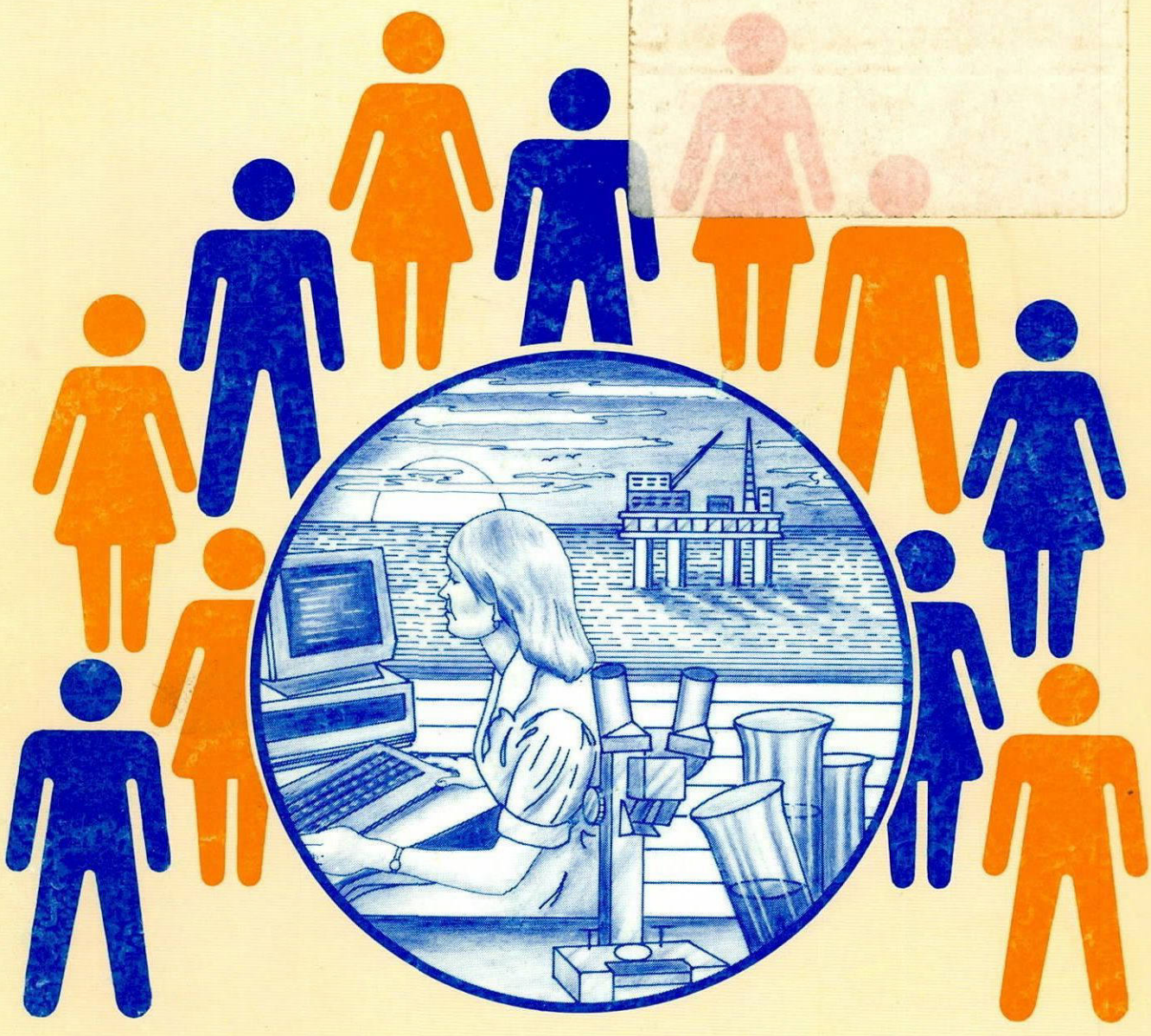
SCIENCE & TECHNOLOGY IN SOCIETY

10

& INDEX



SATIS

ABOUT SATIS

Science and Technology in Society units are designed to be used in conjunction with conventional science courses, particularly those leading to GCSE examinations. Each unit has links to major science topics as well as exploring important social and technological applications and issues.

The units are self-contained and generally require about 2 periods (around 75 minutes) of classroom time. Each unit comprises Teachers' Notes (blue sheets) and Students' materials (white sheets). Full guidance on use is given in the Teachers' Notes accompanying each unit, which also include background information and suggest further resources.

