

CoRE LEARNING FOUNDATION GAMIFYING EARTH SCIENCE

Old as Dirt -
'Outback Trail'

CREATED BY
CoRE Learning Foundation



Outback Trail - Overview

CoRE's Old as Dirt is a compilation of games, which are aligned to the Year 8 ACARA Curriculum. Outback Trail is Game 3 of the compilation, but is not restricted to this year level.

Outback, can be utilised as a digital textbook. The game is based in the beautiful Australian Pilbara Outback and addresses:

- The rock cycle, in particular Banded Iron Formations (BIFs), which diagnostically are the foundation to the Pilbara landscape around Tom Price and Newman.
- BIFs relevance to mining and industry use.
- Comparisons with igneous and metamorphic rocks.
- First Nations use of rocks, to capture and store water, stone tools and mining.
- The unique flora and fauna

The game was designed to showcase how the rock cycle as expressed through our landscape, and its interactions with other Earth's Spheres such as the hydrosphere, atmosphere and biosphere. The rocks cycle and its three groups of rocks form our crust and we use rocks on a daily basis to sustain our existence. The beauty we see in the landscape, the soil it provides to grow our plants and the materials required to build our cities, transport and homes.

The use of rocks:

- in ancient times by First Nations peoples for their everyday existence for the collection and processing of food
- today in mining for iron ore from sedimentary rocks known as BIFs, and the importance of iron in today's world. The Flora and Fauna, the plants and animals



Outback Trail - Conversations

Outback Trail - Comprises two structured conversations. The scene is set in #therealclassroom; an Earth Scientist (educator) is taking a team of students through the outback to learn about the rock cycle, its interactions with the Earth's spheres, and the First Nation's people's use of the rock cycle to sustain their day to day life.

Conversation	Description
1	Rocks - Let's talk about rocks! • BIF (Banded Iron Formation) - a sedimentary rock ◦ BIF (Deep-dive) ▪ BIF Relevance • Iron Importance ◦ Final Rocks ▪ Game ends
2	Indigenous History • Gnamma (Holes) - water collection and storage ◦ Indigenous Geology - Archaeology and stone tools ▪ Indigenous Geology 2 - Stone Tools, hunting and preparing food • Indigenous Geology 3 - mining the oldest mine in the world in Western Australia ◦ Game ends.
3	Flora and Fauna in Australia opening • Rocks and Plants ◦ Animals

Outback Trail - Game Structure and Operations

The students select the direction of the conversation (between conversations 1 - 2). Figure 1. For this conversation, the 'Talk to the Earth Scientist.

Figure 1



The opening page will present (Figure 2)

- A greeting presented by a character that defines the career for the specific conversation
- An outline of the conversation

Figure 2



Within the two main topics, a number of sub-conversations exist and a student vote determines the direction the conversation will occur (Figure 3).

Figure 3



The Earth Scientist (Figure 4) provides direction and prompts the students to ask questions, which are then further elaborated through conversational answers and supported by images.

