The Kiwi Fossil Hunter's Handbook

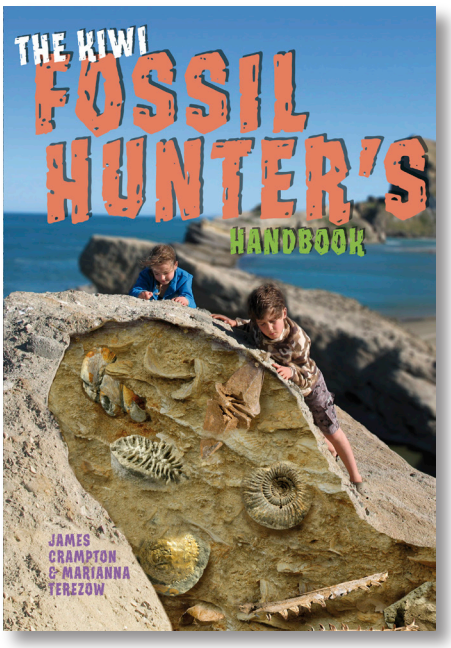
Dr James Crampton

Kids are fascinated by dinosaurs, and love the idea of the fossils they have left behind. New Zealand has a rich fossil record which is accessible to the amateur fossil-hunter in locations around New Zealand, including shells and plant remains as well as the bones, teeth and other remnants of ancient reptiles, birds and fish.

This handy pack-sized guide features 29 accessible locations around the country where kids and their families can find fossils. Each location contains specific information on where to look and what to look for, as well as the geological background and other details of each site, and colour images of fossils that could be found there. What the sites look like now is supplemented by colourful mini-posters showing reconstructions of New Zealand in the past by well-known artist Dave Gunson.

The Kiwi Fossil Hunter's Handbook is releasing to coincide with the opening of the 'Dead Precious' exhibition at Te Papa. The exhibition has already been viewed by more than 300,000 people in New Plymouth, Rotorua, Napier, Invercargill, Nelson, Dunedin and Christchurch.

Geologist Dr James Crampton is the head of GNS Science's Global Change Through Time programme. He has worked closely on the creation of the 'Dead Precious' exhibition and is passionate about getting young people interested in fossils.



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RESOURCE KIT CONTAINS:

- Pre-reading material
- Comprehension questions and activities:
  - Geological time scale
  - Plate tectonics
  - Foraminifera
  - Ancient forests
  - New Zealand undersea
  - Time of the dinosaurs
  - Rocks and minerals

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Pre-reading material

Assess students' existing knowledge by recording answers to these questions, or by brainstorming the answers as a class:

1. What is a fossil?
2. Can any living thing become a fossil?
3. How old are fossils?
4. Why are fossils important? What do they tell us?
5. Are there fossils in New Zealand?
6. Were there dinosaurs in New Zealand?

Using this book with groups:

1. One way to use this book in class is to study different geological events. Topics could include: tectonic plate movements, the period when New Zealand was under the sea, rock formation or volcanic events.
2. Another angle of research might be theme-based, for example: extinction, dinosaurs, shells, foraminifera or ancient forests.
3. Best of all, take a field trip to the nearest fossil site.

Reading comprehension

Introduction

1. Write a one sentence definition of a fossil. (p.4)
2. Explain the difference between a trace fossil and a body fossil. (pp.5-7)
3. What can be learned from trace fossils such as footprints?
4. What common rock is made of millions of fossils? (p.6)
5. Why should we regard fossils as 'miracles'? (p.7)
6. How do scientists know how old rocks and fossils are? (pp.10-11)
7. How old are the oldest rocks in New Zealand? (p.11)
8. What are the four stages of New Zealand's geological history? (p.14)
8. What was Gondwana? (p.14)
9. How is granite formed? Is it likely to contain fossils? (p.15)
10. Why are so many marine fossils found on land in New Zealand? (p.16)
11. Why are rocky outcrops likely to contain fossils? (p.17)
12. Which four rock types most commonly contain fossils?
13. What is the difference between a 'scientific name' and a 'common name'? (p.19)
14. Why is the collecting of fossils discouraged? (p.20)
15. Why should we respect both people and fossils? (p.20)
16. What are some rules for collecting fossils? (pp.20–22)

Fossil activities

1. Imagine a dinosaur falls into a lake and is covered by mud. Draw an illustrated diagram which shows the stages of fossilisation of the dinosaur's bones. (pp.7–8)

2. Make a game about fossils. It might be a simple board game with a pathway – each square could feature stages of fossilisation, or questions about geology.

3. Draw a diagram to show what 'plate tectonics' and 'subduction' mean. (p.15)

4. Make a list of clues that might help you find these fossils: large shells, mould fossil, leaf fossil. (p.18)

5. Find out the common names of the following: sphenodon punctatus, homo sapiens, harpagornis moorei, strigops habroptilus.

6. Design a poster that shows the classification names (from species through to kingdom) of one of these animals: snail, moa, shark.