Each SATIS book contains ten units. The units are numbered in a system giving the number of the book followed by the number of the unit within that book. Thus the first unit in the first SATIS book is numbered 101.

In addition to the SATIS books, there is a *General Guide for Teachers* which gives guidance on some of the teaching techniques involved as well as ideas for further activities.

Many people from schools, universities, industry and the professions have contributed to the writing, development and trials of the SATIS project. A full list of contributors appears in *General Guide for Teachers.*

The names of contributors to this particular book are given on the inside of the back cover.

First published 1988 by The Association for Science Education

Designed by P & PS (Cambridge) Ltd.

SATIS 10 and Index

List of units in this book

EVALUATION OF SATIS UNITS

Users of the units in this book are invited to evaluate them by completing the questionnaire on the next page. Such feedback is of great value in helping to revise and improve the units and in determining future policy.

The Association for Science Education
College Lane
Hatfield
Herts AL10 9AA

ISBN 0 86357 080 1

List of units in the SATIS series

SATIS 1
101 Sulphurcrete
102 Food from Fungus
103 Controlling Rust
104 What's in our Food? — a look at food labels
105 The Bigger the Better?
106 The Design Game
107 Ashton Island — a problem in renewable energy
108 Fibre in your Diet
109 Nuclear Power
110 Hilltop — an agricultural problem

SATIS 2
201 Energy from Biomass
202 Electric Vehicles
203 Drinking Alcohol
204 Using Radioactivity
205 Looking at Motor Oil
206 Test-tube Babies
207 The Story of Fritz Haber
208 The Price of Food
209 Spectacles and Contact Lenses
210 The Pesticide Problem

SATIS 3
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302 Living with Kidney Failure
303 Physics and Cooking
304 A Medicine to Control Bilharzia — Part 1
305 A Medicine to Control Bilharzia — Part 2
306 Fibre Optics and Telecommunications
307 Chemicals from Salt
308 The Second Law of — What?"
309 Microbes make Human Insulin
310 Recycling Aluminium

SATIS 4
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402 DDT and Malaria
403 Britain's Energy Sources
404 How would you Survive? — an exercise in simple technology
405 The Label at the Back — a look at clothing fibres
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407 Noise
408 Industrial Gases
409 Dam Problems
410 Glass

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503 Paying for National Health
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505 Making Fertilizers
506 Materials for Life — new parts for old
507 Computers and Jobs
508 Risks
509 Homoeopathy — an alternative kind of medicine
510 Perkin's Mauve

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603 The Heart Pacemaker
604 Metals as Resources
605 The Great Chunnel Debate
606 The Tristan da Cunha Dental Surveys
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610 Robots at Work

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803 The Technology of Toilets
804 Electrostatic Problems
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806 Stress
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906 IT in Greenhouses
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908 Why not Combined Heat and Power?
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1002 Quintonal: an industrial hazard
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1008 Why 240 Volts?
1009 Trees as Structures
1010 Can it be done? Should it be done?
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Evaluation of SATIS units

Your opinions as an experienced teacher will help to revise and improve the SATIS units in this book and to influence the style of future units.

Please
- Complete a response table (overleaf) for any unit you have used. If you need more response tables, please make photocopies.
- Return the completed sheet(s) to:

  SATIS Evaluation, ASE, College Lane, Hatfield, Herts AL10 9AA

Information about your school

Name of SATIS contact person: .....

Role: .....

Name of school: .....

Address: .....

.....

Type of school *(Please circle):*

Comprehensive Grammar Secondary Modern Independent Other

Boys only Girls only Mixed

Age range: ..... Total school roll: .....

Your opinions about the SATIS units in this book

The aspects for comment are listed below and we have provided response tables on the other side of this sheet. For each unit:

Please
- Complete the headings
- Tick the box which most closely reflects your opinion about each aspect of the unit you have taught
- If you have 'no opinion', or do not wish to give one, please tick the box on the extreme right.

Aspects for comment

(a) Relevance for GCSE courses (Is the unit relevant to your course?)
(b) Students' apparent interest (Did the unit stimulate interest in your students?)
(c) Language level (Is the unit written at a suitable level for your students?)
(d) Concept level (Were the conceptual demands appropriate?)
(e) Suggested amount of time (Was there enough time to complete the unit?)
(f) Recommended teaching/learning method (Was this appropriate for the unit?)
(g) Presentation (layout, diagrams, photos, print size) (Was all this suitable?)
(h) Teachers' notes (blue sheets) (Did you find these useful?)
(i) The teaching sequence in the unit (Was the unit organised suitably?)
(j) Requirements for students' response (Did the unit require suitable activities and feedback from students?)