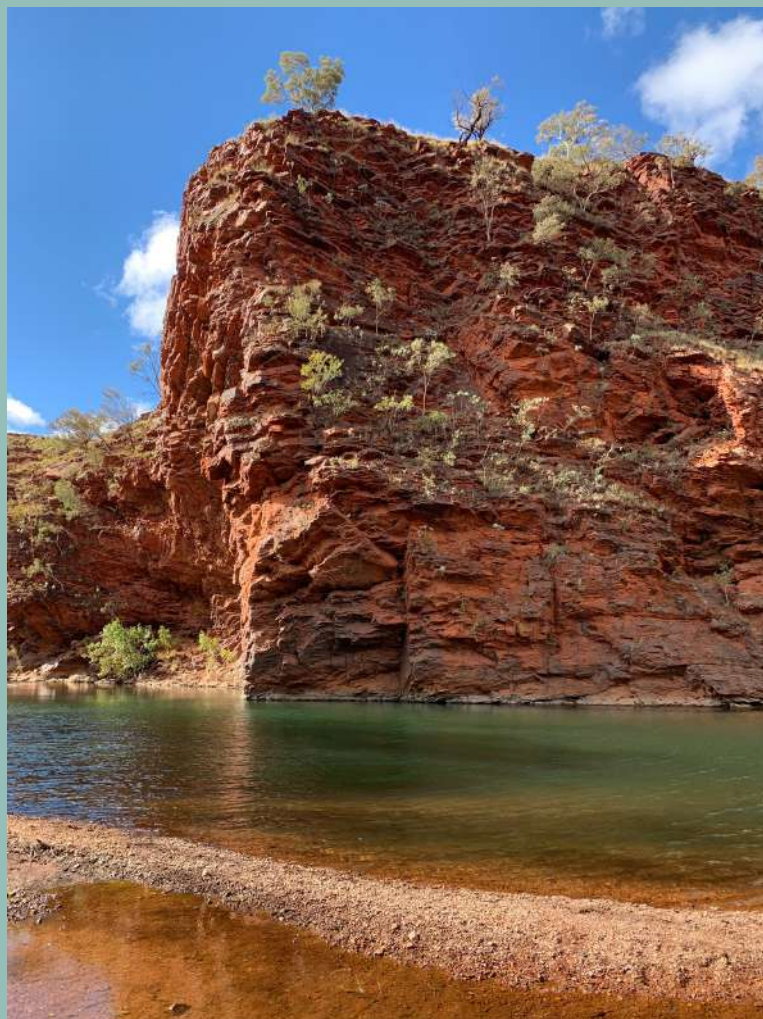
Figure 4



Outback Trail - Conversation Structure Tree

This section describes how to read the dialogue in the appendices. The Appendices are attached to demonstrate the content involved in each of the three conversations. The ES (Earth Scientist) is the career person leading the field trip with a team of students through three different experiences. The students ask the questions, the ES answers the questions, and the conversation evolves through a series of subtopics until the game is completed.

Greeting	Topic 1	Topic 2	Topic 3	Audience
Earth Scientist Field Trip Leader	Rocks - Rock Cycle	Indigenous Geology	Flora and Fauna	Team of students on a field trip in the Australian outback



Kalgan River, Newman, Western Australia

Appendix 1 - Outback Trail Greeting

Earth Scientist (ES) to the students (team)

Greeting

ES: Hey everyone! Welcome, it's great to see you all out here.

ES: We've got a few choices for what you want to do today...

ES: What would you like to chat about?

Team Response 1 to
direct the
conversation

Team Response 2 to
direct the
conversation

Team Response 3 to
Direct the
conversation

Team:
Rocks. We want to
talk about rocks.

Team:
The Indigenous
people of the area.

Team:
The flora and fauna!
Plants and animals!



Fern Pool in Dales Gorge, Karijini National Park, Western Australia

Appendix 2 - Team Response 1

Lets talk about Rocks!

Commencing Rocks Conversation

ES: Ooh rocks. One of my favourite topics.

ES: Let's definitely talk about rocks.

ES: See this. What do you think it is?

ES: C'mon. What do you reckon it actually is?

-> Team: It's rocks.

ES: Yes, very funny. Good job. It is rocks.

Team: It's a BIF!

ES: Spot on! It is a BIF. What's a BIF though?

-> Team: It's banded iron formation.

ES: And what's that?

-> Team: Uh...

ES: Let's talk more about BIFs. They're really interesting.

-> Team: Bands of high- and low-iron rock.

ES: Yeah!

ES: Let's talk more about BIFs.

-> Team: No idea... rocks?

ES: Very wise. Let's talk about BIFs.

ES: BIFs are banded iron formations.

-> Team: Absolutely no idea...

ES: Well, at least you're honest.

ES: It's a BIF.

ES: A BIF is a banded iron formation.

Appendix 2 - Team Response 1.1

Let's talk BIF (Banded Iron Formation)!

Commencing BIF Conversation

ES: This is a fantastic BIF. Look at it! // picture of BIF shows

ES: It's a beauty!

ES: What do you think?

-> Team: Looks great. Can we talk about what a BIF is? Like, banded iron formation, sure. But what's that mean?

ES: Isn't it obvious! It's a large sedimentary rock structure.

-> Team: A large what-now?

ES: A sedimentary rock is one that's formed by the accumulation of iron ore particles.

ES: So it came about over many millions of years, layer by layer. Got it?

-> Team: Makes sense.

ES: It does make sense! I'm glad you agree.

ES: The layers are made of iron oxides, and chert!

-> Team: Chert?

ES: Chert!

