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Michael A. Gibson

University of Tennessee at Martin, mgibson3@utm.edu

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RESEARCH ARTICLE

The history of the Tennessee Earth Science Teachers (TEST)

Michael A. Gibson*

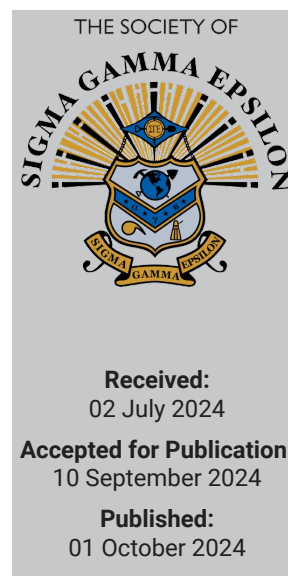
Department of Agriculture, Geosciences, and Natural Resources, The University of Tennessee at Martin,
256 Brehm Hall, Martin, TN 38238 USA

ABSTRACT

Tennessee Earth Science Teachers (TEST) was founded in 1990 to promote awareness of the need to integrate Earth science and geology education into the secondary school curricula of Tennessee and to ensure that Tennessee students received the curricular and instructional benefits of Earth Systems education. That mission expanded to include all K-12 grades and to infusing Earth science into other disciplines. A legacy of the participants from a 1991 Tittle II geology workshop for Tennessee teachers, TEST was instrumental in designing and providing academic and pedagogical training, disseminating educational materials, and with networking K-12 teachers with higher education geoscience educators across Tennessee for over 34 years.

KEYWORDS

TEST, Tennessee Earth Science Teachers, Geoscience education, Standards, Professional Development



WHY IS THE NUMBER OF GEOLOGY MAJORS DECLINING IN TENNESSEE?

This was the question being asked by Tennessee geology professors around the state, including when they met for the annual GeoConclave competitions (see [Haroldson and others, 2020](#), and [Gibson and others, 2021](#), for an explanation of GeoConclave). Geology programs had been seeing declining enrollments in classes and a reduction in the number of majors in the late 1980s, partly as a result of the oil boom and bust earlier in the decade. Many departments resorted to offering courses like “dinosaurs” or “planetary geology” to attract new students. While a number of causes for lowered enrollments were recognized (e.g., declines in departmental funding, oil and gas boom and bust, neglect by administration, retiring faculty, etc.), a common cause identified by all was that geology (and Earth science in general) in Tennessee was an “unknown” to most college students, primarily because they were not exposed to a course during their high school years. To satisfy college science distribution requirements, most students tended

to take the sciences that they had been exposed to in high school—biology, chemistry, and sometimes physics—and avoided geology as an unknown entity. The result was that college-level geology courses, and the potential to major and to have a career in the geosciences, was being missed by most college students. A corollary observation to this was that many of the students who wandered into geology courses did so in their junior or senior year when they were already too far along into a degree program to warrant changing majors without staying on longer to graduate, spending more (if their student loan agencies would even grant them the extended time). The lament “if I had only known about geology earlier” was commonplace with the students who discovered geology too late in their academic careers.

WHY ISN'T GEOLOGY AND EARTH SCIENCE STANDARD IN PUBLIC EDUCATION IN TENNESSEE?

This was the question that was being asked by geology professors and many Tennessee teachers during the late 1980s and early 1990s, even as the news was filled with stories

* Corresponding author: mgibson3@utm.edu

about “our failing schools,” and at the same time as natural disasters were headlining. Tennessee was consistently ranking in the bottom half of student testing nationally (e.g., [OERI, 1997](#)). Data supplied by the Tennessee Department of Education indicated that fewer than 20 schools in Tennessee taught either Earth science or geology courses at the high school level in the middle to late 1990s, most of these in urban areas of East or Middle Tennessee. Why was geology and Earth science not prevalent in high schools was a question being asked nationally as well (e.g., [Holbrook, 1997](#)).

WHAT TENNESSEE TEACHERS TOLD US

The author, and Don Byerly, a colleague from the University of Tennessee, Knoxville used a series of grant-funded “GeoCamps” to solicit information directly from Tennessee teachers regarding the status of K-12 Earth science and geology education as well as provide professional development opportunities. As part of these professional development opportunities, teacher discussions concerning Earth science and geology curricula in Tennessee were frequent. Early on, the authors detected strong frustration among the participants regarding the status of Earth science in Tennessee. A few illustrative examples demonstrate some of the issues that the teachers faced.

“Greene County no longer offers Earth science. I am the only high school out of four in [the] county that offers geology. Technical path students will now take environmental science as this course has some standards that are the same as biology – for example “diversity” (Virginia Cooter, Greene County teacher, personal communication, 1990). “Earth science has been dropped from the entire Clarksville-Montgomery County School System curriculum. It has been decided that since Algebra I, Language Arts I, and Biology I have Gateway tests that must be passed, why should we spend any more time on other subjects. It is no longer important in Tennessee for a person to know about tornadoes, lightning, minerals, rocks, soils, earthquakes, volcanoes, topographic maps, etc. As long as you live in Montgomery County, I guess you will be protected from these things if you can dissect a frog, conjugate a verb, and find figure X. I have been fighting this for seven years, but it has done no good. I even had a job interview for an Earth science [teaching] position. When I go there, the guy said that he didn’t know why he bothered to have me come in – he wasn’t going to offer the subject at his school. (Clarksville teacher Mary Ann Stephens, personal communication, 1990).” “Earth science was dropped from

Campbell County’s high school curriculum at least 10 years ago. As far as I know, the only Earth science taught is as part of the general science curriculum at the middle school level. My Geology class is frequently not offered because we don’t have enough science teachers and the administration gives me reasons like: ‘Earth science ... is too low-level of a course’ or ‘we don’t have enough labs’ or, my favorite, ‘it doesn’t count as a science credit.’ Luckily, this year I am teaching chemistry and am threatening, cajoling, pleading, browbeating, etc. my students to sign up for geology as their 3rd science credit. So maybe next year!” (Campbell County teacher Jo Stout, personal communication, 1990).

