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GSA TODAY

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Surprise Endings to Catastrophism and Controversy on the Columbia

Joseph Thomas Pardee and the Spokane Flood Controversy

Vic Baker
Department of Geosciences, University of Arizona, Tucson, AZ 85721

Figure 1. Late Pleistocene strandlines of glacial Lake Missoula at Missoula, Montana. As recognized by Pardee (1910, 1942), the highest strandlines reach 1280 m. Lake Missoula was 635 m deep in the vicinity of its ice dam in northern Idaho.

ABSTRACT

Joseph Thomas Pardee (1871–1960) played a key role in the Spokane Flood controversy, in which the cataclysmic flood origins of the Channeled Scabland were intensely debated during the decades of the 1920s, 1930s, 1940s, and 1950s. Pardee first drew attention to glacial Lake Missoula in 1910. He suggested it to J Harlen Bretz as a source of the cataclysmic flooding, just prior to Bretz's famous presentation of the flood hypothesis to the January 12, 1927, meeting of the Washington Academy of Sciences. Though Pardee did not publicly advocate the cataclysmic flood hypothesis, his 1940 revelation of the evidence for rapid draining of glacial Lake Missoula, including giant current ripples and immense flood bars, proved to play a pivotal role in the eventual acceptance of the cataclysmic flooding hypothesis by the scientific community.

INTRODUCTION

The debate over the origin of the Channeled Scabland region of eastern Washington is one of the great controversies in the history of geology. The story, as generally recounted (Baker, 1978, 1981; Gould, 1980), centers on the singular role of J Harlen Bretz of the University of Chicago, but there was another major participant in that debate, Joseph Thomas Pardee.

Bretz (1978, personal communication) recalled that his interest in the scabland problem was first piqued by looking at the newly published Quincy topographic map. This map shows the great Potholes Cataract, now recognized as the product of cataclysmic flooding (Bretz et al., 1956). The year was 1910. In that same year Pardee (1910) described the geomorphological evidence for a great glacial lake occupying the intermontane basins of western Montana during the late Pleistocene. He described the prominent strandlines of the lake (Fig. 1) and the evidence for lake impoundment behind a glacial lobe in the basin of modern Lake Pend Oreille in northern Idaho. These relations were well known. Pardee (1910, p. 376) even credited T. C. Chamberlin with the discovery of the lake strandlines: "Chamberlin conceived the idea of a glacial dam and furthermore tentatively suggested that its location was in the Pend Oreille region with outflow by way of Spokane." The glacial lake was named for Missoula, Montana, where its strandlines were particularly prominent (Fig. 1).

HYPOTHESIZING THE SPOKANE FLOOD

In the summer of 1922, J Harlen Bretz began his field research with small field parties of advanced students in the Channeled Scabland. His scabland studies continued over the next seven field seasons. During those years Bretz traversed the entire region first on foot and later in his trusty Dodge 4, an early enclosed-body car. He did this with parties of students and his wife, son, daughter, and collie dog.

Bretz's first paper on the Channeled Scabland was the text of an oral

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GSA Beneficiary of the Pardee and Kelly Estates

Robert L. Fuchs
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Joseph Thomas Pardee

Mary and Ralph Kelly

Mary P. Kelly died in a Missoula, Montana, nursing home on November 16, 1994. Her last years had not been easy, in spite of the careful attention of her close friend, guardian, and attorney, Jack McInnis. Mary had broken both hips during the prior two years, and this left her bed-ridden and generally incapacitated. Additional infirmities such as pneumonia and circulatory problems, too often common afflications among the elderly, had taken their toll. However, she had plans for the future right to the end—a return to her Philipsburg, Montana, ranch, driving the two cars that she wouldn't let Jack sell, attending the GSA Cordilleran Section 1995 meeting in Fairbanks. These were ambitious plans for an 89-year-old invalid, but Mary was a strong individual and the only descendant of a unique but largely unheralded geologist, Joseph T. Pardee, who died in 1960.

The Pardee-Kelly family chronology, spanning nearly a century, includes such significant events as Joe's key role in the resolution of one of the major North American geological controversies of the twentieth century and the second largest gift ever received by GSA. Joe Pardee's career and the related chronicle of the Pardee family—Joe and his wife Ruby, Mary and her husband Ralph Kelly—are a story of lives spent out of the limelight, quietly and frugally, lives that history has now shown to have been scientifically and financially important to both geology and to GSA. The article by Vic Baker, that starts on the first page of this issue of *GSA Today,* relates the boiling controversy that for more than 40 years surrounded the Channeled Scablands, the Columbia Plateau, the Spokane (Bretz) Flood, and glacial Lake Missoula; this is the scientific side of the story. The singular financial event occurred upon Mary's death, when GSA's financial assets were enriched by the addition of the Joseph T. Pardee Memorial Fund. The income from this $2.7 million endowment is to be used by the Society "for research, study and educational advancement in the field of geology and science."

