Name: _____ Group: _____

THE PROJECT

Geological eras to discover

A group of Québec researchers has developed a time-travel machine to study the eras in the history of Earth from the beginning of time to the present. They used recent technological breakthroughs to come up with this fabulous invention. Guy Tremblay, Director of the Centre for Geological Era Research, has this to say: “We are very proud of the machine we've invented. Now we will be able to study groups of living organisms, as well as the reasons why certain species became extinct. What's more, we'll be able to do this for each and every geological era.”

There is one big problem, however. “The centre is in debt right now, and we need to make some money from our invention. We're considering commercial opportunities in the travel and tourism market.” A call for proposals has been issued.

Hearty congratulations to Mr. Tremblay and his team for their extraordinary work!

Call for proposals

The Centre for Geological Era Research is calling for proposals the produce an ad that promotes travel packages to other eras of geological time, by highlighting various significant aspects of these eras.

To be eligible for consideration, the ad must:

- target an era in the geological time scale
- cater to a target audience
- provide information in the ad relating to the following themes: fossils, groups of living organisms and species extinction
- provide at least five items of information about the chosen era

The review committee asks you to submit your ad together with a report explaining your choices.

Date received: _____

No proposals received after the closing date will be accepted.

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In this scenario, you are to play an employee of Geo-Time Audiencing, the successful bidder for the contract to produce advertising materials. See next page for information about the four target audiences.

Name: _____ Group: _____

THE PROJECT (*continued*)

Audience survey on Canadian tourists

1. Adventure tourists

These are young adults aged 18–34, mostly males (67%). They are thrill seekers and like exceptional locations.

Favourite activities:

- Mountain biking (58%)
- Rock climbing (34%)
- Scuba diving (25%)
- Whitewater rafting (21%)
- Ice climbing (6%)
- Dogsledding (6%)
- Hang gliding (1%)
- Wildlife viewing
- Wildlflower viewing

2. Fans of the great outdoors

These are adults in two age groups: 18–34 and 35–44. They prefer family-oriented sport activities.

Favourite activities:

- Hiking and backpacking (58%)
- Wildlife viewing (47%)
- Fishing (46%)
- Recreational cycling (38%)
- Kayaking or canoeing (37%)
- Golf (34%)
- Wildflower viewing (32%)
- Whale watching (25%)
- Bird watching (22%)
- Horseback riding (18%)
- Hunting (11%)

3. Winter sports enthusiasts

These are adults, mostly males, in two age groups: 18–34 and 35–44. They are interested in weekend travel packages.

Favourite activities:

- Cross-country skiing (47%)
- Snowmobiling (35%)
- Ice fishing (34%)
- Dogsledding (4%)
- Ice climbing (3%)
- Downhill skiing or snowboarding
- Hiking and backpacking
- Wildlife viewing

4. Food lovers

These are adults aged 46 years on average and mostly female. Thirty-nine percent of these tourists are also interested in outdoor activities.

Favourite activities:

- Dining in world-class restaurants (58%)
- Visiting a gourmet restaurant (29%)*
- Visiting a cooking school (3%)*
- Visiting a wine-tasting school (2%)*

* with accommodation on the premises

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Source of statistics: Canadian Tourism Commission. “Canadian Wine and Culinary Enthusiasts” [online] (accessed June 16, 2009).
Idem. “Canadian Winter Outdoor Activity Participants” [online] (accessed June 16, 2009).
Idem. “Canadian Soft Outdoor Adventure Enthusiasts” [online] (accessed June 16, 2009).
Idem. “Canadian Hard Outdoor Adventure Enthusiasts” [online] (accessed June 16, 2009).

Name: _____ Group: _____

CREATING THE CONTEXT

Use pages 312–313 in your student book to choose an era for your ad.

I ask myself questions

1. What is an ad?

2. What is a geological era?

3. What is the geological time scale?

4. Who is the ad for? Choose your target audience.

5. What questions could your ad agency consider for gathering information? Keep the themes in mind.

I must

6. State the goal of the project in your own words.

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Name: _____ Group: _____

CREATING THE CONTEXT (*continued*)

I think

7. How can you interest your target audience in the era you have chosen?

_____

_____

_____

8. What medium could you use to publicize your ad (e.g. brochure, slide show, brief video, poster)?

_____

What I know and what I must find out

9. Record the information you know and the information you need to find out.

What I know . . .	**What I must find out . . .**

I prepare my work

10. Where will you find the information to create your ad?

_____

11. What technologies are available for producing your ad?

_____

12. Name the principal stages of your work in chronological order.

1. _____
2. _____
3. _____
4. _____
5. _____

Reflection

	Yes	No
Do I clearly understand what I have to do?	☐	☐

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Name: _____ Group: _____

GATHERING INFORMATION

I do research

1. Do research to find plenty of information and pictures about your chosen era. Be sure to take account of the three themes, although you are not limited to them. Remember to cite the source of each item of information.

