The Grand Canyon:
Explaining features and processes/
predicting futures

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Students develop geographic inquiry skills to investigate places. These skills include interpreting and analysing maps, photographs and visual representations and applying these skills and their content knowledge and understating in new contexts.

These activities are presented as student worksheets in the Appendix that accompanies this edition on the GTA NSW & ACT website.

Introduction

View this short video clip to start students thinking about the Grand Canyon in the context of the formation of landscapes and landforms in general.

Show the short video clip without comment

How was the Grand Canyon formed? https://www.youtube.com/watch?v=t6lBg4Srb6E

ACTIVITY 1: ANNOTATED DIAGRAM

Annotate the diagram with examples of landscapes and / or landforms caused by each of the geomorphic processes shown. Name places in your answer.

CHANGES TO THE EARTH

From ICE   From WATER   From WIND

SLOW CHANGES

Weathering   Erosion   Deposition

FAST CHANGES

Volcanic Eruptions   Earth Quakes   Landslides

Source: Shutterstock

ACTIVITY 2: PHOTO AND MAP INTERPRETATION. THE GRAND CANYON

a. What is it? Describe the landscape you see in these photographs of the Grand Canyon. Using geographical language and refer to any distinctive landforms you can observe.
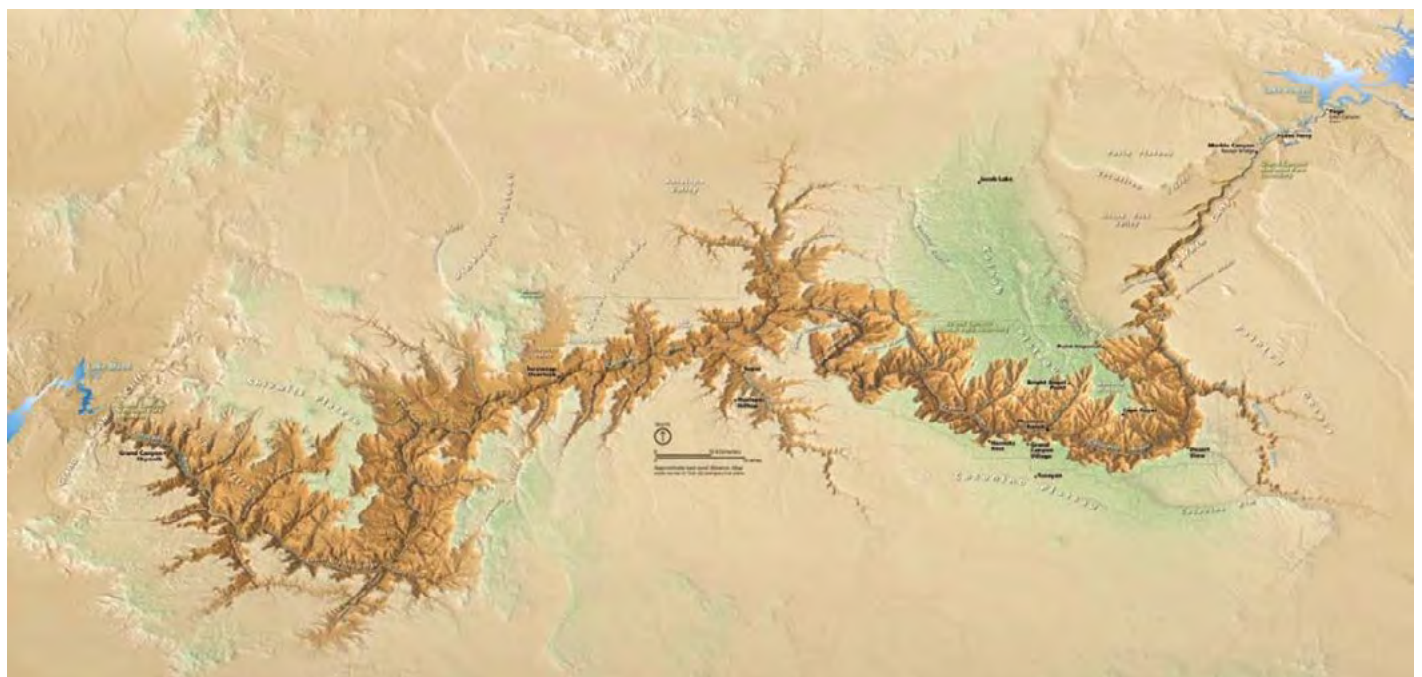

Source: Shutterstock

Source: Dreamstime

Source: Shutterstock

Source: Knowable magazine NPS PHOTO by Mark Lellouch https://knowablemagazine.org/article/physical-world/2019/ deeper-understanding-grand-canyon

Source: https://www.usgs.gov/media/images/grand-canyon-national-park-map-0

b. Where is it?
Describe the location of the Grand Canyon using the following map collection. Refer to places, distances, and directions in your answer.

c. Why is it there? Develop your own explanation of how this landscape was formed. Use geographical terms in a written answer.