WHAT WERE THE IDENTIFIED PROBLEMS WITH GETTING EARTH SCIENCE OR GEOLOGY IN HIGH SCHOOL

Again, using teacher workshops to get access to teachers, several issues were identified as hurdles to initiating Earth science courses in Tennessee. First, biology had historically held the influential “lead” science position within K-12 curricula. Often more than one year of biology is offered (e.g., Biology I and Biology II), so it had become the primary pathway for most students to navigate satisfying their science requirements for graduation. Chemistry and physics courses were more analytical, required a more mathematical mind, usually had prerequisites, and were considered more difficult, thus had fewer students enrolled in them; however, there were more certified/endorsed chemistry and physics teachers available to hire than Earth science teachers. These three courses, the “PCBs” (physics, chemistry, biology), held the monopoly on what could be offered in most school systems across the state, especially rural systems. Importantly, this had been the case for a long time, possibly dating back to the education reforms of the 1960s and 1970s and the Earth Science Curriculum Project (ESCP) programs, when Earth science became a “freshman” level offering nationally ([Byerly and Gibson, 1999](#)).

This historical inertia resulted in tight curricula that were well-ingrained. Teachers wanting to add an Earth science or geology course at the secondary level were told that there was enough time (in teacher scheduling or in the student’s academic plan) for more science in high school (3–4 courses are the maximum usually), and there were not enough students to populate new courses. There also appeared to be a bias towards physics, chemistry, and biology as being better recognized, hence were more strongly promoted in

high school (the “PCB Syndrome”). Many teachers reported their administrators, or even parents, as saying that Earth science or geology was not relevant, or worse, a remedial science (e.g., “rocks for jocks”). Our teachers also confirmed that their students were more likely to take the same science in college that they had in high school.

It also appeared that poor guidance-counseling was part of the problem as there was a general perception that there was greater job potential and more employment opportunities available in other science disciplines. In many cases, echoing a national trend, Tennessee teachers said that their counselors just did not have an awareness of what the Earth sciences and geology entailed (e.g., [Holbrook, 1997](#); [Van Norden, 2002](#)). Another “catch-22” hurdle was that most existing Tennessee teachers were not certified or endorsed to teach Earth science or geology, so even when the opportunity arose in a school, there was no one qualified or endorsed who could teach the course, and resources were not available to hire new teachers for just one or two classes.

HOW TO COUNTERACT THE HURDLES

Higher education, specifically universities with geology departments, needed to be part of the solution, as it was to their benefit from a recruiting standpoint to help solve the issues. This was during the time, nationally, that geoscience education, and geoscience education research, was “coming of age,” but was still not considered valuable science research to the level that basic geologic research was, especially at Tier 1 research institutions. Many of our university colleagues said that geoscience education work and research was admirable service to do, and necessary, but that they did not have the time to undertake this task, nor did most feel that this type of work would be regarded as highly to their administrators, who were evaluating them for promotions and tenure decisions.

Based upon the discussions with Tennessee K-12 teachers, we concluded that the most efficient way to get Earth science or geology courses into an already full Tennessee school curricula was to find an existing teacher, usually a biology or chemistry teacher, willing to offer a single geology or Earth science class as a special section in their school (often without remuneration, perhaps as an advanced class for science club students or honor students) and then allow popularity of the topics to win over the students, parents, and administrators, to ensure the course continued.

One avenue for achieving this could be the Dual Credit (DC), or Dual Enrollment (DE), programs being offered; however, there were virtually no Earth science or geology DC or DE courses in Tennessee at this time (nor was there an exit exam for the DC courses). These pathways had other unique stumbling blocks and our goal was to get Earth science to be a regular curriculum for all high school students, not just advanced students. Additionally, who would teach the DC or DE course? DC and DE teachers had to be trained and certified or endorsed to teach Earth science, and few were. Finally, there were concerns that end of course assessment scores earned would not be high enough to allow students to use a high school geology course for college credit. Additionally, DC and DE could only be applied to colleges that had geology as a science, which not all colleges do.

Getting more Earth science or geology classes into Tennessee schools seemed, to us, and to the teachers with which we were working, to be our best avenue for success. We recognized that there were several potential impediments to our proposed approach including (1) finding teachers interested in adding Earth science or geology to their curriculum, (2) identifying school systems whose administration would be receptive to the new course, at least on an experimental basis, (3) guaranteeing that the teachers had the necessary content knowledge to teach Earth science or geology, and (4) ensuring that these courses were using the most current pedagogical methods, which at this time was inquiry ([Gibson and Byerly, 2024](#), this volume). Our solution to these impediments was first to network existing Earth science teachers in Tennessee, and to then establish a dedicated communication and interaction with this population. We felt that this could be accomplished through a regular long-term content-rich professional development program.

TENNESSEE EARTH SCIENCE TEACHERS (TEST)

In 1990, Don Byerly from the University of Tennessee, Knoxville obtained Eisenhower Title II funding from the state of Tennessee to run a professional development workshop entitled “Field-Oriented Geology Workshop for Secondary School Science Teachers.” Twelve teachers, primarily from East Tennessee, participated in two weeks of travel across the state of Tennessee studying the geology of each physiographic province, collecting mineral, rock, and fossil specimens for classroom use, and developing lesson plans for their students. The workshop was repeated in 1991.