Joe Pardee was a career employee of the U.S. Geological Survey. He was appointed to the Survey in 1909 and retired in 1941. During 32 years of work, his investigations ranged from glacial deposits to gold deposits, from mine sites to dam sites. Joe Pardee spent most of his career on geology in the northwestern United States, with particular emphasis on Montana. Born in Salt Lake City in 1871, Joe grew up in a mining family. The family moved to Philipsburg, Montana, when Joe was three, and his father developed the Algonquin mine. Joe's education was at Presbyterian College in Deer Lodge, Montana, and the University of California at Berkeley. After college he opened an assay office and operated a gold and sapphire mine, but a growing interest in geology led him to the USGS. He and his wife Ruby moved to Washington in 1909, where the family lived until 1954.

The records indicate that Joe Pardee was perhaps the consummate employee—accurate, thorough, versatile, a competent professional, an effective public servant, a clear writer, and a teacher to those who followed. He was at home with both the leading geologists of his day and the ranchers and prospectors he associated with in the field. He fought red tape with a sense of humor, and his reports from the field occasionally ended with a snatch of appropriate original verse. Much of Joe Pardee's career was spent mapping in the Northwest, often accompanied

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presentation to the Geological Society of America (Bretz, 1923a). In that paper he took special care not to call upon cataclysmic origins. The paper provided a detailed description of physiographic relations in the region. He did note, however, that the indicated channel erosion required prodigious quantities of water. Referring to the three outlets at the south end of the Hartline Basin (Dry Coulee, Lenore Canyon, and Long Lake Canyon), Bretz (1923a, p. 593–594) stated, "… these are truly distributary canyons. They mark a distributive or braided course of the Spokane glacial flood over a basalt surface which possessed no adequate pre-Spokane valleys."

The idea of a truly catastrophic flood appeared in Bretz's second scabland paper (Bretz, 1923b). His interpretation of the mounded scabland gravel deposits as subfluvial bars led directly to the requirement for great water depths. This paper also included the first detailed geomorphic map of the entire Channeled Scabland, showing the overall anastomosing pattern assumed by a great flood of water.

Much of the 1920s research in the scabland region centered around Spokane, Washington, where the glacial margin was presumed to be located. Bretz named the hypothesized cataclysm the Spokane Flood because the flood source seemed to lie near that city. A year prior to Bretz's first scabland work, W. C. Alden, chief of Pleistocene geology at the U.S. Geological Survey, sent a junior Survey geologist, J. T. Pardee, to study the scabland region near Spokane. The result was a brief article (Pardee, 1922) proposing that the Cheney-Palouse scabland tract was created by glaciation of rather unusual character. Bretz visited Pardee's field locations a season or two later and found that Pardee's "glacial" deposits were actually flood bars (Bretz, 1974).

Various correspondence in the 1920s led Bretz to believe (Bretz, 1978, personal communication) that Pardee was actually considering flooding from a glacial Lake Missoula as a cause for the scabland topography. Bretz (1974) speculated that Alden dissuaded Pardee from the idea. Bretz saw a memorandum of September 25, 1922, to David White, chief geologist of the U.S. Geological Survey, in which Alden noted of Pardee's work: "… very significant phenomena were discovered in the region southwest of Spokane.… The results so far … require caution in their interpretation. The conditions warn against premature publication."

At the famous 1927 "scabland debate" at the Geological Society of Washington (Bretz, 1927) Pardee was silent on the Missoula source for the flood. Bretz believed that Pardee's superiors at the Survey, particularly Alden and Kirk Bryan, were antagonistic to the cataclysmic flood hypothesis. Did Pardee indeed first hypothesize the flooding associated with the Spokane Flood controversy? Did the critical reception accorded Bretz's hypothesis (Baker, 1978) provide a deterrent to his own theorizing?