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Name: _____ Group: _____

GATHERING INFORMATION (*continued*)

I apply my research results

2. Write down your chosen target audience. Using the information in the *I do research* section, choose at least five items of information to put in your ad. Next, examine the audience survey and, if possible, match activities and items of information.

Target audience: _____

1. Item(s) about the era: _____

_____

_____

Activity: _____

2. Item(s) about the era: _____

_____

_____

Activity: _____

3. Item(s) about the era: _____

_____

_____

Activity: _____

4. Item(s) about the era: _____

_____

_____

Activity: _____

5. Item(s) about the era: _____

_____

_____

Activity: _____

Reflection

Do I clearly understand:	Yes	No
• the geological time scale?	☐	☐
• the major stages in the history of life on Earth?	☐	☐
• extinction?	☐	☐
• fossils and stratigraphic layers?	☐	☐

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Name: _____ Group: _____

COMPLETING THE PROJECT

I make suggestions

1. Draw up a plan for your ad.

a) What medium are you using to present your ad (e.g. brochure, slide show, brief video, poster)?

_____

b) Prepare your introduction.

_____

_____

_____

_____

_____

c) Rewrite your five items of information as catchy phrases that will captivate prospective customers. Rank the phrases by order of importance.

1. _____

_____

_____

2. _____

_____

_____

3. _____

_____

_____

4. _____

_____

_____

5. _____

_____

_____

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Name: _____ Group: _____

COMPLETING THE PROJECT (*continued*)

d) Find a slogan.

_____

e) What other elements will you include in your ad (picture, photo, etc.)?

- _____
- _____
- _____
- _____

f) Write the conclusion of your ad.

_____

_____

_____

_____

_____

2. Produce your ad. Make sure it looks appealing.

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Reflection

	Yes	No
• Have I considered several types of ads?	☐	☐
• Have I considered attention-grabbing ways to present the information?	☐	☐

Name: _____ Group: _____

VALIDATING THE PROJECT

I justify my approach

1. How does your ad cater to the interests of your target audience?

2. Have you used vocabulary suited to your target audience? Explain.

3. Does your ad emphasize the important aspects of the chosen geological era and also meet the desires of the target audience? Explain why you chose each item of information.

1.

2.

3.

4.

5.

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Name: _____ Group: _____

MY EVALUATION

Use the evaluation grid on the next page for your self-evaluation. Enter A, B, C, D or E in the appropriate space on this table.

SSC2 Makes the most of his/her knowledge of science and technology				
Criteria*	Observable indicators	Me	Teacher	Comments
1	**Creating the context** Definition of the goal and formulation of questions for information gathering		☐ With help	
2	**Gathering Information** Choice of information related to the themes or the selected era		☐ With help	
3	**Completing the project** Production of an ad; the ad itself		☐ With help	
4	**Validating the project** Justification of each item of information included in the ad		☐ With help	

*** Evaluation criteria**

1 Formulation of appropriate questions
2 Appropriate use of scientific and technological concepts, laws, models and theories
3 Relevant explanations or solutions
4 Suitable justification of explanations, solutions, decisions or opinions

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EVALUATION GRID

Name: _____ Group: _____

SSC2 Makes the most of his/her knowledge of science and technology

Criteria*	Observable indicators	A	B	C	D	E
1	**CREATING THE CONTEXT** Definition of the goal and formulation of questions for information gathering	The goal is very clearly defined. All of the questions relate to the themes or the target audience.	The goal is clearly defined. Most of the questions relate to the themes or the target audience.	The goal is defined more or less clearly OR a few of the questions relate to the themes or the target audience.	The goal is poorly defined OR the questions do not relate to the themes or the target audience.	The work needs to be redone.
2	**GATHERING INFORMATION** Choice of information related to the themes or the selected era	More than five correct items of information are chosen, and all of them relate to the themes or the selected era.	Five correct items of information are chosen, and most of them relate to the themes or the selected era.	Fewer than five items of information are chosen, and most of them relate to the themes or the selected era.	Fewer than five items of information are chosen, and few of them relate to the themes or the selected era.	The work needs to be redone.
3	**COMPLETING THE PROJECT** Formulation of the ad; the ad itself	All chosen information is included in the ad, and all of the statements are adapted to the target audience.	All chosen information is included in the ad, and most of the statements are adapted to the target audience.	Most chosen information is included in the ad, and a few of the statements are adapted to the target audience.	A few items of information are included in the ad, and a few statements are adapted to the target audience.	The work needs to be redone.
4	**VALIDATING THE PROJECT** Justification of each item of information in the ad	All information in the ad is justified in terms of the target audience or the selected era.	Most information in the ad is justified in terms of the target audience or the selected era.	Some information in the ad is justified in terms of the target audience or the selected era.	Little information in the ad is justified in terms of the target audience or the selected era.	The work needs to be redone.