ES: Chert is a rock composed of microcrystalline crystals of quartz. Very exciting.

ES: Anyway, let's talk more about BIFs!

-> Team: If it wasn't a sedimentary rock... what would it be?

ES: It could be an igneous rock, or a metamorphic rock.

-> Team: What's an igneous rock?

ES: Igneous rocks are rocks that formed after magma or lava cooled.

ES: Igneous comes from the latin for fire: ignis.

ES: But really, we're here to look at BIFs...

-> Team: Metamorphic rock? Sounds scary.

ES: Metamorphic rocks are rocks formed by other, existing rocks, being heated..

ES: ... or pressurised, causing chemical and physical changes.

ES: Thus, a new rock!

ES: But really, we're here to talk about BIFs!

Appendix 2 - Team Response 1.1

Let's talk BIF (Banded Iron Formation)!

Continuing BIF Conversation

Team: Right. Sedimentary, as opposed to igneous or metamorphic.

ES: Exactly right.

ES: BIFs are fascinating. They can be many kilometres long and wide and hundreds of meters thick.

ES: We're pretty sure most BIFs are from the Precambrian age.

-> Team: Precambrian?

ES: The earliest period in Earth's history!

ES: It's between 4.6 billion and only about 541 million years ago!

ES: Anyway, we're here to talk about BIFs!

-> Team: When was the Precambrian age?

ES: That was about 541 million to 4.6 billion years ago.

ES: Anyway, we're here to look at BIFs!

-> Team: I think I know what a BIF is, but when did it.. get put here?

ES: Put there? Not quite 'put there'!

ES: It formed over the years — many, many millions of years ago — from layers of other stuff.

-> Team: Stuff?

ES: Stuff! Mostly chert and iron oxides, and sometimes some shale.

ES: You'll understand more soon!

-> Team: How long did it take to form?

ES: A long time. Many, many millions of years.

-> Team: What makes it a BIF?

ES: Well, it's banded and has iron.

ES: But you'll understand more soon, I promise!

-> Team: Who cares?

ES: Well, I do!

ES: But let's talk more about BIFs so that you can care as well!

Appendix 2 - Team Response 1.2

Let's do a BIF Deep-dive!

Commencing BIF Deep-dive Conversation

ES: BIFs really is very exciting.

ES: They're made of bands of iron-rich and iron-poor rocks.

-> Team: Iron-rich?

ES: Iron-rich! Hematite, magnetite, siderite, pyrite.. stuff like that!

-> Team: Hmm, OK. That makes sense. Where does the iron-poor stuff fit in?

ES: The iron-poor bands are usually chert and some tiny bits of iron oxide.

-> Team: Chert?

ES: Chert. It's, uh, excellent quartz, basically.

-> Team: Neat... so banded means bands of iron-rich and iron-poor. Makes sense. Why is it significant?

ES:

-> Iron poor?

ES: Iron poor bands of chert, which is excellent quartz.

-> Team: So bands of iron-rich, and iron-poor. Makes sense.

ES: I'm glad! Do you see why they're so interesting?

-> Team: Uh..

ES: Let me tell you!

ES: BIFs are great evidence of oxygenic photosynthesis.

-> Team: Oxygenic photosynthesis?

ES: Yes! And other things.

ES: BIFs are really important.

-> Team: Of course. Oxygenic photosynthesis.

ES: Yeah!

ES: BIFs are super important.

-> Team: Iron-rich and iron-poor? Can't they make up their minds?

ES: Hah, not really. The two bands are why they're BIFs. Banded.

ES: Anyway, they're great evidence of oxygenic photosynthesis.

-> Team: OK...

ES: Yes!

Appendix 2 - Team Response 1.3

BIF Relevance!

Commencing BIF Relevance Conversation

ES: BIFs are really important to Australia now, this year. As we speak.

-> Team: Why?

ES: Because Iron ore comes from enriched BIFs, basically.

-> Team: Enriched BIFs?

ES: Enriched BIFs!

ES: Enriched BIFs are those that have had the iron-poor bands leached away over the years.

-> Team: So they're mostly iron?

ES: Yep!

ES: And Iron ore is really important to the Australian minerals industry.

-> Team: I don't believe you.

ES: Enriched BIFs are those that have had the iron-poor bands leached away over the years.

-> Team: So they're mostly iron?

