



Earth Science Education 2. Paleontology Summer Day Camps for Children

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SUMMARY

A multi-tiered program of week-long paleontology summer day camps is offered in Saskatchewan for children aged 8-12. These camps provide children with a background in earth science and an appreciation of life's history.

RÉSUMÉ

En Saskatchewan il existe un programme de camps d'été en paléontologie adaptés aux enfants de 8 à 12 ans et qui s'étale sur une semaine. Grâce à ces camps, les enfants peuvent acquérir des connaissances de base en sciences de la Terre et avoir une idée des grandes lignes de l'histoire de la vie sur la Terre.

INTRODUCTION

Dinosaurs have the power to evoke a sense of awe and wonder, especially in children. Most of us can recall, as children, having stared raptly at the dinosaur exhibits in a natural history museum, eventually to be forcibly removed by impatient parents. We use the children's interest in dinosaurs to introduce them to geology and biology in ways that are fun and exciting.

The paleontology summer camp project was developed to promote scientific literacy in children and to provide them with a background in earth sci-

ence that they are unlikely to receive in the public school system. The camps were initiated in the summer of 1998, with a pilot program of two introductory camps. The response was very encouraging, and both camp sessions quickly filled to capacity. The success of the pilot project was followed up in the summer of 1999 with another two introductory (level 1) sessions and an intermediate (level 2) camp. An advanced (level 3) camp is planned for the summer of 2000. By offering a multi-tiered program, children are able to return every summer for a continuing education. Each camp session runs for five days, from Monday to Friday, 8:30 am to 4:00 pm, and is limited to 13 children aged 8-12.

The camps are held in the Department of Geological Sciences at the University of Saskatchewan, where the children benefit from the associated natural sciences museum.

INTRODUCTORY PROGRAM

There are three components to the introductory camps: classroom lectures, lab activities, and field trips. The following topics are an example of some of the lectures given:

- Introduction to geological time, discussing the origins of the Earth and solar system, an overview of the development of the Earth, the origin of life, and the geological time scale.
- Fossilization processes, discussing modes of preservation, and preservational environments.
- The ethics of collecting, discussing the ethical issues involved in collecting fossils, an overview of the Saskatchewan Heritage Act, which governs fossil collecting in the province, and who to contact when fossils are discovered.
- A series of slide shows discussing ecology, behaviour, and evolution of several Mesozoic animal groups, including marine reptiles, pterosaurs, dinosaurs and birds.

In the lab, each child receives a piece of Cretaceous marine shale, which they dissolve in a container of vinegar. After several days the insoluble residue is dried and examined with hand lenses, and small fish bones and shark teeth recovered.

The field trips represent one of the most important aspects of the camp. Two trips are made to nearby Lake Diefenbaker to hunt for marine invertebrate fossils in the Cretaceous Bearpaw Formation, which crops out along the

shore. Fossil bivalves and cephalopods are very abundant and most students can find a few specimens. The depositional environment is discussed, and the children learn how to use the fossils to interpret ancient environments. They bring their fossils back to the lab for cleaning, and identify them by comparing their specimens with those in the natural sciences museum.

INTERMEDIATE PROGRAM

The second tier of the program is intended for students who have already completed the introductory camp. Most participants are children who attended the introductory camp the year before, but some are eager to take both camps in the same summer, so the intermediate program is offered after the introductory camps. The intermediate camp challenges the children by exploring subjects in greater depth. As in the introductory camp, the program consists of lectures, lab activities, and field trips.

A series of lectures introduce children to the history and development of paleontology. They learn about many of the pioneers of the science, such as Gideon Mantell, Georges Cuviers, Edward Cope, Othniel Charles March, Charles Sternberg, *etc.*, as well as some contemporary paleontologists. By studying the history of paleontology, the students gain a sense of connection with the science and learn the valuable lesson that even the best scientists are only human and often make mistakes.

Lectures on comparative anatomy introduce the students to vertebrate skeletons. They learn to identify various bones of the skeleton, how to infer the animal's ecology from its bones, and how to distinguish amphibians, reptiles, birds and mammals. A brief overview of the evolutionary history of the vertebrates is also discussed, focussing on concepts such as skeletal adaptations to life on land, and the skeletal transition from reptile to bird. The evolution of horses is discussed as an example of adaptation to a changing environment.