* Evaluation criteria

1 Formulation of appropriate questions
2 Appropriate use of scientific and technological concepts, laws, models and theories
3 Relevant explanations or solutions
4 Suitable justification of explanations, solutions, decisions or opinions

Name: _____ Group: _____

INFORMATION DOCUMENTS

THE PRECAMBRIAN

The history of planet Earth began 4.6 billion years ago at a time when our planet looked nothing like it does today. Indeed, Earth was covered in molten lava, shrouded in toxic gases and relentlessly bombarded by meteorites. It slowly evolved over more than 4 billion years as it changed into a haven of life. That section of geological time is known as the Precambrian era.

Given the rarity of traces of living organisms from that era, we know very little about it. We do know, however, that the Precambrian witnessed the most decisive episodes and events in the geological history of our world. During the first 800 million years, the planet surface slowly cooled, changing from liquid to solid. The most ancient known rocks include some discovered in Greenland that back 3.8 billion years.

The cooling of Earth's surface signalled the formation of the oceans. For millions of year, atmospheric water vapour from countless volcanic eruptions condensed and fell to Earth as torrential rains. That deluge set the stage for the appearance of life.

The first living organisms were bacteria that developed in the hostile environment of the ocean depths. They lived in darkness near sources of hot water devoid of oxygen but rich in sulphur and metals.

Next, cyanobacteria bloomed on the ocean surface. These blue-green algae photosynthesized solar energy into chemical energy, useful to bacterial cells, while at the same time they released oxygen. Once that invaluable gas had spread and saturated the oceans, it rose into the atmosphere.

This explains the gradual buildup of oxygen in the atmosphere and finally the creation of conditions for the appearance of more complex life forms. Protists, rudimentary organisms such as unicellular algae, protozoa and yeasts, emerged 1.8 billion years ago. Protist cells were much better organized than bacterial cells. Their clearly defined nucleus was separate from the rest of the cell and contained the genetic material of the host organism. Such eukaryotic cells would eventually become the foundation for the living organisms of the four major kingdoms: protists, fungi, plants and animals.

After countless mutations, reproductive processes and natural selections, the first multicellular organisms appeared toward the end of the Precambrian era. Multicellular algae and the first soft-bodied marine invertebrates began to proliferate. It had taken 4 billion years for life to take hold.

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Name: _____ Group: _____

INFORMATION DOCUMENTS (*continued*)

THE PALEOZOIC

Life on Earth was thriving 543 million years ago. Virtually all animal phyla as we know them today existed at the time, while major biodiversification was taking place in terrestrial and marine ecosystems. This era is known as the Paleozoic, meaning "ancient life."

The Paleozoic is subdivided into six periods:

- Cambrian: This period commenced with the appearance of numerous hard-shelled invertebrates, the trilobites being the best known. The articulated parts of these invertebrates represented a giant step in the evolution of mobility. Although confined to the oceans, living organisms diversified and colonized as yet unoccupied areas. Developments were helped along by a milder climate and a higher oxygen content in the atmosphere and the oceans.
- Ordovician: The oceans were shallow but teeming with life. The period saw the appearance of the first vertebrates, the agnathans, which resembled today's fish but were jawless (their mouth was always open). The rigid skeleton of the agnathans was a true revolution enabling them to move around much more easily than the other marine organisms. The Ordovician period ended with the extinction of more than 60 percent of marine species. Although the causes are unknown, speculation points to the arrival of an ice age.
- Silurian: As the climate warmed again several million years later, primitive plant species invaded dry land. It was also then that the oceans gave rise to the first jawed fish, which were better equipped than their predecessors to catch prey.
- Devonian: This period is known as the "Age of Fish." Some fish ventured out of the water to explore dry land and their fins evolved into limbs. But there was much more to come. Plants developed extraordinary mechanisms to better colonize land, marking the emergence of the first seed plants.
- Carboniferous: This geological period is chiefly known for its vast forests of bark trees and sprawling marshlands. These systems eventually decayed and developed into the storehouses of coal that are still being plundered today.
- Permian: The megacontinent, Pangaea, formed during this period and encompassed all land above water. Pangaea was invaded by reptiles, which learned to lay shelled eggs and could therefore reproduce outside the water. It took little time for reptiles to supplant the amphibians. The Permian period ended with a mass extinction of species.