Source: https://www.britannica.com/place/Grand-Canyon

Source: Shutterstock

Source: Extract from map at https://grandcanyoncvb.org/area-map/

ACTIVITY 3: EXPLAINING CHANGE OVER TIME

a. Match the diagrams with the text boxes that explain the formation of the Grand Canyon over time. (Diagrams from Knowable magazine)

b. Predict what the landscape will look like in another 50 million years under two scenarios:
– The future climate is wetter than today with 1000 mm additional rainfall a year.
– The continent experiences a new tectonic uplift of 1000 metres. Explain your predictions.

1 1.72 billion years ago
Vishnu Mountains

2 1.25 billion years ago
Erosion surface

3 500 million years ago
Cambrian Sea
— Sea level
— Grand Canyon Supergroup

4 60 million years ago
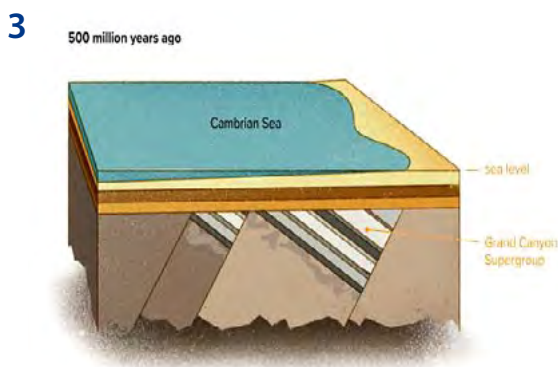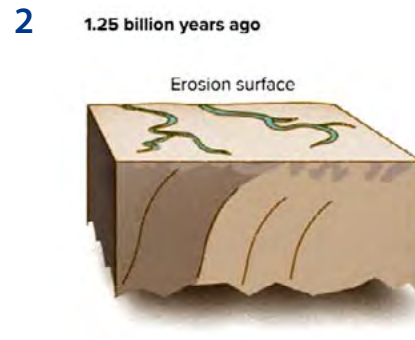
5 Today

The Colorado River carved down through the plateau, exposing ancient layers of rock.

EXPLANATION	
1	The Colorado River carved down through the plateau exposing the ancient layers of rock seen today.
2	Erosion levelled the mountains and created a flat plain on which new layers were deposited.
3	Basement rocks form deep below a mountain range.
4	Layers of rock are titled by tectonic forces; the area was covered by water and more layers deposited.
5	Colliding tectonic plates pushed upwards creating the Colorado Plateau at a high elevation.

Learn more

– A Brief History of Colorado Through Time (Geology of Colorado)
https://www.youtube.com/watch?v=i5QeyztIlT8

– Knowable magazine (Source of diagrams)
https://knowablemagazine.org/article/physical-world/2019/deeper-understanding-grand-canyon

ACTIVITY 4: THE PHYSICAL EVIRONMENT

a. Refer to the climate statistics for Page below.

   i.   Calculate the annual precipitation and number of rainy days.

   ii. Describe the variation in temperatures between January and July.

   iii. What would be the best time of year for a hiker to visit the Grand Canyon? Explain.

	January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Avg. Temp °C	2.2 °C	4.7 °C	9.8 °C	14.3 °C	19.9 °C	26.6 °C	29.1 °C	27.2 °C	23 °C	15.6 °C	8.2 °C	2.3 °C (36.2) °F
Precipitation mm)	23 (0.9)	22 (0.9)	17 (0.7)	13 (0.5)	10 (0.4)	3 (0.1)	7 (0.3)	11 (0.4)	15 (0.6)	20 (0.8)	13 (0.5)	19 (0.7)
Rainy days (d)	4	4	3	3	2	1	2	2	2	2	2	3
Avg. Sun hours (hours)	7.2	8.6	10.3	11.6	12.6	13.2	12.9	12.1	11.0	9.5	8.1	6.9