As part of the workshop, the teachers were tasked with finding ways to promote Earth science teaching in Tennessee and to continue their personal investment in teaching Earth science. Publicity and communication were recognized as essential, so one of the requirements of the teachers in these workshops was to attend the annual meeting of the Tennessee Science Teachers Association (TSTA), which originally had been established in 1975 as the Science Association of Tennessee, and is the primary state-level science teacher agency sponsored by the Tennessee State Department of Education (TSTA, 2024). The members organized an Earth science session for the 1991 TSTA meeting and each teacher presented their lessons. Programming expanded for 1992 with both the 1991 and 1992 workshop teachers presenting. This is an annual tradition that continues and has expanded to full day workshops in addition to the multiple days of individual teacher sessions. For a few years in the late 1990s, TEST dominated the TSTA meeting with the largest number of sessions.

After the 1991 TSTA meeting held in Nashville, Tennessee, the workshop members held their next meeting as an organization at Cedars of Lebanon State Park, where they designed a quarterly newsletter, *The Test Tube: Communication for Tennessee Earth Science Teachers*, to be printed on a regular schedule. The first issue was mailed in December of 1991. In that newsletter, as a way to achieve some degree of official recognition within the state, Byerly asked for the group to develop a suitable name for their fledgling grassroots organization and proposed a June retreat for Tech Aqua, a research farm operated by Tennessee Technological University near Cookeville, Tennessee. In short order the Tennessee Earth Science Teachers (TEST) was adopted as the official name. Elections for officers (President, Vice President, Secretary, Treasurer, and Historian) ensued with officer duties subdivided geographically between the three Grand Divisions of Tennessee. It was determined that field trips that alternated across the state would be a primary recruiting activity of the TEST and that the TEST would have meetings twice per-year at a centralized areas in Tennessee (usually at the annual TSTA meeting held in either Nashville or Murfreesboro and a “floating meeting” held alternately in east or west Tennessee). The TEST initiated affiliation with other Tennessee teacher organizations (e.g., Tennessee Educators of Aquatic and Marine Science (TEAMS) and Tennessee Environmental Education Association (TEEA)). Soon after, Valerie Hunt, the artistically talented wife of a TEST officer, designed “Peck,” a cartoon geologist named for

his constant use of a geologic rock hammer to peck on rocks, as the mascot of the TEST (FIGURE 1). The TEST also created a logo (FIGURE 2).



FIGURE 1: “Peck” is the official mascot of the TEST. Peck was designed by Valerie Hunt.



FIGURE 2: The TEST logo. The TEST logo consists of a background field made of two rock hammers facing one another and rounded at the bottom to produce a central sphere, representing the Earth, and ES for Earth Science. The upper left shows a brown starburst representing the process of impacting to include planetary geology. The upper right contains a star.

Since 1991, the TEST has held its annual meeting in conjunction with that of TSTA with additional fieldtrip meetings (sometimes as many as five) throughout the year and spread across the state. These fieldtrip meetings were seen as a way for teachers to experience more of the geology of Tennessee and gather specimens for their classrooms. TEST held numerous organizational meetings during this formative period (1991–1993), mostly in East Tennessee, at which they developed a mission statement and goals statement. The mission of the TEST was, and still is to promote an appreciation and understanding of the interrelatedness of the physical, geological, chemical, and biological components of the Earth's environment. The stated goals of the TEST were, and still are:

1. To promote collaborative efforts between the business and educational communities with the primary focus on the enrichment of Earth science education.
2. Integrate Earth science across the curriculum and through the grade levels K-12.
3. Provide, encourage, and promote professional growth opportunities for all levels of Earth science teaching.
4. Increase awareness of social responsibility as related to Earth science issues.

Don Byerly was given the role of higher-education advisor to provide a communication and association with a major geology program in Tennessee. In 1992, Dr. Michael Gibson from The University of Tennessee at Martin, who had participated in the first two workshops as a field guide for their West Tennessee studies, became the second permanent higher education advisor. In 2002, The TEST's higher education advising expanded to four advisors from across Tennessee, adding geologist Dr. Anne Holmes (University of Tennessee at Chattanooga) and astronomer Dr. Lionel Crews (University of Tennessee at Martin). Later, in 2014, Dr. Peter Lemiszki (Tennessee Division of Geology) became an advisor for a few years and in 2017, Dr. Wayne Leimer (Tennessee Technological University) was added as an advisor until his retirement in 2021.

The primary responsibilities of the higher education advisors included the following: to help organize field trips, define curricula, support programing conducted for and by the TEST (including obtaining funding); to provide professional development opportunities related to content and pedagogy (e.g., [Gibson and Byerly, 2024](#), this volume); to promote Tennessee Earth Science education at the state,

regional, and national levels; to provide continuity to the TEST; and to ultimately expand the number of Earth science and geology courses taught in middle and high school in Tennessee. As with any formal organization, written bylaws and procedures were needed, especially if the group was to be recognized as a 501(c)(3) IRS-recognized nonprofit organization, which the TEST later became. By 1995, the TEST finalized a constitution and by-laws, elected its first slate of officers, and had opened a bank account to fund its activities.

PRIMARY ACTIVITIES OF THE TEST

The primary gathering venue for the TEST was the annual meeting of the Tennessee Science Teachers Association, usually held in early November of each year. To prepare for The TEST activities at this meeting, several regional meetings would be held, beginning soon after the previous meeting was over. The leadership of the TEST would plan their activities for that year and schedule additional meetings to achieve these goals. At first, just a few hour-long sessions were offered at TSTA, but by 1995 the TEST was providing day-long, paid (teachers paid a fee to attend) workshops in addition to the free one-hour sessions. The TEST soon became active in writing science curricula, selecting textbooks, giving teacher awards, and more. By 1997, the TEST had achieved one of its primary goals, to increase the impact of Earth science and geology in Tennessee schools. Following are descriptions of the most important and recurring activities of the TEST.