Many theories have been proposed in an effort to explain this cataclysm. It may have resulted from a dramatic drop in ocean levels, climatic deterioration, meteoroid impacts or intense volcanic activity. Whatever the reason, the Paleozoic era ended in the destruction of 90 percent of marine life and nearly 70 percent of land-dwelling species.

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Name: _____ Group: _____

INFORMATION DOCUMENTS (*continued*)

THE MESOZOIC

The Mesozoic era is well known as the age of the dinosaurs and other giant reptiles. These animals were by far the largest and most powerful ever to inhabit Earth. The era spanned 180 million years and witnessed the origins of the mammals and the breakup of Pangaea into our present-day continents.

Reptiles rule

Animal life emerged again 245 million years ago after the mass extinction event at the end of the Paleozoic. Reptiles diversified and formed two main groups: mammalian reptiles (ancestors of the mammals) and archosaurs. The archosaurs evolved and gave rise to dinosaurs, flying reptiles (pterosaurs) and crocodilians.

It was not until the Jurassic period some 40 million years later that dinosaurs became the largest animal group. After starting out as a few small animals, dinosaurs gradually formed many lineages, including brontosaurs (giant 30-tonne plant-eaters) and tyrannosaurs (the most impressive of all the carnivores at 15 m long and 5–6 m tall). Most of them ruled for more than 150 million years.

The mammalian reptiles were far less developed than the others, but nevertheless had some interesting characteristics, such as their teeth. Unlike the conical teeth of the archosaurs, the Lystrosaurus had teeth enabling it to chew plants efficiently. But despite such adaptation, mammals could never have developed without the mass extinction event that wiped out all the dinosaurs 65 million years ago.

Continental drift

Earth was all one continent at the dawn of the Mesozoic era. Pangaea, as that continent is known, later broke into two parts and then six parts. The resulting continents were much like those of today—North and South America, Africa, Eurasia, Australia and Antarctica. That breakup, which likely resulted from a monumental volcanic eruption, caused significant changes on Earth, including rising sea levels and the creation of climate zones. Indeed, the formerly uniform climatic conditions gave way to conditions corresponding to three distinct latitude zones: a glacial zone at the poles, a temperate zone near the tropics and an equatorial zone. These different climates are what made diversification of Earth's flora and fauna possible.

The Mesozoic era ended with yet another mass extinction. According to scientists, that extinction can be blamed on an impact from an enormous meteorite that slammed into what is now the Gulf of Mexico. A few dinosaur bones are all that remain from that natural disaster.

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Name: _____ Group: _____

INFORMATION DOCUMENTS (*continued*)

THE CENOZOIC

The dinosaurs are dead. Long live the mammals! After hiding out in trees and bushes for time on end, mammals were at last free to come out and really start living. And they have been multiplying and diversifying for the past 65 million years.

Mammals

Rudimentary in the beginning, mammals learned to survive by developing many distinctive characteristics. Unlike reptiles, they were warm-blooded, an advantage that helped them adapt to the climate zones. They also had a better digestive system and sharper senses. Even more important, they had more sophisticated methods of reproduction: most mammals used internal reproduction. With gestation of offspring inside the mother, eggs were shielded from other animals.

Mammals formed two lineages, known as placental mammals (having a placenta) and marsupial mammals (having a ventral pouch). Until Australia shifted away from the other continents, the two lineages lived side by side, with marsupials the dominant one.

The first Cenozoic period, the Tertiary, saw the appearance of the sabre-toothed tiger, the hyracotherium (ancestor of the horse) and the first large monkeys. Mammoths arrived later, about 4 million years ago.

Flowers and birds

While all this was taking place, flowering plants were invading the lands. They developed an original method of reproduction: they had both female and male sex cells and reproduced with the help of insects.

Birds, the only descendents of the archosaurs, multiplied during this time. Contrary to widespread belief, they did not descend from flying reptiles (pterosaurs), but from small running dinosaurs whose front limbs evolved into wings.

Hominids

The first hominids arrived on the scene about 4 million years ago. Australopithecus walked upright, carved stone and made fire, then became extinct about 2.4 million years before our time.

The first representatives of modern humans, Homo sapiens, showed up about 195 000 years ago. Their closest living relative is the chimpanzee.

Climate

The second Cenozoic period, known as the Quaternary, began 1.8 million years ago and was marked by 100 000-year climatic cycles. For 85 000 years, the temperature cooled very slowly to a glacial maximum. Then in the space of 15 000 years, the temperature climbed again to an optimum level, in zones where the temperature was warmest.

The last glacial maximum occurred about 21 000 years ago. The space now occupied by Montréal was covered in ice 2 km thick. That ice age ended 10 000 years ago. Thanks to their use of tools, humans were able to adapt and survive those times.

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