Source: https://en.climate-data.org/north-america/united-states-of-america/arizona/page-16315/#climate-graph

b. Refer to the vegetation profile:

   i.   Describe the change in vegetation from the bottom to the top of the south facing slopes of the Grand Canyon (0 to 4,000 metres altitude)

   ii. Suggest why the higher areas are more vegetated.
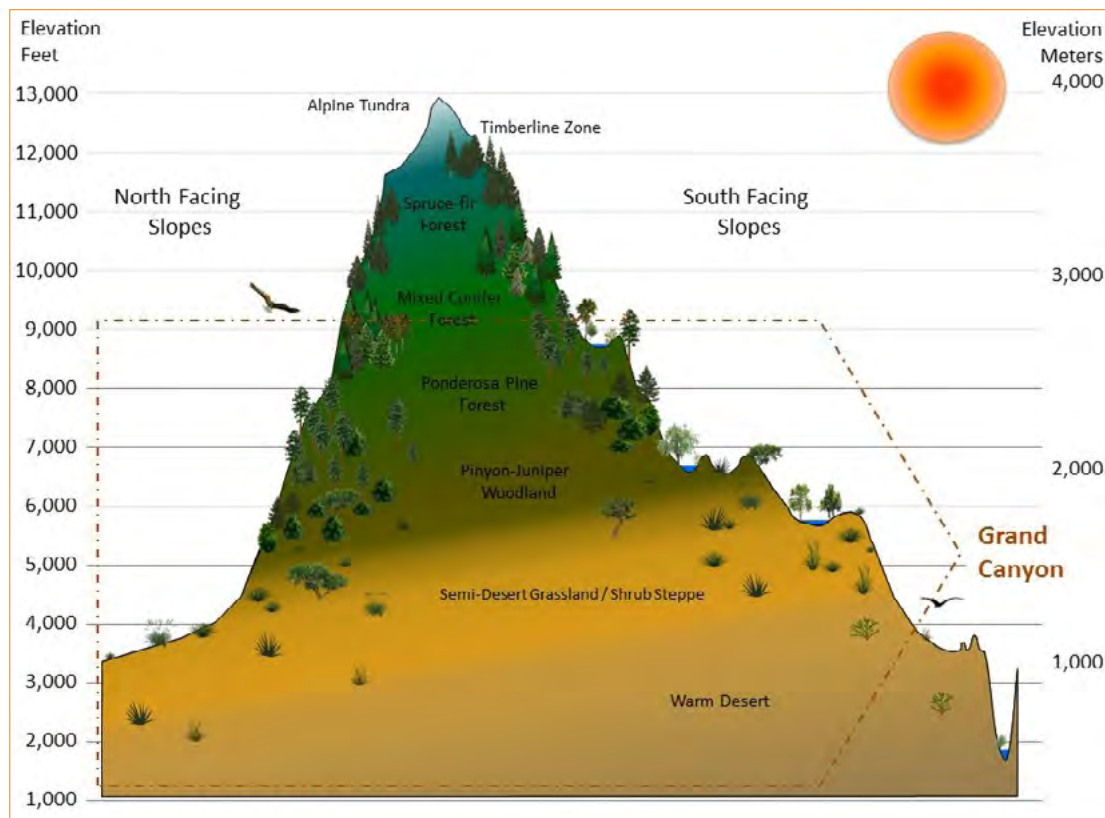
Source: Natural resources of the Grand Canyon https://www.nps.gov/im/scpn/grca.htm

c. Synthesis

   i.   How does the climate of the Grand Canyon affects the landscape of the Grand Canyon that you have observed in photographs and maps?

   ii. Where do you think the water in the Colorado River comes from?

Learn more

   –   Inside Grand Canyon National Park – https://www.youtube.com/watch?v=IVqdES5-Y4I

LANDSCAPES AND LANDFORMS: THE GRAND CANYON

ACTIVITY 5: TOPOGRAPHIC MAPPING

Visit the following website **https://commons.wikimedia.org/wiki/File:NPS_grand-canyon-south-rim-east-topo-map.pdf** to use or download a topographic map of the Grand Canyon.

a. **Locate** the following places – Grand Canyon Village
                               – Colorado River
                               – Clear Creek
                               – Bright Angel Canyon
                               – Granite Gorge
                               – Lyell Butte and Pattie Butte

b. **Study** the patterns of contour lines on the map.

What does the pattern of contour lines tell you about the following?

– the landscape northeast of Grand Canyon Village compared to south of the village.

– the width, depth and shape of Granite Gorge and Bright Angel Canyon?

– the size and shape of buttes.

c. **You take a helicopter flight** from the Visitor Centre in the Grand Canyon Village to Phantom Ranch in Bright Angel Canyon.

– i. Calculate the straight-line distance you travelled (km)

– ii. State the direction you travelled

– iii. Describe the landscape you observed along the way. Your description should refer to landforms and vegetation.

The following video may assist you to visualise and describe your flight:

– Grand Canyon – US National Parks 3D Maps **https://www.youtube.com/watch?v=eTzj7yyha_M**

d. **State three pieces of evidence** that this area caters for tourists.

Grand Canyon Southeast Rim. Source: http://npmaps.com/wp-content/uploads/grand-canyon-south-rim-east-topo-map.jpg

Source: Dreamstime