I intend to use the following units again without revision. (Please quote unit number only.)
I intend to use the following units again, with revision.
I do not intend using the following units again.

SATIS unit number ....

Years and abilities used with ....

(a) Relevance for GCSE	Very relevant	Relevant	Little relevance	Not relevant	No opinion
(b) Students' apparent interest	Very interested	Interested	Little interest	Bored	No opinion
(c) Language level	Very suitable	Suitable	Quite difficult	Very difficult	No opinion
(d) Concept level	Very appropriate	Appropriate	Not appropriate	Completely in-appropriate	No opinion
(e) Suggested amount of time	Very satisfactory	Satisfactory	Difficult to meet	Badly estimated	No opinion
(f) Recom-mended teaching/ learning method	Very appropriate	Appropriate	Needs improving	Not at all appropriate	No opinion
(g) Presentation (Layout, dia-grams, photos, print size, etc.)	Excellent	Good	Needs improving	Poor	No opinion
(h) Teachers' notes (the blue sheets)	Very useful	Useful	Need improving	Of little use	No opinion
(i) The teaching sequence in the unit	Very suitable	Suitable	Needs some reorganising	Needs much reorganising	No opinion
(j) Requirements for students' response	Very suitable	Suitable	Need improving	Unsuitable	No opinion

Further comment:

SATIS unit number ....

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(j) Requirements for students' response	Very suitable	Suitable	Need improving	Unsuitable	No opinion

Further comment:

Chocolate Chip Mining

Contents: A practical activity linked to analysis of data about copper mining.

Time: 2 to 3 periods.

Intended use: GCSE Chemistry and Science. Links with work on metal extraction with special reference to the environmental problems associated with the recovery of minerals.

Aims:

- To show the economic importance of the fact that mineral resources are not evenly distributed in the Earth's crust
- To develop awareness of the environmental impact of mining and the difficulty of reclaiming mined areas
- To provide an opportunity for open-ended problem solving
- To provide an opportunity to practise the skill of interpreting data.

Requirements: Students' worksheets No.1001. Suggested equipment for Part 1 is listed below.

Author: Andrew Hunt

Suggested use

This unit is in two parts. Each part is self-contained.

Part 1 Mineral processing

This is a practical activity which should have a wide appeal. It uses the problem of 'mining' chocolate chips in a biscuit as an analogy for the difficulties involved in developing mineral resources.

Part 2 Copper mining

This is a data-analysis exercise which is designed to show the real-life importance of the analogy used in Part 1. With some pupils it may be more appropriate to give Part 1 more meaning by showing a film, slides or a video (see below under 'Further resources').

Notes on Part 1

Safety

There is little doubt that some students will be tempted to eat the results of their 'mining' and so this activity should not take place in a laboratory if at all possible. In any case normal laboratory equipment should not be used unless it can be guaranteed that no one will eat the output of their processing operations. One way round the practical problems is to set this activity for homework but students will then miss the benefits of discussing the results with others. Alternatively students can be asked to bring their own 'mining equipment' from home.

Requirements

Each group of students will need:

2 chocolate chip biscuits (which should be stored in a refrigerator or other cool place before use)
clean containers, e.g. margarine tubs, or yoghurt pots
access to a variety of equipment and materials such as:
- knife
- spatula
- sieve or strainer
- water bath
- a balance
- measuring cylinder
- oven

This exercise could be used as an opportunity to introduce some simple statistical ideas. Students could be asked to plot a histogram to show the range and variation of the quantities of chocolate 'mined' from biscuits by the groups in the class.

Answers to questions in Part 2

Q.1 80 times more concentrated

Q.2 (a) 500 kg
(b) 8 kg
(c) 2 kg

Q.3 (a) 25%
(b) 0.4%
(c) 0.2%

Q.4 0.2%

Further resources

Background reading for the teacher is included in:

Science in Society, Book G, *Mineral Resources,* Heinemann Educational Books, 1981.
Revised Nuffield Advanced Chemistry, *Mineral Process Chemistry,* Longman, 1984.

Information on films or videos about the extraction and uses of metals is available from:

Viscom Limited (for British Steel and RTZ Group films), Audio Visual Library, Unit B11, Park Hall Road Trading Estate, London SE21 8EL. (Tel: 01-761-3035)

TV broadcasts for schools also include programmes about the extraction and uses of metals.