Tennessee mineral, rock, and fossil boxes

The TEST developed a series of box kits that contained samples of minerals, rocks and fossils native to Tennessee. Over the years, these kits evolved from a combined kit to be separate boxes, with curriculum each year (TABLE 1, FIGURE 3) and the topics of kits becoming thematic. Samples of Tennessee minerals, rock, and fossils were collected by the TEST members from across all regions of Tennessee and the boxes were usually assembled in early fall at a meeting held in a central location. The boxes were used annually at the TSTA conference. The TEST teachers developed State- and National Standards-based activities tied to the sample kits and assembled support materials to accompany the box kits. At the TSTA meeting, paid and free sessions were offered in which the teachers received a box kit and the supporting materials, as well as demonstrations of activities and instructional training on the geology of Tennessee. Funding for the kits came from grants to the TEST or to the advisors

TABLE 1: Resource box kits used in professional development workshops by the TEST.

Year	Box/kit topic	Venue (paid session/free session)
1995	Economics of Natural Resources Rock Box	Free Sessions
1996	Tennessee Rocks Giveaway	Free Sessions
1999	Tennessee Rocks Giveaway	Free Sessions
1998	Tennessee Rock Giveaway	Limited Ticketed Free Sessions
1999	Tennessee Fossil Box	Limited Ticketed Free Sessions
2000	Great Smoky Mountains Rock Box	Paid and Free Sessions
2001	Great Smoky Mountains Rock Box	Paid and Free Sessions
2002	Tennessee Rock Box	Paid and Free Sessions
2003	Tennessee Fossil Box	Paid and Free Sessions
2004	Plate Tectonics	Paid and Free Sessions
2005	Economics of Natural Resources	Paid and Free Sessions
2006	NSTA: Economics of Natural Resources	Paid Session
2007	Teaching Evolution	Paid and Free Sessions
2008	Astronomy	Paid and Free Sessions
2009	Tennessee Fossil Box	Paid and Free Sessions
2010	Plate Tectonics	Paid and Free Sessions
2011	Teaching Chemistry with Geology	Paid and Free Sessions
2012	Environmental Geology and Reading	Paid and Free Sessions
2013	Tennessee Rocks!	Paid and Free Sessions
2014	Teaching Evolution	Paid and Free Sessions
2015	Great Smoky Mountains Geology	Paid and Free Sessions
2016	Coon Creek Science Center NSTA Trip*	Paid Fieldtrip
2017	Teaching Sea Level Change	Paid and Free Sessions
2018	Effective 3-D Mathematics Applied to Global Sea Level Change	Paid and Free Sessions
2019	No Sessions	
2020	Earth Science Field and Virtual Field Experiences at the University of Tennessee Coon Creek Science Center (online)	Online Delivery – COVID-19
2021	Miscellaneous Geology of Tennessee Topics	Free Sessions
2022–24	No Sessions	

(e.g., NSF, Tennessee Department of Education, etc.), commercial and non-commercial donations (e.g., Wal-Mart, Memphis Archaeological and Geological Society, Middle Tennessee Rockhounds, East Tennessee Geological Society), as well as the TEST membership dues.

Tennessee Earth science and geology standards

In 1993, the TEST was given the task of revising the state curriculum in both Earth science and geology by the State Department of Education. This new Tennessee curriculum was to be firmly rooted in both the newly published National Science Standards, based upon the principles of Earth System Science, which was a national initiative at that time, as well

as using inquiry as the primary pedagogy (see summary in Gibson and Byerly, 2024, this volume). For the next decade and a half, the TEST was the primary group of teachers responsible for reviewing and revising the Earth science and geology portions of the Tennessee Standards. Additionally, the TEST produced a Standards Sampler for teachers, which was a document to help teachers to incorporate the curriculum into their classrooms.

Communication and information dissemination

The TEST TUBE, a quarterly newsletter, became the primary means of communication for the TEST. The original newsletter was only one-page in length, but by the late



FIGURE 3: An example of a Tennessee rock box kit. This kit was prepared for the workshops that focused on plate tectonics and included mapping activities, sediment from Trinidad, and supplies to complete the activities. Each teacher would receive one kit as part of their workshop. Additional kits were available for purchase.

1990s had expanded to be up to eight pages long. There were standard inclusions to the newsletter, such as “The President’s Corner” in which the president had an open forum to discuss issues related to Earth science teaching and TEST. An announcements section listed up-coming meetings for TEST, state and national meetings, workshops, professional development, and deadlines for grants. Additionally, advisors often authored sections that were thematic in nature, such as the following: “Evolution Corner” about the teaching of evolution in Tennessee; “What’s In Your Backyard?” a column about local geology; and contests, such as “Where in Tennessee” and “Mystery Fossil,” in which readers were challenged to identify a Tennessee landform or fossil from pictures. Many of the museums in Tennessee submitted short contributions highlighting their exhibits and professional development opportunities. Teachers could submit original works as well, including artwork and poetry. One important inclusion to the newsletter was a listing of “kudos” for teachers who won awards for their Earth science endeavors. Eventually, the newsletter added e-mail delivery to its members. Due to declining participation, discussed below, the final TEST TUBE was published in 2016.

TEST Net

During the early 2000s, the TEST developed a web page. TEST Net struggled from the onset. Developed early in the days of the Internet before the development of user-friendly author software, web page development required some degree of programming skills, was time consuming, and required a “host.” Consequently, “webmaster” skills and continuity were problematic for the TEST, as was finding a host for the webpage. The TEST advisors attempted to get their institutions to host the website; however, the administrators indicated that they could not host non-University groups. TEST Net

only lasted a few years before it was abandoned. Ultimately, this proved to be one of the major contributors to the decline of the TEST because Internet communication (“online”) soon became vital to any organization’s survival as “pen and paper” newsletters and advertising gave way to online as the primary source for information.

