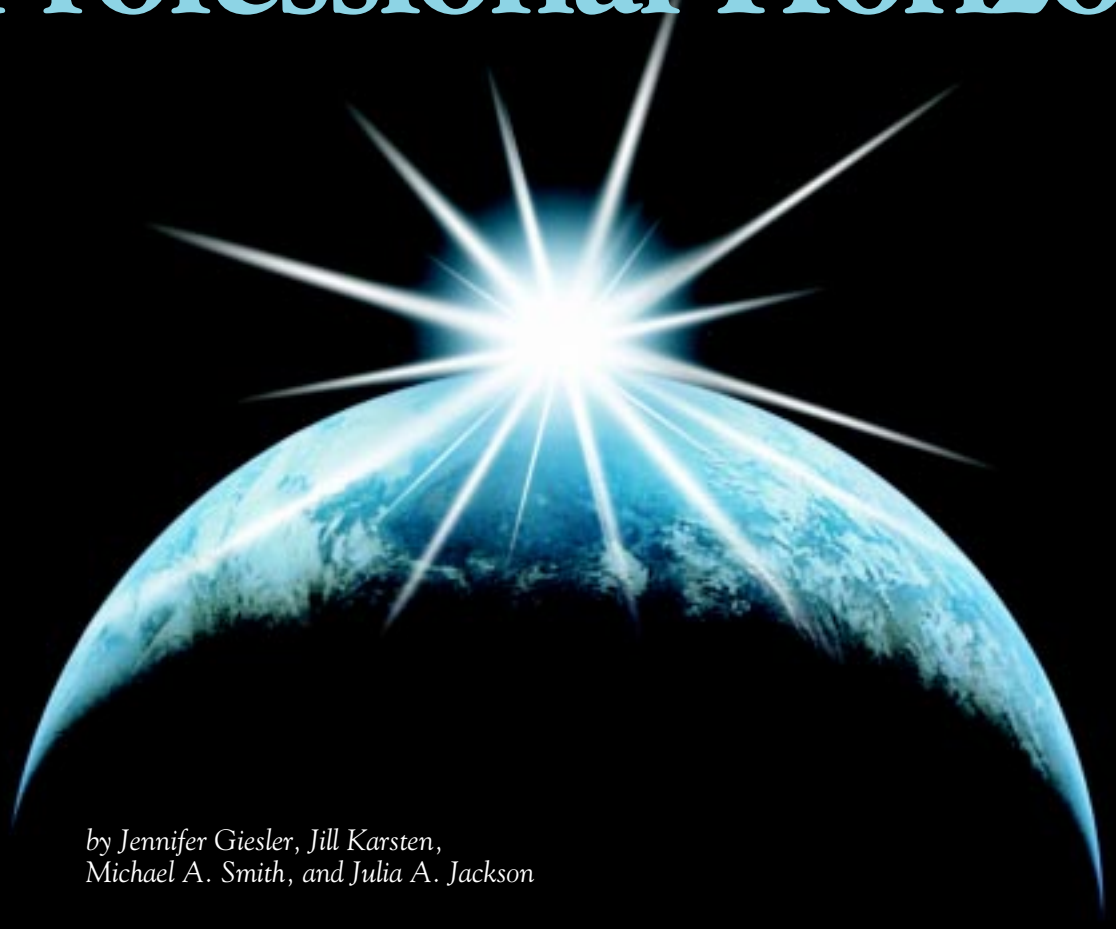
Expanding Students' Professional Horizons:



by Jennifer Giesler, Jill Karsten, Michael A. Smith, and Julia A. Jackson

Here's a quick quiz: What do people who study erupting volcanoes, the bottom of the ocean, hurricanes and tornadoes, raging rivers, and the solar system and universe have in common? They are all geoscientists. What do energy resources, sustainability, global climate change, water quality, coastal erosion, natural hazards, and solar flares have in common? They are all major issues affecting society that are best addressed with policy decisions made by people who understand the geosciences. What do the American Geophysical Union (AGU), American Geological Institute (AGI), and NSTA have in common? They are all professional societies that work hard to provide the best science education to our nation's students to prepare them for playing productive roles in tackling geoscience-related problems that confront modern society.

A View from the Earth and Space Sciences

As this month's insert demonstrates, geoscientists have careers that are exciting and rewarding. The world is their office and their jobs take them to extremes! Earth and space scientists study water, Earth, space, air, and life. They examine each of these components and strive to understand how they interact as part of complex, integrated systems that control the weather, climate, physical environment, and ecosystems that affect our daily lives—so the work of geoscientists has significant impact on non-scientists as well.

