

## Overview

In 1848, gold was discovered in California. Thousands of gold prospectors headed west. As the most easily accessible deposits were rapidly exhausted, the prospectors had to devise ways of extracting more gold from the rock and gravel. One method used large volumes of mercury, which – when poured into the water sluices – combined with the finest fragments of gold, preventing them from being swept away. The gold was then separated from the resulting amalgam.

Unfortunately, residues of the mercury reached the streams and rivers that drained into the lakes in the area.

Scientists have surveyed fish from lakes in the historical gold-mining area of California and measured the amounts of mercury they contain today.

## The activities

This unit is made up of an introductory activity called ‘James and the gold rush’, and one main activity entitled ‘What happened next?’.

### James and the gold rush

Students are introduced to the gold rush through the eyes of James, a prospector, who is trying to decide what type of gold deposit and equipment he should choose when he stakes his claim.

### What happened next?

Students help a modern-day environmental scientist, Hannah, as she interprets the results of mercury analysis of fish from rivers and lakes in the historical gold rush mining area. Students are asked to suggest what recommendations Hannah should make to local fisherman based on the results.

## Curriculum links (for students aged 14–16)

### How Science Works (from POS KS4 for England)

#### Data, evidence, theories and explanations

1a how scientific data can be collected and analysed

1b how interpretation of data, using creative thought, provides evidence to test ideas and develop theories

#### Practical and enquiry skills

2d evaluate methods of collection of data and consider their validity and reliability as evidence

## GCSE or equivalent 14–16 specifications

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Please note that these links do not apply to *all* activities.

### England (GCSE)

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#### **AQA Science A 4461**

Unit Biology 1b Evolution and environment: 11.8 How do humans affect the environment?

Unit Chemistry 1a Products from rocks: 12.2 How do rocks provide metals and how are metals used?

#### **AQA Science B 4462**

Unit Biology 1: 11.8 How do humans affect the environment?

Unit Chemistry 1: 12.2 How do rocks provide metals and how are metals used?

#### **AQA Biology 4411**

Unit Biology 1: 11.8 How do humans affect the environment?

#### **AQA Chemistry 4421**

Unit Chemistry 1: 11.2 How do rocks provide metals and how are metals used?

#### **AQA Additional Applied Science (Single Award) 4863**

Unit 2 Science at work: 11.2 Food science – Food labelling and food testing

#### **AQA Applied Science (Double Award) 4861**

Unit 2 Science for the needs of society:

11.2 Health and medicine – The body at risk

11.3 Countryside and environmental management – Managing the environment; Environmental management

#### **Edexcel 360 Science 2101**

Biology B1a: Topic 1 – Environment

Biology B1a: Topic 6 – Making changes

#### **Edexcel 360 Additional Science 2103**

Biology B2: Topic 3 – Energy flow

Biology B2: Topic 4 – Interdependence

#### **OCR Science A (21C science) J630**

Module C3 Food matters: C3.3 How can we make sure that our food does not contain chemicals that may be harmful to health?

Module C1 Air quality

Module B2 Keeping healthy

#### **OCR Biology A (21C) J633**

Module B2 Keeping healthy

#### **OCR Chemistry A (21C) J634**

Module C3 Food matters: C3.3 How can we make sure that our food does not contain chemicals that may be harmful to health?

Module C5 Chemicals of the natural environment: C5.4 How can we extract useful metals from minerals?

## **OCR Additional Science A (21C science) J631**

Module C5 Chemicals of the natural environment: C5.4 How can we extract useful metals from minerals?

## **OCR Additional Applied Science (21C)**

Module AP2 Agriculture and food: AP2.1 The agricultural and food industries

Module AP4 Harnessing chemicals: AP4.1 The chemical industry

## **OCR Science B (Gateway Science) J640**

Module B1 Understanding ourselves: Item B1c Keeping healthy, Item B1e Drugs and you

Module C1 Carbon chemistry: Item C1g Using carbon fuels

Module C2 Rocks and metals: Item C2f Clean air

## **OCR Additional Science B (Gateway Science) J641**

Module C4 Chemical economics: Item C4h How pure is our water?

## **OCR Chemistry B (Gateway Science) J644**

Module C4 Chemical economics: Item C4h How pure is our water?

## **OCR Applied Science (Double Award) J649**

Section 2.3 Obtaining useful chemicals: 2.3.2 Useful chemicals, Using raw materials

## **Scotland (SCE standard grade)**

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### **Science**

Topic 4 A study of environments – 5 Pollution

### **Biology**

Topic 1 The biosphere: Sub-topic c – Control and management

### **Chemistry**

Topic 11 Metals

## **Wales (WJEC GCSE)**

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### **Additional Science**

Biology B2: 7 The impact of human activity on the environment

### **Applied Science (Double Award)**

Unit 2: Science and society (b) Man and the environment, (c) Chemical and material behaviour

## **NI (CEA GCSE)**

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### **Science (Single Award)**

Module 2 Human activity and health: Man's activity on Earth

### **Additional science**

Biology B2-7 The impact of human activity on the environment

Chemistry C2-3 The production and use of metals

# Gold rush!

## Biology

3.2 Environment – Pollution 3.2.12

## Chemistry

3.5 Useful products from metal ores and rocks

## Applied Science (Double Award)

6.2 Obtaining useful chemicals – Human influences 3.5.5

## Learning objectives

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By working through the unit, students come to:

- understand some advantages and disadvantages of methods used by gold prospectors to recover gold
- recognise some of the environmental implications of historical gold mining
- interpret data presented in a scattergraph
- become aware of how mercury accumulation occurs in fish populations in historical gold mining areas.

## Teaching and learning approaches

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Learning Skills, learning by/from:

- interpreting and evaluating data (LSS1, LSS4)
- reflective reading (LSS1, LSS3)
- 'case studies' in a variety of contexts (LSS3)

## Downloads

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### James and the gold rush

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- Presentation
  - slide 1 – starter stimulus
  - slide 2 – Gold-collecting equipment
  - slide 3 – Gold-collecting equipment
  - slide 4 – Gold-collecting equipment
- Information sheet – James
- Information sheet – Gold claims map
- Activity sheet – James and the gold rush

## What happened next?

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- Presentation
  - slide 1 – starter stimulus
  - slide 5 – Mercury analysis – comparison of lab results
  - slide 6 – Mercury analysis – Lake Engelbright
  - slide 7 – Mercury analysis – all lakes and reservoirs
- Information sheet – James: what happened next ...
- Activity sheet A – Hannah
- Activity sheet B – Hannah (simplified version)

## Acknowledgements

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This unit was written by Helen Harden and edited by Silvia Newton. It is based on a report published on the USGS website (see Weblinks page). The material was originally used by the author as part of Hodder Education's *Science Interact* KS3 course but new activities have been produced here tailored to KS4 students. A relevant original SATIS unit that may be of interest is SATIS unit No: 801 – The water pollution mystery.

Thanks to Chris J. Carlon, Head of Geosciences at Anglo American Plc ([www.angloamerican.co.uk](http://www.angloamerican.co.uk)), for reviewing this activity. It should be noted that Anglo American Plc *does not* mine gold using mercury amalgamation of river course sediments, and has never operated mines in the California gold belt.

Thanks also to Hebe Powell for drawing the original map on 'Information sheet – Gold claims map'.