Awards

NAGT OEST Award

One of the activities in which the TEST excelled was in recognizing excellence in teaching Earth science and geology, especially in K-12. The TEST serves as the primary vehicle through which the National Association of Geoscience Teachers (NAGT) operates in Tennessee. Awardees are identified by the TEST Awards Committee through its own activities and through nominations made by school administrators, students, and fellow teachers. They are then nominated to the NAGT each year for their prestigious Outstanding Earth Science Teacher (OEST) award ([NAGT, 2024](https://www.nagt.org/2024/01/2024-outstanding-earth-science-teacher-award/)). The TEST notifies school system officials and local newspapers of all winners. The Awards Committee members would work closely with school systems in Tennessee to find a teacher who the committee felt met NAGT’s criteria

for the award and works with the teacher and their school administrator to help them prepare the dossier that would accompany the award application. The Tennessee OEST winner was, and still is, automatically entered into the southeastern regional competition for the Regional OEST award. In the case of Tennessee, the impact that the TEST had on teacher effectiveness in Tennessee was so great, that Tennessee OEST teachers also won NAGT’s southeastern region award each year from 2001–10 with the exception of 2009 (TABLE 2). The OEST award was the only national award regularly offered by TEST and the winners were presented their OEST plaque at the Awards Banquet for the annual meeting of the TSTA (FIGURE 4). The OEST award was only one of two Earth science awards presented at the TSTA conference and was reported in the press, as well as published in the Journal of Geological Education, or their website

(NAGT, 2024), with pictures of the awardee and notification of the teacher’s school system administration. In addition to the plaque, NAGT provided a treasure trove of resources to the teacher and provided a means for that teacher to attend a Geological Society of America meeting to further network with other Earth scientists and teachers.

Ptero Award

The TEST developed its own award. The Ptero Award, named after the official state fossil for Tennessee—*Pterotrigonia thoracica*—affectionately nicknamed “Ptero,” was, and still is given to an individual or organization who made outstanding contributions to Earth science education in Tennessee. The award recipient receives an engraved personalized wooden plaque with an authentic 76-million-year-old fossil “Ptero” attached to the plaque (FIGURES 4 AND 5).

TABLE 2: Tennessee National Association of Geoscience Teachers’ Outstanding Earth Science Teachers award winners.

Year of award	Winner and school system
2023	Dr. Greg Smith (John Overton High School, Nashville, TN)
2021–2022	No Award
2020	Kari Hughes (Selmer Middle School, Selmer, TN)
2019	Andrea Starks (Houston Middle School, Germantown, TN)
2017–18	Jana Young (Northeast Middle School in Jackson, Tennessee)
2016	John Griffin, Southside Highschool, Jackson, TN
2013–2015	No Award
2012 ²	Dr. Chris Vanagas (School for Science and Math, Vanderbilt University, Nashville, TN)
2011	No Award
2010 ¹	Bryan Freeman (Clinton High School, Clinton, TN)
2009	Frances Hamilton (Blanche School, Taft, TN)
2008 ¹	Tina Coleman (Martin Middle School, Martin, TN)
2007 ¹	Pat Royal (Camden Middle School, Camden, TN)
2006 ¹	Bryan Byrne (Cox Middle School, Columbia, TN)
2005 ¹	Rose Lummus (Dyersburg Middle School, Dyersburg, TN)
2004 ¹	Tina King (West Elementary School, Mt. Juliet, TN)
2003 ¹	Christine Henry (Knox County Schools, Knoxville, TN)
2002 ¹	Jane Luhn (Knox Country Schools, Knoxville, TN)
2001 ¹	Virginia Cooter (North Greene High School, Greeneville, TN)
2000	Mary Ann Stephens (Kenwood Middle School, Clarksville, TN)
1999	Greg Bailey (Fulton High School, Knoxville, TN)
1998	Jim Hunt (Chattanooga School for the Arts and Sciences, Chattanooga, TN)
1997 ¹	Jane Skinner (Farragut High School, Knoxville, TN)
1993, 1996	Jim Watson (Soddy-Daisy School, Soddy-Daisy, TN)

TABLE 3 lists the recipients of the Ptero Award.

The TEST had been instrumental in getting the fossil established as a state symbol by the State Legislature in 1997 (Gibson, 2024). The “Ptero” fossil represents the vast geologic and paleontological riches across Tennessee and commemorates their utility as an educational resource. Many of the TEST’s fossil workshops included interdisciplinary uses of Ptero to teach science, mathematics, art, history, and civics. As with the TEST’s mascot “Peck,” a “Ptero” caricature was designed by Valerie Hunt (FIGURE 6). The Ptero Award is the TEST’s highest-profile internal award as the presentation of the award occurs at the Tennessee Science Teachers Association

¹ Also southeastern regional OEST award winner that year.
² Not nominated by TEST



FIGURE 4: TEST awards. The TEST presents its awards in association with the Tennessee Science Teachers Association annual meeting awards banquet. Left to right: TEST founder Don Byerly (University of Tennessee Knoxville) holding the 2004 Tennessee Economics of Mineral Resources Kit, State Geologist of Tennessee Ron Zurawski received the Ptero Award on behalf of the Tennessee Geological Survey, NAGT OEST state and regional award winner Tina King, and TEST advisor Michael Gibson who presented all of the awards at the Tennessee Science Teachers Association awards banquet.

annual convention in front of the conference banquet attendees along with the OEST.

