Introduction

There are a number of unique things about this CREST Activity Book. First, this book was made possible by a National Science Foundation Teacher Enhancement Program grant that was made to a state agency, the Maine Geological Survey. This grant has enabled the Maine Geological Survey to channel the talents and research data from a variety of State and Federal natural resource agencies into creative and informative curriculum products. Private sector contributions have been included through various intern sponsorships.

Secondly, this book is eclectic in approach; we have taken materials from many sources without bias towards so called learning styles and pedagogy. Hopefully there is something here for everyone and materials have been included that will challenge a wide range of ability levels in a variety of learning situations.

Finally, and perhaps most important, this book was written by Maine teachers, for Maine teachers to use in the education of Maine students. While the primary audience is composed of Maine teachers and students, the materials and concepts encompassed by this book would be useful in almost any introductory study of the earth sciences.

The book is not complete; each group of CREST interns will be adding their lesson plans to the book over the next two years. Teachers are encouraged to arrange these materials in the Activity Book to meet their own needs and teaching strategies.

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Walter Anderson
James Barden
Jack Biscoe
Donna Casavant
Grant Connors
Steven Dickson
Herbert Dobbins
Thomas Easterly
Michael Foley
Lauren Foster
Kevin Godsey
Dick Hartford
David Hersey
Tim Hupp
Robert Johnston
Thomas Keller
Joseph Kelley
Alan Lane
Daniel Locke
David Locke
Marc Loiselle
Ernest Marshall
Joseph Martin
Robert Marvinney
Patricia Millette
Craig Neill
Chris Palmer
John Poisson
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To the Teacher:

The rationale for a citizenry well educated in the earth sciences is as close as the newspaper headlines. With stories of global warming, floods, earthquakes, pollution, volcanoes, and war over dwindling mineral resources, we are constantly reminded of the vital link between ourselves and our planet. To educate our children effectively about this link we need to weave together four strands of learning in terms of their experiences. These four strands are a deep and profound appreciation of the earth, factual knowledge about the earth, scientific thought and discipline as it applies to the earth, and a sense of responsibility for the earth. All of these will play a crucial role in how well our students will handle their tenure as custodians of the planet.

There is much truth in the old adage "What I hear I forget, what I see I remember, what I do I know." With kit based experimental science rapidly becoming the vogue in elementary education, it will be but a few short years before secondary school teachers routinely get large numbers of students who are used to DOING things in science. These students should be especially receptive to the activities, exercises, and open-ended questions included in this book. It is the overall objective of each activity listed in this book to involve the student, actively, in one or more of the above strands in an experiential fashion. A number of activities may warrant repetition during the course of the year. Teachers should select, modify, and augment those activities which meet the particular needs of their students.

As supplies permit, students should work either singly or in small groups. All students should be strongly encouraged to be doers. The situation where one student manipulates the equipment or materials and the other student is the "recorder" often becomes a habit for both students, which ultimately has a detrimental effect on their education. One activity can often lead to another. Once students have tested the local pond or stream for dissolved oxygen, they often want to do phosphates, nitrates, and carbon dioxide. This can easily take several weeks. Individual teachers will have to determine how far a series of activities will go, and how long they will take.

You will notice frequent and sometimes seemingly trivial references to safety procedures, techniques, and precautions. While these may seem like common sense to an adult, many students will be doing some of these things for the first time. Getting hurt during an activity is negative reinforcement at its strongest. Teachers are

encouraged to make safety issues a routine part of instruction and may wish to have students sign a safety contract - see Flinn Scientific Co. catalog for sample contracts and other safety related materials. All teachers should insist on immediately being informed of any student having an accident.

The format for each activity consists of teacher pages and student pages. The student pages can be used in a number of fashions; one rather appealing one is that of a log or journal that provides the students with a written account of their activities over the course of the year. Follow up activities are suggested for those who wish to extend either the range or depth of the topic. All pages may be duplicated for classroom use.