Exploring geoscience careers

Careers in the geosciences range from teaching and conducting research in schools and universities, to working in government labs, industry, and consulting firms. Geoscientists commonly work in teams and they enjoy teaching others the wonder of the geosciences.

Whether teaching students about the wonders of planet Earth, conducting experiments in the field or laboratory with sophisticated instruments, or presenting research results at international meetings, a day in the life of a geoscientist is generally diverse and stimulating. Not surprisingly, job satisfaction is extremely high in these fields. As one geoscience graduate said in a recent survey "I love what I do 24 hours a day, 7 days a week, and 365 days a year!"

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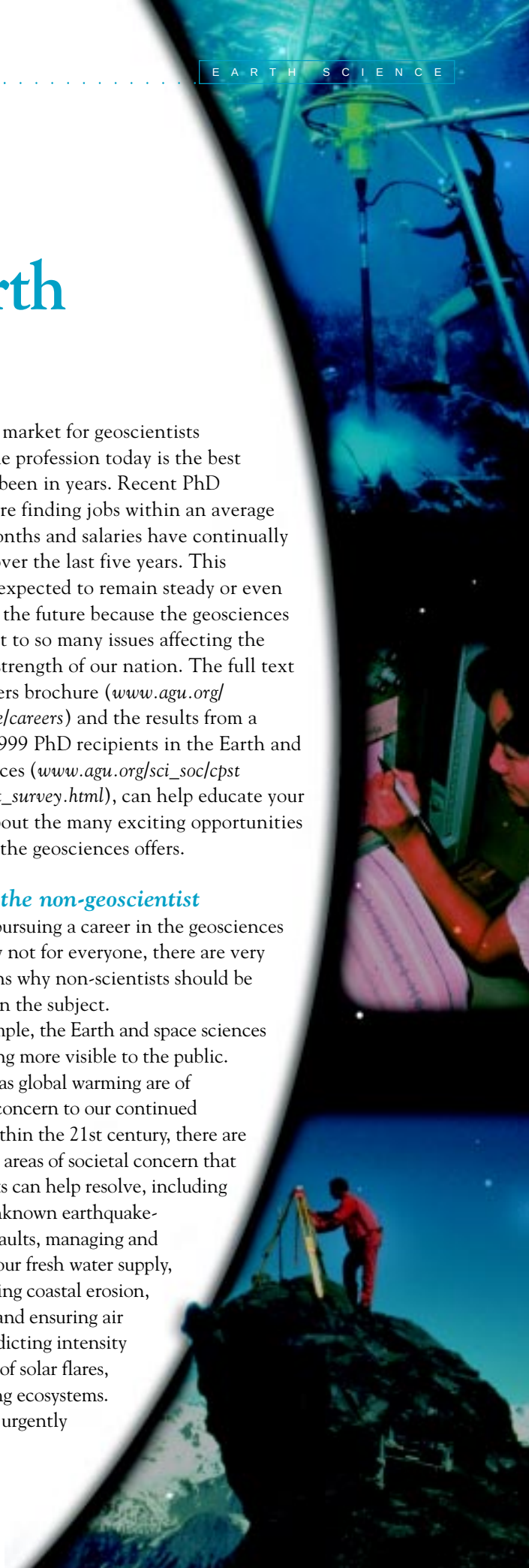
The job market for geoscientists entering the profession today is the best that it has been in years. Recent PhD graduates are finding jobs within an average of three months and salaries have continually increased over the last five years. This demand is expected to remain steady or even increase in the future because the geosciences are relevant to so many issues affecting the economic strength of our nation. The full text of the careers brochure (*www.agu.org/earthinspace/careers*) and the results from a survey of 1999 PhD recipients in the Earth and space sciences (*www.agu.org/sci_soc/cpst employment_survey.html*), can help educate your students about the many exciting opportunities a career in the geosciences offers.

Tools for the non-geoscientist

Although pursuing a career in the geosciences is obviously not for everyone, there are very good reasons why non-scientists should be interested in the subject.

For example, the Earth and space sciences are becoming more visible to the public. Issues such as global warming are of increasing concern to our continued welfare. Within the 21st century, there are many other areas of societal concern that geoscientists can help resolve, including mapping unknown earthquake-producing faults, managing and protecting our fresh water supply, understanding coastal erosion, improving and ensuring air quality, predicting intensity and timing of solar flares, and restoring ecosystems. Our nation urgently



EARTH AND SPACE SCIENCE CONCEPTS ARE SO DIVERSE AND INTERDISCIPLINARY THAT THEY OVERLAP WITH BIOLOGY, CHEMISTRY, PHYSICS, AND MATHEMATICS.

needs to train students with enough scientific literacy about geoscience topics that they can make informed and wise policy decisions that will affect future generations, as well as ourselves.