Pardee wrote to Bretz in 1925 suggesting that Bretz consider the draining of a glacial lake as a possible source for the cataclysmic Spokane Flood. In 1926 correspondence to J. C. Merriam, Bretz wrote:

> Mr. Pardee of the Federal Survey, who has seen much of the scablands, has suggested that his glacial Lake Missoula might have afforded the water for these enormous rivers if it were suddenly drained out across the plateau. This comment indicates tha[t] his former view of scablands by land ice and concomitant subglacial drainage under ordinary climatic melting has been abandoned. Even our ultra-conservative in Pleistocene geology, Dr. Alden, wrote that the phenomena I describe certainly appear to be river work "if you could only show where all the water came from in so short a time."

PARDEE'S SCABLAND HYPOTHESIS

Brian K. McDonald, grandson of Thomas Large, a confidant of both Bretz and Pardee in the 1920s, has extensively researched correspondence relating to the origins of the cataclysmic flooding hypothesis. Thomas Large wrote prolifically on various speculations concerning scabland origins. Correspondence (researched by McDonald), in the summer of 1922 to Barton W. Evermann, contains the following passages:

> … One of Pardee's most interesting theories is that this broad belt of rough lava extending from Medical Lake and Cheney down through the state to Pasco is due to sub-glacial water erosion. Neither glacial nor river erosion will account for it as it has no gradient, while water under pressure under the ice could cut out a hole of any depth and rise again where resistance was least. I have as yet not been able to pick any flaws in the hypothesis. As yet we are very much in doubt as to the depth of the ice sheet. Some evidence which I have would indicate not over 200 feet between Cheney and Medical Lake. Objection will be made that this is not sufficient to cause ice movement over so large an area but it must be remembered that there is an average slope from here to Pasco of about 14 feet per mile.
>
> … Prof. J Harlan Bretz of U. of Chicago has been to see me twice since I wrote you. He has a group of geology students and they have gone over some of my work. He thinks that glaciation on the "prairies" may be Wisconsin but I am quite sure he does not make allowance for the aridity of this climate and its effect on slowing down weathering. Furthermore he must account for the two other glacial

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ANNOUNCEMENT

TRAVEL GRANT PROGRAM

30th IGC in Beijing, China • August 4–14, 1996

The Geological Society of America is accepting applications for the International Geological Congress (IGC) Travel Grant Program.

This program was established as a final act of the Organizing Committee for the U.S.-hosted 28th IGC held in Washington, D.C., in July 1989. Surplus funds available at the conclusion of the 28th IGC were transferred to the GSA Foundation with the stipulation that income from the fund be used to support the attendance of young geoscientists at future IGCs, until such time as the United States again hosts an IGC. Travel grants will consist of economy airfare to and from China.

To be eligible, an applicant must be a resident or citizen of the United States (includes students); must have a birth date after August 31, 1956; and must have an abstract for inclusion in the program of the 30th IGC.

Official application forms are available from the Grants Administrator, GSA Headquarters, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301. Along with the form, applicants must include a copy of the abstract that was submitted to the 30th IGC. Applications must be supported by two letters from current or recent supervisors; students may use faculty members. **Qualifying applications and letters of support must be postmarked no later than September 15, 1995.** Applicants will be notified of results early in 1996.

NOTICE OF COUNCIL MEETING

Meetings of the GSA Council are open to Fellows, Members, and Associates of the Society, who may attend as observers, except during executive sesions. Only councilors, officers, and section representatives may speak to agenda items, except by invitation of the chair. Because of space and seating limitations, notification of attendance must be received by the Executive Director prior to the meeting. The next meeting of the Council will be Tuesday afternoon, November 7, 1995, at the annual meeting in New Orleans.

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What's new on the GSA home page on the World Wide Web? If you haven't yet connected to the Web, the Universal Resource Locator (URL) is **http://www.aescon.com/geosociety/index.html.**

1995 New Orleans Annual Meeting Technical Program: NOW AVAILABLE! Go to **Meetings** and choose **1995 Annual Meeting.** This area also contains information about field trips, continuing education, exhibits, travel, lodging, and registration.

If you want to know more about the GSA Employment Service or about becoming a GSA Campus Representative, check the **Membership** section, which also has information on nominating a member to fellowship and on obtaining forms for applying to become a GSA Member or Student Associate.

See the **Geoscience Calendar** section for a listing of meetings of general geological interest.

The **Publications** section has a monthly table of contents and abstracts of articles for the *GSA Bulletin* and *Geology.* Also in this section is a guide for authors preparing manuscripts for submission to GSA publications. *GSA Today* issues are posted here for downloading and viewing.