It is hoped that this activity book will continue to grow, evolve, and serve an ever widening circle of teachers. If this is to happen, we will need your feedback and suggestions for future editions. Comments and suggestions of all kinds are solicited and may be directed to CREST at the address in the front of the book.

Supplies, Sources, and Storage:

An adequate amount of supplies is vital to any successful activity. Group work where there is one "widget" for every 5-6 students is not only unproductive academically; it undermines the whole process of education. It in essence tells the student "This isn't really important; there isn't a widget for you." Most of the activities in this book are designed to be done by students working in pairs. Supplies can be calculated accordingly.

It is obvious that supplies cost money and need storage. Improperly stored materials send another message to both students and administrators that most teachers really don't want to send. The following table lists a number of suppliers of specialty items; many materials needed for these activities can be obtained locally. Intrepid teachers with the time and energy can often obtain most of the required rock/mineral/ soil/water samples needed by doing some intensive field work. It is more than appropriate to involve students in these collection building activities.

In some cases, apparatus can be constructed out of locally available materials for a fraction of the cost of a "professional" model. Where appropriate, plans and directions

for such constructions are provided. Again, student assistance can be invaluable as well as providing an excellent learning opportunity for the student.

Functional storage of materials provides for the following: security of the materials, easy access to the materials, minimal disruption of the classroom, and, additionally, storage should occupy the least amount of space possible for the given amount of material needing storage. If you have access to a separate store room with floor to ceiling steel shelving your problems are probably solved; if not, the following options offer excellent alternatives.

1. There are a number of sturdy plastic bins with hinged lids available on the market. These come in a variety of shapes and sizes. They make excellent storage units; many are nested, stack easily, and will accept writing in many types of markers. These are available at a nominal cost; volume buyers can usually get a discount.
2. The standard container for shipping grapes is a box with wooden ends and a wooden/cardboard laminate on the sides and bottoms. It measures 17 x 13 x 6 inches and one box will easily hold fifty pounds of earth science materials. The boxes stack nicely and the wooden ends accept a variety of types of labels. An array of grape boxes 6 feet long and 30 inches high would consist of 20 boxes, contain 9 cubic feet and store up to 1000 pounds of materials. Grape boxes are usually obtainable at no cost from the produce departments of the larger supermarkets.
3. Excellent plastic trays with lids are often available from the meat/fish counters of larger supermarkets. Odors can be removed by letting the tray soak in Clorox overnight. One gallon of Clorox will do many trays. They are approximately 15 x 9 x 3 inches in size.

The following suppliers are all excellent sources for basic earth science education materials and supplies. Additional and local sources as well as suppliers of more esoteric items are detailed in APPENDIX A.

Ward's Natural Science Establishment

Ward's is the leading supplier of rock, mineral, fossil, and process samples in the United States. They also have an impressive list of AV materials, collecting supplies, and specialized equipment.

Flinn Scientific, Inc.

Flinn Scientific is a premier distributor of reagent grade chemicals. Their small quantity packaging systems and special attention to safety considerations makes them an ideal choice for teachers. Free catalog and educational materials.

LaMotte Chemical Products Company

This company produces the best in soil, water, and air pollution test kits. Their micro titration kits are rugged, easily used, and give professional results as well as being very reasonably priced. Excellent source for water testing materials of ALL types.

Hutchinson Bag Corporation

An excellent source for specimen collecting bags in a range of sizes from 3.5 x 5 to 17 x 28 inches. These bags have draw-strings and label tags attached and are machine washable for repeated use.

Maine Geological Survey

A local source for maps and geologic publications of all sorts, the staff is also available to answer questions and provide information. Some free materials.

United States Geological Survey

The source for all publications sold by the USGS. Provides lists of publications.

John Wiley & Sons, Inc.

Publishers of all types of geological books on every conceivable topic, their books are well written and are standards in the literary field.

Ben Meadows

An excellent source for all kinds of more specialized field equipment. They have an excellent selection of compasses, tapes, transits, magnetometers, geiger counters, field notebooks, sampling gear, and marking/staking materials.