Geological Time Scale (pp.9-16)

1. *Group activity*

   To get an idea of the very long periods of geological time, construct a timeline strip around the wall of the classroom (e.g. using a scale such as 1 metre = 100 million years). It should be 4.5 billion years long. Discuss the geological periods (using the time scale on the endpapers of the book), early plant life, dinosaurs and early humans. Mark the periods on the timeline.

   Divide the class into small groups and assign a period to each group. The students can illustrate the rocks and lifeforms of each period and stick these onto the timeline.

2. *Modelling*

   Model the four phases of New Zealand's geological history: chunk, bulldozer, separation, and appearance of islands (p.14). This could be a clay model, paintings, diagrams, cardboard shapes or computer illustration.

3. *Individual activity*

   The geological time scale is like 'the Earth's diary'. Write a diary of New Zealand's geological history beginning 510 million years ago (ma). Write in the style of a personal diary. For example:

   510 ma: Dear diary, today I made a chunky belt of Paleozoic rocks.

Plate Tectonics

1. What are the 'plates' that make up the Earth's crust?

2. What are 'faults'?

3. Look at the pictures on page 13, of the Australian and Pacific plates. What kind of movements occur where the plates meet? How do these movements relate to earthquakes, volcanoes, mountain building and rock layers?

4. On a map of New Zealand, show the following geological features: the Alpine

Fault (p.65); the West Coast (South Island) moving northwards; Marlborough Fault System (p.126); Pacific Plate pushing under the Australian Plate.

5. Why is the Medway River (p.122) described as a 'crash zone'? What is the landscape like as a result?

6. Castle Point (p.102-108) is another area where the great plates are colliding. At what speed are the plates moving towards each other? How has coastal Wairarapa been lifted up? Why are shells found at the top of hills there?

Foraminifera (pp. 26-27)

1. What is so special about the size of the foraminifera cells at Hokianga?

2. What is limestone made of?

3. Why is it 'impossible to imagine' how many foraminifera there are on the ocean floor?

4. Why are foraminifera so helpful for scientists in finding oil and gas deposits underground?

   View photo of foraminifera at this website (or others). Draw one using pastels or watercolour paints:
   www.teara.govt.nz/en/fossils/7/1

Ancient Forests

1. Jurassic Forests (pp.181–185)

a) When was the Jurassic Period?

b) List the fossil trees and plants found at Curio Bay.

c) Why were there no flowers in the forest?

d) Draw a comic strip that shows how the Jurassic fossil forest formed at Curio Bay. Include the following events: floods, burying of trees, layering and trees turning into silica.

2. Auckland Forests (p.36 - 41)

a) Draw a flow-diagram to show how a 'mould fossil' of a tree is formed (p.39).

b) What are the two different ways the Ihumatao forests were fossilised? (p.40)

c) Research Auckland's 50 volcanoes. Make a poster showing some eruption types and dates.

3. Miocene Forests (p.128-133)

a) What powerful earth movements created the Longford Formation? (p.129)

b) What extinct fossil plants are found there?

c) What rare fossils are still waiting to be found there?

d) What evidence is there that the climate in the Miocene epoch was warmer than today?

New Zealand Undersea

1. When did 'Zealandia' slip beneath the sea? (p.16) For how long?

2. On a map of New Zealand, identify the area covered by the sea in the King Country Basin (p.64), from Taranaki to Hawke's Bay.

3. What happened to the basin about 4 to 5 million years ago?

4. What kind of fossil shellfish and snail shells can be found at Paparoa Rapids? (p.61)

5. Why are the rocks at Ototoka Beach world famous? (p.73)

6. What caused the sea level to go up and down so much?

7. What evidence is there of past global warming (and sea level rise) at Makaretu Stream? (p.86-87).

8. Te Mata Peak was an undersea hill. Research and retell the Maori legend about Te Mata O Rongokako. How was the limestone here formed?

Time of the Dinosaurs

1. Where were New Zealand's first dinosaur footprints found? (p.5)

2. Which marine reptile bones have been found at Haumuri Bluffs? (p.139-140)

3. Make a scale drawing of an 8 metre long marine reptile alongside a 2 metre long modern shark.

4. What is the debate over dinosaurs living in New Zealand? (p.141) Find out the difference between cold-blooded and warm-blooded animals.

5. Read the story of New Zealand dinosaur hunter Joan Wiffen in *Atoms, Dinosaurs and DNA* by V. Meduna and R. Priestley. What fossil dinosaurs did Joan Wiffen find in Hawke's Bay?

6. What most likely caused the extinction of the dinosaurs? (pp.172–173, and p.58)

7. What happened at Mitchells Rocks after the mass extinction event?

Rocks and Minerals

1. Rocks can be made in three ways to form sedimentary rock, metamorphic rock or igneous rock. Make a poster which shows these three main types of rocks and how they are formed. (Use the index of the book to find some examples of each type.)

2. Use the index to research and find out the difference between:
   a) limestone and calcite
   b) mudstone and sandstone
   c) conglomerate and gravel

3. How is coal made?

4. Write a picture book for younger children that explains in simple words how a leaf could be turned into rock (fossil). (p.8)