Additional TEST activities

Over the years, the TEST has participated in numerous geoscience education initiatives. Thematic Earth/Environmental Science at the Middle School-Secondary Level: An Interdisciplinary Approach (1998–1999) was funded through the Tennessee Higher Education Commission (THEC) and was a collaboration of the TEST and the Center for Excellence in Science and Mathematics Education (CESME) at the University of Tennessee at Martin. The project brought together 16 Tennessee teachers (eight Earth science teachers and eight teachers from non-science disciplines, including mathematics, language arts, history/social studies, and the fine arts) to implement action research on a pilot program using Earth science as an interdisciplinary basis for integrating other disciplines with science and mathematics. CESME and the TEST felt that one way to get Earth science into a school was to partner with established programs to demonstrate the cross-disciplinary nature of

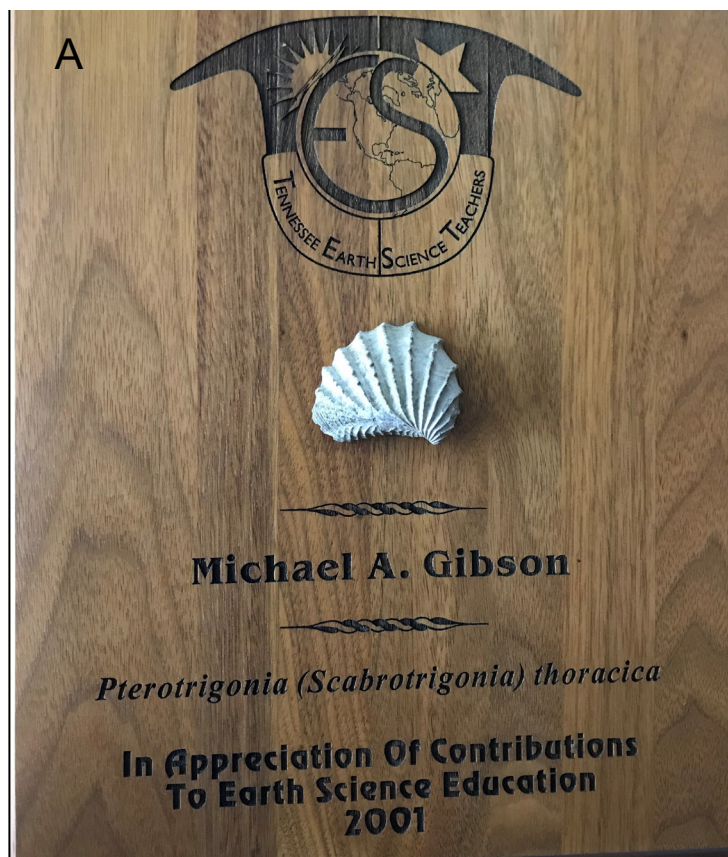


FIGURE 5: The TEST Ptero award. (A) The original plaque design with a fossil Ptero attached to the plaque. (B) The redesign of the Ptero award in 2019. All plaques featured an authentic *Pterotrionia (Scabrotrionia) thoracica*, the official state fossil of Tennessee.

Earth science. The teachers, working as teams of two, developed and taught interdisciplinary thematic unit, reporting the results at the national Geological Society of America meeting in Denver, CO (Bailey et al., 1999). There are many examples of TEST teachers presenting their programs and research at professional geology meetings (e.g., Crews et al., 2007; Bailey and Gibson, 2007). This same approach was utilized to use Earth science or geology as a vehicle to teach the other sciences (e.g., Gibson and Byerly, 2018).

Perhaps the most successful and longest running programing that involved the the TEST, and that was the catalyst for creating the TEST, were the GeoCamps that were run from 1990 through 2004. The legacy of these multiweek field-oriented camps is the “rock box” program described above. In 1990 the precursor model for GeoCamps was offered—Earth Sciences for K-12 Tennessee Teachers—but by 2001 the series had expanded to six separate camps that spanned the breadth of the Earth sciences. Most of the GeoCamps were funded through the Eisenhower Title II Professional Development Program grant program with the TEST advisors serving as the PI’s of the grants. The TEST was called upon each year to suggest the topics for the next GeoCamp professional development, to help in grant writing, which included pedagogy and curriculum, and to participate during the geocamp as “master teachers.” Two goals drove the GeoCamps program: (1) to cultivate science awareness through greater knowledge of geosciences and (2) to enhance teacher confidence and competence for teaching Earth Science and Geology.

Each of the six multi-week duration GeoCamps were designed to achieve content-specific goals. GeoCamp I: Geoscience Basics provided the basic field skills, was oriented as a general introduction into Earth materials and processes, and was a prerequisite for participation in later GeoCamps. GeoCamp II: Landform Evolution/Surface Processes focused on surface processes and landform evolution using the east Tennessee region, especially the Great Smoky Mountains and Valley and Ridge provinces, as its natural laboratory. GeoCamp III: Earth History, Geologic Time, and Life was based at the Coon Creek Science Center in McNairy County

TABLE 3: Tennessee Earth science teachers Ptero award winners.

Year	Recipient
2022	Governor Bill Lee
2021	Ron Brister, Curator of Collections, Pink Palace Museum, Memphis
2015–2020	No Awards
2014	Jim Watson, Soddy-Daisy School, Chattanooga
2013	Dr. Ann Holmes, University of Tennessee at Chattanooga
2011–2012	No Award
2010	Dr. Lionel Crews, University of Tennessee at Martin
2009	No Award
2008	Vulcan Materials Parsons Quarry
2007	No Award
2006	Memphis Archaeological and Geological Society (MAGS) Knoxville Gem and Mineral Society (KGMS)
2005	Pink Palace Museum and Coon Creek Science Center
2004	Tennessee Division of Geology
2003	Bob King, Lebanon School System
2002	Nancy Stetten, State Department of Education
2001	Dr. Michael A. Gibson, University of Tennessee at Martin
2000	Dr. Don Byerly, University of Tennessee Knoxville
1999	Tennessee Representative Mark Maddox and Senator Roy Herron
1999	University of Tennessee at Martin GeoClub
1998	Dr. Linda K. Jordan, Tennessee State Science Consultant

and at UT Martin in West Tennessee. Earth history, geologic time, and paleontology were the central focus of this camp; however, earthquake hazards associated with the New Madrid Seismic Zone were also included in this camp. GeoCamp IV: Tennessee Maps was based at UT-Knoxville and focused on interdisciplinary activities emphasizing mathematics and history using a variety of maps, aerial photographs, and satellite imagery featuring the Great Smoky Mountains and Cumberland Plateau regions. GeoCamp V: Weather & Climate was also based at UT Martin and focused on the basic atmospheric processes of weather and climate with applications to Tennessee’s physiographic regions and causes of “extreme weather.” GeoCamp VI: Paleoceanography of Tennessee was based at UT Martin. Its focus was on overcoming the handicap of teaching oceanography in “land-locked” Tennessee by using the rich geologic record of ancient oceans that once covered the state. Additionally, this GeoCamp placed emphasis on the uniformitarian approach to historical science by comparing modern Gulf Coast environments, working out of the Dauphin Island Sea Lab in Alabama, to ancient counterparts that the teachers studied in Tennessee.