Booklets, wall charts and other printed information about metal extraction are available from:

British Steel Corporation, 9 Albert Embankment, London SE1 7SN (Tel: 01-735-7654)
Institute of Metals, 1 Carlton House Terrace, London SW1Y 5DB (Tel: 01-839-4071)
RTZ Services Limited, Intermail Ltd, Unit 2, Fleming Road, Newbury, Berkshire RG13 2DE

Acknowledgements Part 1 of this unit is based on an idea from 'Outlook', a programme for environmental education enrichment from the Iowa Department of Public Instruction, USA. Figure 3 in Part 2 supplied by RTZ Ltd.

CHOCOLATE CHIP MINING

This unit is in two parts. Part 1 is practical. You have to try and extract a useful 'mineral' from a 'rock' sample. Part 2 describes some of the problems of copper mining.

Part 1 Mineral processing

You are a research scientist for a mining company. You work in a laboratory which investigates methods for getting useful minerals from rocks. You have just been sent a sample of rock which seems to have small pieces of a valuable mineral mixed up with unwanted waste material. The mineral is dark brown. The waste is paler.

Research brief

- Find a method for separating the valuable mineral from the rock sample.
- Measure the amount of mineral and the amount of waste. Compare your results with those obtained by other working groups. Does the amount of the valuable mineral seem to be about the same in each rock sample?
- Compare the volume of waste rock with the volume of your original sample. Is it likely to be possible to put the waste back into the hole made during mining?
- If a second rock sample is available, try to see if you can extract the mineral more efficiently.
- Carry out any further investigations which you think may be helpful and then write a report for the directors of your company.

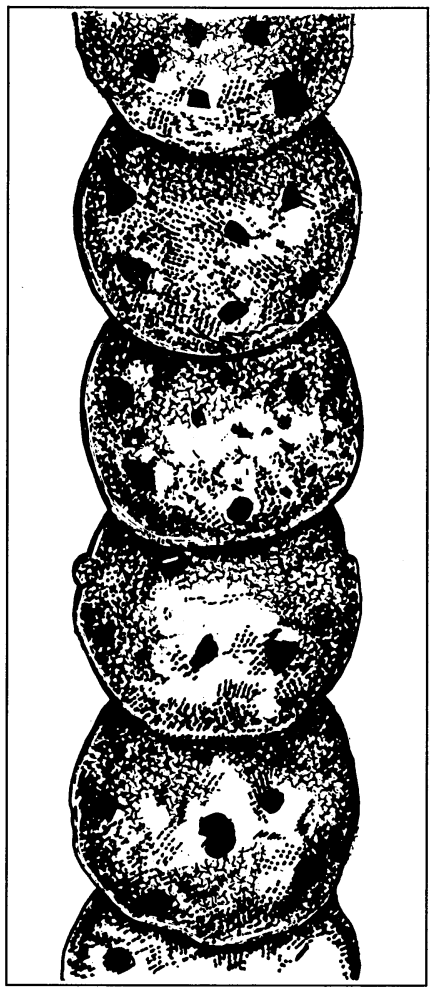

Figure 1 A typical 'rock' sample

Part 2 Copper mining

There is very little of some metals in the crust of the Earth. Look at the table below — the centre column gives the average percentage of five metals, including copper. Fortunately minerals are not spread evenly through the Earth's crust. There are places where valuable minerals are concentrated as ores.

The right-hand column in the table shows you the percentage of the metals in ores which are economical to mine. Below these percentages the ore is not worth mining because it costs more to get the metal out than the metal is worth.

Look at the table and answer question 1.

Table 1

Metal	*Average percentage in the Earth's crust*	*Percentage of the metal in ores which can now be mined economically*
Aluminium	8	30
Iron	5	17
Copper	0.005	0.4
Lead	0.001	2
Gold	0.000 000 4	0.000 8

Question

1 *How much more concentrated is the copper in an ore than the average concentration of the metal in the crust of the Earth? (See table.)*

You can see from the table that some ores contain very little of the metal. This means that a huge amount of waste has to be mined to get at the valuable metal. The mining company has the problem of getting rid of the waste.

There is a big open-pit copper mine on the island of Bougainville in Papua New Guinea (see Figures 2 and 3). About 220 000 tonnes of ore and waste rock are mined each day. The ore from the mine is used to produce about 500 tonnes of copper metal a day.