ES: Yep!

ES: And Iron ore is incredibly important to Australia. And the world.

-> Team: Can't be. They're too old.

ES: Enriched BIFs are those that have had the iron-poor bands leached away over the years. Which means...

ES: They're full of Iron.

ES: And Iron... well, it's really important to humans at the moment.

Appendix 2 - Team Response 1.4

Iron Importance!

Commencing Iron Importance Conversation

ES: Who knows why Iron is so important?

-> Team: It's worth a lot of money...

ES: It can be, yes. You're not wrong. But it's also just incredibly useful...

-> Team: It makes steel...

ES: Yes, Iron is used to make steel.

ES: Steel is iron plus...?

-> Team: Carbon..?

ES: Right, Carbon.

ES: Steel is basically the backbone of the modern world.

ES: Incredibly useful stuff.

-> Team: Dunno...

ES: Carbon. It's carbon.

ES: Steel is used to build everything around us in the modern world.

ES: It's so very useful!

-> Team: It can be used to make alloys, together with other metals.

ES: Absolutely, it can. Allows can be super strong, and don't rust, and can be easily shaped.

ES: So, so useful!

Appendix 2 - Team Response 1.5

Jumping into Final Rocks!

Commencing Final Rocks Conversation

ES: Rocks are pretty amazing. And we've only really talked a tiny bit about BIFs.

ES: As we said, BIFs are sedimentary. Do you know what sedimentary rocks are?

-> Team: They're rocks...

ES: Go on...

-> Team: They're rocks formed by layers of deposited material.

ES: Right!

ES: What about igneous rocks, then?

-> Team: Igneous rocks.. are cooled magma or lava?

ES: Right again!

ES: What about metamorphic rocks, then?

-> Team: Those are rocks that have changed into something else, from heat, or even pressure or both.

ES: Yeah!

ES: You know your rocks.

ES: It was nice to chat with you today!



Hamersley Gorge,
Karijini National Park,
Western Australia

Appendix 3 - Team Response 2

Indigenous Science

Commencing Indigenous Science Conversation

ES: Let's have a chat about the ingenuity of the original Australians.

ES: Do you know how the First Nations Australians of old sometimes found water?

ES: It involves rocks! One of my favourite subjects.

-> Team: Uh, no idea.

ES: At least you're honest.

ES: Well, one of the ways they found water was using Gnamma (Holes).

-> Team: Wells?

ES: Well.. (haha) sort of!

ES: Gnamma (holes) are kind of like wells.



Gnamma,
Nungarin,
Western
Australia

Appendix 3 - Team Response 2.1

Gnamma (Holes)!

Commencing Gnamma (Holes) Conversation

ES: This is a gnamma hole! // picture of gnamma hole is shown

-> Team: A gnamma what?

ES: A gnamma hole! Rainfall is... a complex consideration in arid places like this.

ES: But of course, if you know what you're doing, there's water to be found.

ES: The traditional owners depended on hidden water sources... like this 'gnamma' hole.

-> Team: Hidden?

ES: Hidden! Sort of.

ES: Gnamma holes are natural gaps or cavities in hard rock.

ES: They behave like natural water tanks.

-> Team: Where's the water come from?

ES: The water comes from rainwater run-off, or sometimes even underground stores or water.

ES: They have a pretty small opening to the surface, which means the water in it doesn't evaporate as much.

-> Team: That's pretty clever.

ES: Yeah, very clever. It even cools the water from the heat.

-> Team: What sort of rock are they in?

ES: They're mostly in hard rock, like granite, but all sorts, really.

ES: It's a clever and natural way to get safe drinking water.

Appendix 3 - Team Response 2.2

Indigenous Geology - (Archaeology & Stone tools)!

Commencing Indigenous Geology Conversation

ES: Do you know what the most common archaeological evidence found in Australia for the duration of a human presence here is?

-> Team: 'archaeological evidence'?

ES: Yes, archaeological evidence. Any physical evidence of something about the past.

-> Team: So, stuff.. things?

ES: Stuff and things! Yes.

ES: What do you think the most common stuff that archaeologists find in Australia, showing how long humans have been here, might be?

-> Team: Tools, we guess?

ES: Spot on. Stone tools and evidence of the creation of stone tools.

-> Team: 'human presence'?

ES: The presence of humans at all.