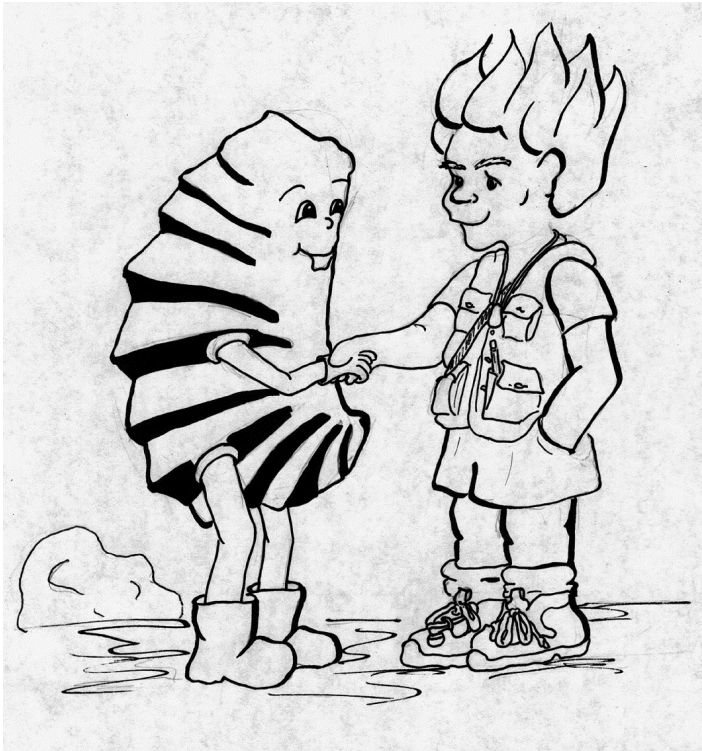


FIGURE 4: Peck and Ptero. These caricatures were used as fun advertising for the TEST, T-shirts, and field trip guides in written materials produced by the TEST. Valerie Hunt designed this caricature as part of the campaign to identify an official state fossil for Tennessee.

In all camps, the TEST members were called upon to meet with the participants of the other GeoCamps to further the networking process, thus providing these teachers with an extended resource base after completion of the program. By the end of the early 2000s, the Title II funding source dried-up and it was becoming more difficult to recruit teachers to leave their homes during the summer for multiple weeks, so many of these camps were downsized to a series of day-long workshops of the same names, some offered at the TSTA annual meeting, with follow-up sessions at the annual Tennessee Earth Science Teachers meetings. One reason for the decline was the rise of “virtual field trips” available on the Internet. The number of smaller workshops shrank as the years wore on, but several remained popular (e.g., Tennessee rock box programs geared at Tennessee resources, plate tectonics, fossils, and evolution) especially at the annual TSTA meeting. Over 200 teachers matriculated through the various fieldtrip-oriented GeoCamps over the years.

Until 1997, all of the field trips sponsored and run by the TEST were restricted to Tennessee. TEST desired to upgrade their fieldtrip opportunities, so in 1997, the first GeoTrek was conceived. GeoTreks followed the same inquiry-based

field format that was successful in the GeoCamps, but the destinations were to areas outside of Tennessee. The first, GeoTrek 1997, was three-weeks in duration and included a week-long trek across all physiographic provinces in Tennessee followed by a two-weeks of field activities within Yellowstone National Park region, including calculator-based lab (CBL) geochemistry studies of the geysers and mudpots in the park. This trip also included a hosted fossil dig at the Ashfall Fossil Beds in Nebraska. The coastal region of Dauphin Island, Alabama was a repeatedly offered GeoTrek with teachers participating in the Dauphin Island Sea Lab’s Discovery Hall programs and included boat trips into the Gulf of Mexico to core for sediment and trawl plankton and fish. Some GeoTreks were international in scope including several trips to the Quintana Roo region of Mexico, Belize and Guatemala, Central America, and to Scotland to see the classic early history of geology.

The TEST participated in test-piloting the American Geological Institute’s EarthComm® Curriculum ([AGI, 2024](#)) from 1998–2001. The TEST was tasked with writing position statements on Teaching Earth Science and Teaching Evolution in Tennessee for the State Department of Education. TEST members routinely populated the Textbook Selection committees established by the Tennessee Department of Education. TEST advisors were members of the 2010 review of the Tennessee Teacher Licensure Standards.

WHY HAS THE TEST BEEN SUCCESSFUL FOR EARTH SCIENCE IN TENNESSEE?

The TEST has been in existence for 34 years, since 1990, and has certainly made a positive impact on Earth science and geology teaching in K-12 in Tennessee. What were the attributes that contributed to this grassroots organization’s longevity? The TEST was an organization run by Tennessee teachers with higher education professional scientist advisors for support. All activities of the TEST were designed to provide teachers with resources related to Earth science in Tennessee. The TEST has endeavored to maintain frequent contact with members and advisors and to foster active connections to other state organizations (e.g., TEA, TSTA) and national organizations (e.g., NAGT, GSA, NESTA, NMEA). The TEST has reached out to partner with, and are often also members of, other Tennessee teacher groups, such as the Tennessee Educators of Aquatic and Marine Sciences (TEAMS). The TEST used a strong reward system for teaching excellence and developed a consistent presence through its