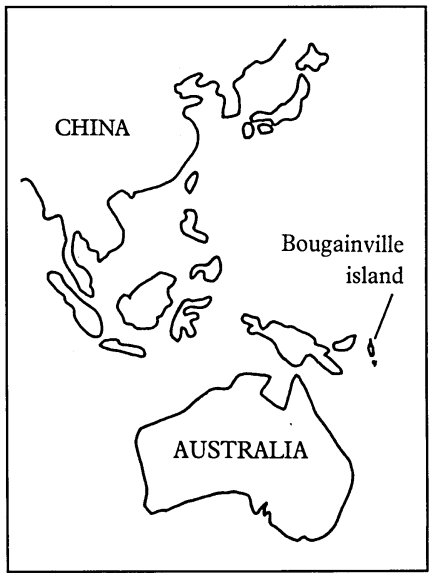

Figure 2 The position of the island of Bougainville

Figure 3 Mining copper ore at Bougainville

Waste rock with no ore in it is dumped. The ore with the copper in it is crushed and ground to a powder. Then the valuable mineral which contains the copper can be separated from the rest of the waste.

Powdered wastes from the separating plant are washed into the Kawerong river. Some of the waste ends up along 35km of the river system. The rest is making a delta where the river flows into the sea. In the future it is planned to take these wastes out to sea, via a pipeline.

The Bougainville mine is only economic because the ore also contains traces of gold and silver. There is about 0.6**g** of gold and 1.6**g** of silver in each **tonne** of the ore. Even with such tiny amounts, for every £1.00 earned by the mine in 1984, 45p was from sales of gold, 2p from silver and 53p from copper.

Study Figure 4 and then answer questions 2 to 4.

Questions

2 *This question is based on Figure 4.*
   (a) How much metal ore is obtained for each tonne (1000 kilograms) of rock dug from the mine?
   (b) How much of the valuable copper concentrate is obtained from 1000 kilograms of rock dug from the mine?
   (c) How much copper metal is obtained from 1000 kilograms of rock (ore and waste) dug from the mine?

3 *Work out the answers to this question with the help of Figure 4 and your answers to question 2.*
   (a) What is the percentage of copper in the copper concentrate?
   (b) What is the percentage of copper in the metal ore?
   (c) What is the average percentage of copper in the rock in the ground?

4 *Compare your answers to question 3 to the information given about the Bougainville mine. What is the percentage of copper in the 220 000 tonnes of rock which are mined each day?*

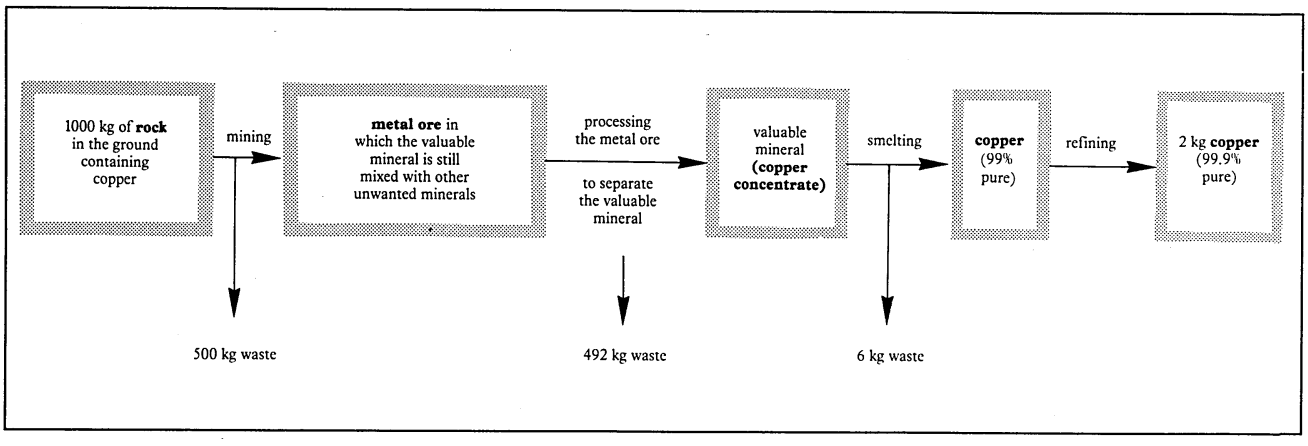

Figure 4 The main stages in the mining and processing of a copper ore