Another lecture and slide show provides an overview of the animal phyla. Particular emphasis is placed on marine invertebrates commonly found as fossils. This is followed up by a visit to a marine invertebrate aquarium in the geology department's natural sciences museum. The students examine fossils representing the phyla discussed, including sponges, rugose, tabulate and

scleractinian corals, trilobites, brachiopods, bryozoans, bivalves, gastropods, cephalopods, graptolites and echinoderms. The children draw and label specimens from each group and identify the phylum to which they belong.

One of the field trips is to the Royal Saskatchewan Museum of Natural History in Regina, where in addition to visiting the exhibits, the children get a tour of the museum's collections and preparation facilities and get to talk with curators and preparators.

The second field trip involves the excavation of buried cow bones, and ties together everything that has been learned so far (Fig. 1). The bones (which can be obtained from butcher shops or farmers) were buried in a sandy bank on the South Saskatchewan River, and the students excavated the skeleton by carefully uncovering, then pedastalling and plastering the individual bones. The children learned the importance of recording the provenance of each bone by maintaining an accurate site map, numbering each bone as it was uncovered.

FUTURE ACTIVITIES

Based on the success of the basic and intermediate camps during the past two summers, an advanced camp is in the planning stages. This camp will likely involve a three-day fossil-hunting trip in the Lake Diefenbaker area based out of a nearby field research station operated by the University of Saskatchewan. The goal of this camp will be to have the children make a representative collection of the fossil fauna in the area, then identify and describe the fossils and, we hope, publish their results as a series of articles in the Saskatchewan Natural History Society's journal, *Blue Jay*. A project of this scope is beyond the time available in a week-long camp, so the research and write-up stages of the project will continue in the autumn in a Saturday or Sunday afternoon Paleontology Club. This will provide the children with a rare and exciting opportunity to conduct a real research project from beginning to end, and learn first-hand what paleontologists really do.

KEYS TO SUCCESS

We have found that including a variety of activities is essential to maintaining the student's interest and enthusiasm throughout the entire day. One of the activities we devised was an outdoor



Figure 1 Students in the intermediate camp excavating cow bones on the shore of the South Saskatchewan River.

game called Raptor Attack, which is a tag game that teaches predator-prey dynamics. It is played in a field with safe zones (watering holes) at either end. Two players are velociraptors, and take positions in the middle of the playing field. The remaining students are hadrosaurs and begin at one end of the field in the safe zone. The object is for the hadrosaurs to cross the field to the watering hole without being tagged by a raptor. Each raptor is allowed to tag only one hadrosaur per round. If they fail to tag a hadrosaur they starve and become a hadrosaur on the next round. Hadrosaurs that are tagged are eaten and become raptors on the next round. As the raptor population grows, the hadrosaur population declines until there are not enough hadrosaurs to feed the predator population. This results in a sudden decline of the predator population due to starvation, and a subsequent rebound in the hadrosaur population. This game is one of the most popular activities in the camp, and the children gain an appreciation of population control mechanisms in nature. After a long game of Raptor Attack, the children are tired and ready for a quiet slide show.

Field trips are also a popular component of the camp. Unfortunately, the closest fossiliferous outcrops are at least an hour and a half drive from Saskatoon. To help the travel time pass more quickly we provide dinosaur books and magazines for the children to read in the van.

The children in the 8-12 age group have an attention span of about 1-1.5 hours. By maintaining a balance of classroom lectures, lab exercises, and outdoor activities, the children are able to remain focussed and attentive through the whole day.

IMPACT

The feedback we have received from the children and their parents has been very encouraging. Many parents have mentioned that rather than becoming tired of dinosaurs after having been to the camp, the children are more enthusiastic than ever. We were amazed at how much information children can absorb and retain when they are interested in the material. In the first year we were afraid that some of the lectures might be too detailed for children so young. On the contrary, they could have been even more detailed, and we have found that the children are able to comprehend university-level subject matter with

ease. Many of the students in the intermediate camp commented that they preferred the more challenging activities and advanced lectures to those of the previous year.

With the opportunity for continuing education that the multi-tiered program offers, the children's passion for paleontology grows each year, as their interest is nurtured, rather than ignored and allowed to diminish. We hope the camps will promote a lifelong interest in earth science and may encourage some children to pursue careers in science. Several of the older students, who will enter high school in another year, have expressed an interest in geology and paleontology as a career and have asked what classes they should take and what they can do to prepare for such a profession. The opportunity to serve as role models for young students and to encourage and direct their interest has been the greatest reward in offering these programs.

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