorge, by mining company, Rio Tinto (Toscano 2020).

Why me?

Mining in Australia

Mining was the largest contributor to the Australian economy in 2019–20 (Constable 2020). The exploitation of Australian minerals to sell overseas has been detrimental to the environment and Country of First Nations Peoples. Mining poses environmental risks on ground and surface water quantity and quality, air quality, **biodiversity**, landscape stability and climate change.

Environmental impacts of mining

Australia has signed the Paris Agreement to reduce **greenhouse emissions** by 26 to 28 per cent below 2005 levels by 2030 (Hanna 2015). As global citizens, it's important to have a say and contribute to holding the government accountable for these promises about the future of the environment. Utilising sustainable practices in industry and at home is vital to reaching these goals to reduce greenhouse emissions. A good place to start is by consulting with First Nations people, who are widely recognised for effective **sustainability** practices and care of the environment.

Our Cultures

Art across the cultures

In almost all human societies, art has been practised for thousands of years. Professor of developmental anatomy at Oxford University, Gillian Morriss-Kay (2010) explains that "the visual arts are intimately **intertwined** with music, dance, ritual (marking life landmarks, death, religion and politics) and language (poetry, song and story-telling)" (p. 158). Ochre has been used, and still is today, in many cultures around the world, from South Africa, to Peru, from Germany to Australia. It's used to paint cave walls, bodies, bark, seashells and burial sites (Tarlach 2018).

Uses of ochre

New studies have found people not only used ochre to express themselves artistically, but also for a range of other uses. In Ethiopia, it's been used to clean hair; and in South Africa as sunscreen, an adhesive and an insect repellent. There's even evidence to suggest red ochre was ingested for medicinal purposes to increase iron levels (Tarlach 2018).

Across many different cultures, colours are used to communicate similar meanings to one another. As red ochre is commonly found and withstands most **weathering** conditions, it's believed to have been used to warn others of nearby dangers (Tarlach 2018).

Current Indigenous art

There are many different styles of Indigenous art, which vary across the continent and in the media that are used, not just ochre. First Nations artists are using a range of different mediums to express and share their stories, while incorporating a range of painting styles and techniques.

My Response

Where to from here?

In response to this learning, our class could:

- research and design a dye garden, where we grow plants and flowers that can be used to make dyes (ensure they are not toxic)
- design and paint a mural for the school, using the same colours of the ochre found in Australia
- create a conservation group that looks at sustainability within the local area.

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