meetings (e.g., Fall retreat, TSTA, summer workshops), all devoted to Earth science, and maintained a strong, visible, and consistent attendance at teacher-venue conferences. Perhaps the greatest strength was that early on, the TEST attracted and maintained a strong nucleus of “life” members that remained active and were devoted to Earth science as their primary science. These teachers always infused Earth science into whatever other science they were teaching, using geology to teach chemistry, biology, physics, and environmental science (e.g., [Gibson and Byerly, 2018](#)). Over the years, many teachers came into the TEST and many moved on to other opportunities; however, the original dedicated core group remained consistent for most of the run. Finally, the TEST spent a great deal of time and resources constantly trying to recruit (e.g., brochures, newsletter, prizes, hosting social gatherings at meetings). The annual TEST Reunion Party that was held at the TSTA convention hotel, hosted by the higher education advisors in their hotel rooms, was a highlight that attracted many new teachers and alumni. It was followed by a dinner at a local restaurant with as many as 30 dining. The TEST and their higher education advisors were successful at finding external funding and many TEST teachers were successful at grantsmanship. The TEST was consistently active in state science meetings providing service and giving awards, recruiting, and making Earth science as visible as possible to all science teacher attendees.

The TEST was also a timely organization in that it came on the scene in time to participate in some major K-12 education challenges. The 1990s saw a time of public education evaluation and revision with programs such as No Child Left Behind and innovations in pedagogy, such as the move to inquiry ([Gibson and Byerly, 2024](#), this volume). In terms of Earth science content, the 1990s was the time when Earth Systems Science took center stage as the new organization for Earth science, with NASA leading the charge and professional societies producing national curricula.

Post Covid-19 Pandemic TEST

Unfortunately, as of this writing, the TEST is not the organization that it was, although it still exists, and can certainly revitalize. The TEST has seen a difficult decline over the past decade, such that, it is now effectively in a state of suspension without active officers and only one advisor. The decline of TEST is a useful lesson for all grassroots organizations.

Noting the attributes listed above that contributed to the

rise of the TEST, a core of dedicated “life” members is essential to the vigor and continuity. By 2016, most of the original 1990s teachers that were that reliable core had reached retirement age and attrition began to take place, without a strong complement of new replacements with the same dedication. One of the most common lamentations of the “old timers” of the TEST is that the “younger generation” of teachers coming into the profession are less interested in investing their personal time and energy, much less commitment to travel, that is required to maintain the level of involvement that the TEST had developed. They noted that the advent of online professional development, professional development with stipends, and virtual field trips was making it too easy to not be part of intensive workshop participation such as what the TEST ran.

Another Tennessee issue that impacted participation was the increased focus on performance by teachers and their students on standardized tests, especially after No Child Left Behind. Most teachers were focused on “teaching to the test” and on those sciences in which their administrators wanted strong test performance for school evaluations (the PCB’s). Earth science’s reputation of not being a valid high school science on par with the PCB’s, along with the fact that it is not strongly represented on Gateway and End of Course testing was again contributing to the decline of Earth science in Tennessee curricula. Additionally, the most recent revisions of the Tennessee Science Standards for grades K-8 had moved most Earth science topics downward in grade level ([TDE, 2016](#)).

The last official TEST officer meeting and elections in the TEST were carried out in 2018. The Covid-19 global pandemic struck at the end of 2019 with Tennessee schools entering a shutdown mode by February of 2020. Already in decline, TEST activities essentially ceased to occur, except for a few online appearances by the TEST advisors and a few officers for the annual TSTA meeting. There was never a quorum of members for voting according to the bylaws. The in-person events with resource giveaways that had served the TEST so well for years, ceased to happen. By the time schools reopened in 2022, the TEST was dormant with no teacher leadership or plans for immediate recovery and Earth science was again being ignored by teachers and administrators.

Contributing to the attrition of seasoned TEST core members was the retirement of some of its higher education advisors that had been relied upon for so long. TEST founder Don Byerly retired in 2000, but remained active until his

death in 2018. Ann Holmes, who had come on board in 2002, retired in 2018 without a replacement. Both Peter Lemiszki and Wayne Leimer became inactive within a couple years of becoming advisors and Leimer retired in 2021 during the pandemic. By 2018, the only active TEST advisors were this author and Dr. Lionel Crews, both of UT Martin. In 2018, the author took over directorship of the University of Tennessee at Martin Coon Creek Science Center (UTMCCSC) forcing him to withdraw most of his participation in the TEST. In 2023, the author retired from UT Martin and as director of the UTMCCSC; however, remains the primary higher education advisor to the TEST.

Many of the activities of the TEST continue on a smaller scale by the staff and faculty of the UTMCCSC. The UTMCCSC is a 234-acre Earth science field site in McNairy County, West Tennessee. The reader is referred to Gibson (2024) for a history of that site and its programming, which includes a discussion of the TEST's involvement with the site. The UTMCCSC has continued to run Earth science teacher professional development and the TEST is a listed partner in these activities. All TEST records and leftover geology resources are housed at the science center.

SUMMARY

The Tennessee Earth Science Teachers (TEST) is a grassroots teacher organization that has functioned successfully for 34 years in Tennessee. The TEST has been heavily involved in K-12 teacher professional development related to the Earth sciences and geology with a long list of achievements and has successfully achieved almost all of its goals established in its mission statement. Unfortunately, the primary goal of the original advisors that prompted the founding of the TEST, that of increasing the number of Earth science and geology courses at the secondary level in Tennessee, has not been realized. Today, the TEST is in a state of decline, primarily due to the changing landscape of public education in Tennessee and in infusion of technology and online professional development opportunities. The rise and decline of the TEST mirrors many state-level teacher groups with periods of growth and prosperity along with periods of decline. The TEST has allied itself with another teacher development resource that is devoted to the Earth sciences and geology, The University of Tennessee Coon Creek Science Center, which should ensure that the TEST continues to be a strong resource for Tennessee teachers, and perhaps a revitalization to its heydays.

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