Achievement Standard Earth and Space Science 91412: Investigate the evidence related to dating geological event(s)

Resource reference: Earth and Space Science 3.3

Resource title: Movement of the Alpine Fault

Credits: 4

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| Achievement | Achievement with Merit | Achievement with Excellence |
| Investigate the evidence related to dating geological event(s). | Investigate in-depth the evidence related to dating geological event(s). | Investigate comprehensively the evidence related to dating geological event(s).  |

Student instructions

Introduction

This assessment activity requires you to investigate the evidence relating to the dating of earthquakes along the Alpine Fault over time. Dating should be relative dates and actual dates.

You may gather information in small groups, but your report must be all your own work. You will have approx. 8 periods of class time to complete this assessment.

Present your findings in a report. Your report may contain: geological maps, images, and diagrams relevant to the event.
 **Task**

The Alpine Fault is a major geological feature that has had movement along it for many millions of years.

Investigate the evidence that relates to the dating of earthquakes along the Alpine Fault. Use a range of resources from the list on the next page as well as our class notes

**The stages of the task are:**

* **Explain the geological history of the Alpine Fault**Use the relevant notes that you have been given to explain:
	+ what the Alpine fault is, and how it relates to the wider NZ situation
	+ when and how it formed (about 15-20 million years ago)
	+ how tectonic plate movement causes earthquakes along it.
	+ The landforms that show movement on the Alpine fault e.g. fault scarps, stream changing direction
* **Explain a range of evidence that can be used to date movement along the Alpine Fault (Achieve)**. **A range means at least 3 types of evidence.**
Dating methods can give relative ages, actual ages or chronological ages. E.g. saying that one fault scarp is older than another is relative dating. Saying a date exactly, e.g. the last Alpine Fault earthquake was 1717 is an actual age. The last 3 earthquakes were 1717 AD, 1450 AD, and 1100 AD which is chronological dating.
Evidence can include:
	+ the observations that you find from virtual field trips, especially on vertical and horizontal movement
	+ the river terraces showing both vertical and horizontal movement
	+ offset (Dunite) rocks, valleys and streams as seen on geological, topographical and Google maps, photos, and satellite images.
	+ How layered sediment (stratigraphy) can be used to find the relative dates of earthquakes
	+ How tree ring data is used to find out the actual date of an earthquake
	+ How carbon-14 is used to find out the actual date of an earthquake
* **Explain in detail a range of evidence that can be used to date movement along the Alpine Fault. (Merit)**In this section, explain exactly how each piece of evidence above relatively or actually dates movement along the Alpine Fault.
* **Justify how key evidence from a range of sources enables movement along the Alpine Fault to be dated (Excellence)**

This section explains in detail why each piece of evidence can be used for dating

* **Explain how cross-correlation of the evidence contributes to the understanding of the dating of the geological event. This means that one piece of evidence backs up another. (Excellence)**For example, explain how a date gained from counting tree rings can back-up a date gained by carbon-14 dating.

NOTE – you may find that you write down similar information for the last two bullet points – that doesn’t matter. We need to see that you have done more than just copied from the handouts.

Resources:

Geological paper: Major Earthquakes Occur regularly on an Isolated Plate Boundary Fault

[**Kelvin R. Berryman**](http://www.sciencemag.org/search?author1=Kelvin+R.+Berryman&sortspec=date&submit=Submit)[1](http://www.sciencemag.org/content/336/6089/1690.full#aff-1)**,**[\*](http://www.sciencemag.org/content/336/6089/1690.full#corresp-1)**,**[**Ursula A. Cochran**](http://www.sciencemag.org/search?author1=Ursula+A.+Cochran&sortspec=date&submit=Submit)[1](http://www.sciencemag.org/content/336/6089/1690.full#aff-1)**,**[**Kate J. Clark**](http://www.sciencemag.org/search?author1=Kate+J.+Clark&sortspec=date&submit=Submit)[1](http://www.sciencemag.org/content/336/6089/1690.full#aff-1)**,**[**Glenn P. Biasi**](http://www.sciencemag.org/search?author1=Glenn+P.+Biasi&sortspec=date&submit=Submit)[2](http://www.sciencemag.org/content/336/6089/1690.full#aff-2)**,**[**Robert M. Langridge**](http://www.sciencemag.org/search?author1=Robert+M.+Langridge&sortspec=date&submit=Submit)[1](http://www.sciencemag.org/content/336/6089/1690.full#aff-1)**,**[**Pilar Villamor**](http://www.sciencemag.org/search?author1=Pilar+Villamor&sortspec=date&submit=Submit)[1](http://www.sciencemag.org/content/336/6089/1690.full#aff-1)

**Websites:**

<http://www.gns.cri.nz/Home/Learning/Science-Topics/Earthquakes/Major-Faults-in-New-Zealand/Alpine-Fault>

<http://www.gns.cri.nz/Home/News-and-Events/Media-Releases/improved-understanding-of-alpine-fault>

<http://www.otago.ac.nz/geology/research/structural_geology/alpinefault/index.html#alpine_fault_maps> Good maps of section of the Alpine Fault

<http://www.otago.ac.nz/geology/research/structural_geology/alpinefault/AF_traces/AF_traces_v2_50k_map_NZTM.pdf> 25 mgs so only download if you want detailed maps of sections of the Alpine Fault. Try one above first.

<http://www.otago.ac.nz/geology/research/structural_geology/alpinefault/AF_traces/AF_traces_v2_legend.pdf> Key for maps above

<http://www.3news.co.nz/Alpine-Fault-considered-ticking-time-bomb/tabid/367/articleID/259452/Default.aspx>

<http://en.wikipedia.org/wiki/Alpine_Fault>

<http://www.eqc.govt.nz/research/research-papers/dating-past-alpine-fault-rupture-south-westland>

<http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=10816071>

<http://www.stuff.co.nz/science/7184893/Big-Alpine-Fault-quake-may-be-in-near-future>

<http://phys.org/news/2012-06-year-quake-alpine-fault.html>

<http://www.stuff.co.nz/national/4090376/Tree-stumps-old-Alpine-Fault-theories>

<http://www.youtube.com/watch?v=xfpxGQsvrHE>

<https://www.youtube.com/watch?v=tfj8MIAxec4&feature=em-subs_digest> – really good recent GNS video.

 Lichenology <https://www.researchgate.net/publication/279982435_Prehistorical_earthquakes_on_the_Alpine_fault_New_Zealand>

Assessment schedule: Earth and Space Science 91412: Movement along the Alpine Fault

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| Evidence/Judgements for Achievement  | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The student has produced a report in which they investigate the evidence related to movement along the Alpine Fault. | The student has produced a report in which they investigate in-depth the evidence related to movement along the Alpine Fault. | The student has produced a report in which they investigate comprehensively the evidence related to movement along the Alpine Fault. |
| The student has explained the movement along the Alpine Fault |  |  |
| The student has explained a range of evidence related to dating movement along the Alpine Fault  | The student has explained in detail how a range of key evidence contributes to the understanding of the dating of geological events  | The student has justified how a range of key evidence contributed to the understanding of the dating of the geological eventThe student has explained how the cross-correlation of the evidence contributed to the understanding of the dating of geological events |
| **N** | **A** | **M** | **E** | **Comments** |