-> Team: Humans living here?

ES: Right, any humans.

ES: What do you think the most common evidence of humans living in Australia in the long-distance past is?

-> Team: We're thinking of tools of some kind..

ES: Yep! Tools. Stone tools and the bits leftover from making stone tools.

Appendix 3 - Team Response 2.3

Indigenous Geology 2 - (Stone tools - hunting & preparing food)!

Commencing Indigenous Geology 2 Conversation

ES: So, stone tools were super important to First Nation Australians of the past.

-> Team: What did they use them for?

ES: All sorts of things, from hunting to preparing and processing food.

ES: Also to make new tools!

-> Team: What did they make them from?

ES: Great question.

ES: It depends on what was being made, really.

-> Team: Makes sense..

ES: Yes. Sandstone, a sedimentary rock, and quartzite, a metamorphic rock, are useful for making grindstones for milling food.

-> Team: Because they can be abrasive?

ES: Exactly.

Appendix 3 - Team Response 2.4

Indigenous Geology 3 - (Mining)!

Commencing Indigenous Geology 3 Conversation

ES: The First Nations Australians of the past had all sorts of sophisticated extraction techniques to get the resources.

-> Team: They had mines?

ES: Pretty much. They quarried and mined.

ES: We know of hundreds of recorded sites where First Nations mineral and rock extraction took place.

ES: Most resemble an open-cut mine, but some are even underground.

ES: Wilgie Mia, in the Weld Range in Western Australia, is perhaps the world's longest-running continuous mining operation!

-> Team: It sounds like the First Nations Australians of the past had quite a sophisticated knowledge of rocks and mining.

ES: Right, Australians have been exploiting the useful properties of rocks and helping to build a society and culture for millennia.

ES: Anyway, nice to chat with you!



Appendix 4 - Team Response 3

Flora and Fauna

Commencing Flora and Fauna Conversation

ES: Great idea! The flora and fauna of Australia is totally amazing!

ES: The same things that make distinct rocks also contribute to the diverse plant communities we find.

-> Team: How are the rocks and the plants connected?

-> Team: What sort of animals can we find?



(Top Left) Sunset over the Dampier Archipelago, (Above) Wildflowers in Kalamina Gorge, Karijini National Park, (Left) Wildflowers, South Karijini National Park.

Appendix 4 - Team Response 3.1

Rocks and Plants

Commencing Rocks and Plants Conversation

ES: That's a great question!

ES: The kind of alluvial clay soil, sandplains, and granite outcrops that also present....

-> Team: BIFs! Banded Iron Formations!

ES: Right. That also present BIFs.. that sort of environment creates microhabitats that support fascinating plants.

ES: For example, Acacia adinophylla is a plant that is localised across areas where BIFs are.

ES: It's exclusively found on the iron ridges, slopes, and adjacent plants.

-> Team: Are there more?

ES: Absolutely!

ES: Types of Banksia, Grevillea, and many others.

ES All sorts of fascinating plants that grow in iron-rich areas.

-> Team: Are the plants protected these days?

ES: Also yes!

ES: Most of them have some sort of conservation status.

ES: And they're really useful to study, as they're so hardy.

-> Team: Amazing!



(Left) - Plants and Rocks. Hamersley Gorge, Karijini National Park

Appendix 4 - Team Response 3.2

Animals

Commencing Animals Conversation

ES: Animals are as diverse as the rocks.

-> Team: So, emus, kangaroos, wallabies, stuff like that, right?

ES: Sure, but also possums, dingoes, galahs, wedge-tailed eagles and more.

ES: Lots and lots of mostly small, very versatile animals, typically marsupials and birds, that have adapted well.

-> Team: Adapted well?

ES: Adapted to the dry outback, basically.

-> Team: What about lizards?

ES: Definitely lizards too.

ES: Lizards thrive in harsh desert conditions.

-> Team: What sort of lizards?

ES: Lots. Australia has more kinds of lizards than anywhere else.

ES: Tiny skinks, which are only 20 centimetres or so long, to 2-metre Perentie!

ES: Types of skinks are more than 50% of Australian lizards alone.

-> Team: That's a lot of skinks.

ES: Sure is.

ES: The wildlife is as diverse as the plants, as the rocks.



Rock (BIF)
and Reef,
Cleaverville,
Western
Australia