The geosciences also offer an excellent tool for teaching math and other scientific disciplines at all pre-college grade levels. Earth and space science concepts are so diverse and interdisciplinary that they overlap with biology, chemistry, physics, and mathematics.

The geosciences, therefore, can offer a compelling and, in many ways, more tangible vehicle for illustrating fundamental principles found in these other courses.

Biology concepts, such as photosynthesis and food chain pathways, could be taught within the context of shallow marine or hydrothermal vent ecosystems. Hydrothermal vents create a unique habitat that supports a variety of organisms that must live without light; their exotic lifestyle and appearance will motivate students to learn more.

Thinking about the formation of the planets and the Sun can enliven discussions of the periodic table of elements.

The intensity of hurricanes and tornadoes provide powerful examples of some basic physics concepts such as centrifugal force, inertia, and pressure.

The enclosed brochure contains compelling examples that should excite and intrigue students about the concepts of the geophysical sciences and their relationship to the other sciences.

Resources for teaching geoscience

There is an increasing need for Earth science teachers at the K–12 level who can help students become aware of our science, the diversity of opportunities, the excitement of working in the field, and the enjoyment of traveling to field sites and meetings.

Unfortunately, undergraduate enrollment in the geosciences has steadily declined in recent years. Many students are not exposed to the geosciences in middle or high school and their first opportunity to take a course is at the university level, often after they already have declared a major.

However, this trend is changing, as many states have revised their learning frameworks to align with the *National Science Education Standards*, which call for Earth science throughout grades K–12.

The geoscience education community is also working to create an Advanced Placement course and exam in Physical Geology (for more information, see *www.collegeboard.org/ap/newsubjects/geology.html*). Until these incentives for encouraging students to pursue the Earth and space sciences at the K–12 level are fully implemented, students interested in biology, mathematics, physics, and chemistry are perfect candidates for careers in the geosciences.

AGU, AGI, and NSTA are working to build tools and programs to communicate the geosciences to the K–12 community.

AGU (*www.agu.org*) has been working for 75 years to advance understanding of the Earth and its environment in space and make the results available to the public. Its 39,000 scientist and student members are actively engaged in the areas of atmospheric sciences, hydrology, volcanology, seismology, geochemistry, oceanography, planetary sciences, biogeosciences, geophysics, and space physics.

AGI (*www.agiweb.org*) is a nonprofit federation of 37 geoscience and professional associations that represent more than 100,000 Earth scientists. Founded in 1948, AGI provides information services to geoscientists and plays a

role in strengthening geoscience education and enhancing public understanding of this field.

AGU and AGI offer a suite of education-related opportunities that can enhance the teaching of science in the K–12 arena.

For AGU these include Geophysical Information For Teachers (GIFT) workshops that bring teachers and scientists together at our national meetings; sponsorship for geophysical science speakers at the NSTA meetings; and tutorial sessions at national meetings will be offered starting in December 2001. These sessions will highlight recent research results and present the materials at a K–12 level. Additionally, AGU will soon be launching a major geoscience outreach website, which, among other things, will provide biographies of geoscientists and information about cutting-edge research discoveries.

For AGI, these resources include awards, curriculum materials (EarthComm for high school and Investigating Earth Systems for middle school), and teacher professional development and leadership programs to support the teaching of Earth science through inquiry. Further information about AGI's programs for teachers is available at *www.agiweb.org/education*.

AGI also spearheads Earth Science Week each October. AGI works in conjunction with government and corporate sponsors and professional scientific societies to produce this program that is devoted to increasing the public's awareness of the Earth sciences. Teachers can obtain free teaching resources (an Earth Science Week kit) by visiting *www.earthscienceworld.org/week*. In addition, AGI has produced videos, CD-ROMs, and websites devoted to careers in the geosciences. Teachers can use these multimedia products in their classrooms (see *www.agiweb.org/career*).

These programs overlap and augment those currently being offered by NSTA. In particular, the new National Science Teaching Institute and Building a Presence for Science Initiative offer excellent tools for bringing the geoscience research and K–12 science teaching communities together. We hope to encourage continued interaction between AGU, AGI, and NSTA and develop additional ways to combine our resources to improve geoscience education.

It is likely that scientists will continue to debate and research the future of Earth's climate, natural hazards, and resource issues for some time. One thing about which there is no debate is that you, the K–12 science teachers, are on the front line in improving scientific literacy. We salute you in those efforts and look forward to finding productive ways to bring the geosciences to you and your students.

Okay, final question on the quiz: What do outstanding teachers, dedicated professional societies, Earth and space science, and important scientific issues confronting society have in common? Together, they are the ingredients that can lead students to exciting and rewarding career paths and wise policy decisions to manage our resources and environment.