For Congressional Contact Information, see the **Administration** section. ■

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> trains at lower levels which in no way connect with the dissected plateau prairies. He says my "out-let" by way of Mica, California Creek, and North Pine will stand. Also my marginal moraine at Pantops. Thinks he may find some evidence of ground ice on south side of the Spokane Valley above the city. May leave a student here to hunt for it. I am willing he should. He goes after Pardee hard on origin of Palouse soil and glaciation farther South-west. As Pardee is a careful man and had six weeks and a "Ford" to go over the ground while Bretz had about 10 days and only "Shank's mares" it looks like a good fight in prospect.

Confirmation that Pardee's views are accurately presented in Large's letters is provided by correspondence in 1943 between Pardee and University of Michigan professor W. H. Hobbs, who proposed (Hobbs, 1943) a glacial origin for the Channeled Scabland. Hobbs wrote to Pardee about the 1922 paper and received the following reply:

> ... The "drift" referred to in the article in Science consists of bouldery deposits which at that time (1922) I interpreted as a gravelly till transported and deposited by glaciers that extended far over the Columbia Plateau. The principal feature of the deposits that suggested glacial action is the presence of large boulders, some of them of foreign origin. From information of the region that has been made available since 1922, however, I have concluded that the deposits are more likely the work of flood waters, such as postulated by Bretz, rather than of glacial ice. That is—I do not regard them as conclusive evidence of glaciation. On the other hand the deposits are indirectly, if not directly, related to glaciation and may have been formed by streams that gouged out the channels and basins under an ice cover as you suggest.

Though Pardee may not have advocated the cataclysmic flood origin of the scablands, Bretz was not its first proponent. McMacken (1937) attributed a "Flood Theory" to a teacher at Lewis and Clark High School, Alonzo P. Troth, who apparently never published his hypothesis.

PARDEE'S REVELATION

Whatever the origins of the cataclysmic flooding hypothesis, J. T. Pardee played a major role in the resolution of the Spokane Flood controversy. His contribution came in rather dramatic fashion at a 1940 meeting of the American Association for the Advancement of Science in Seattle, Washington. Howard Meyerhoff (1978, written communication), who attended that meeting, recalls a key moment in a session organized to debate various proposed origins of the Channeled Scabland. The session, held on Tuesday afternoon, June 18, was entitled "Quaternary Geology of the Pacific." The session paper titles suggested that nonflood origins of the Channeled Scabland would be strongly advocated. A postmeeting field trip had been organized during which Richard Foster Flint of Yale University would demonstrate the evidence for a noncataclysmic origin of the Channeled Scabland. Bretz was invited to participate, but he refused, noting that all of his ideas were in print and that the field evidence would speak for itself.

Early in the session Flint gave a well-prepared synopsis of his complex arguments (Flint, 1938) of proglacial outwash stream aggradation and incision. Flint had proposed that the surface form of the scabland flood bars was that of "non-paired stream-cut terraces in various states of dissection" (Flint, 1938, p. 475). This was an idea

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PEPTALK

Barbara L. Mieras, Partners for Education Program Manager

PEP Members "Bridging the Gulf"

PEPpy greetings to all present and future members of the Partners for Education Program. Please come see us at the GSA 1995 Annual Meeting in New Orleans, where geoscience education promises to be a captivating topic. The Geology Education category received a whopping 118 abstracts, and the two educational theme sessions, Environmental Issues across the Geoscience Curriculum (T45) and Making Connections: Ties between K–12 and University Education (T46), each received more abstracts than any other theme sessions.

Whether or not you're a PEP member, please stop by our PEP-SAGE booth (#414 and 416). We'll have plenty of Partnering information for you and lots of dynamic science education resources for you to examine. We'd like to have everyone see your smiling volunteer faces, so if you're not the camera-shy sort (or even if you are), please proceed directly to the nearest mail drop and send us a picture of you (and your Partner, if possible) for display in the PEP booth.

You can also let everyone in New Orleans know you're part of the PEP team by wearing a PEP volcano sticker on your registration badge. If you don't receive your sticker before the meeting, we'll have a supply at the PEP booth. If you haven't joined PEP but would like to, we'd be glad to remedy that situation at the booth, too. Incidentally, a bright purple PEP registration flier will accompany each GSA member's 1996 dues statement, so another quick way to join PEP is to fill in the back of the flier and return it to us. If you're already a PEP member, you might want to share the flier with someone else (your Partner?) We're currently averaging one new PEP member a day. Let's keep going!

In New Orleans, we'll also be hosting a PEP reception on Tuesday, November 7, from 4:30 to 6:00 p.m. This will be a great opportunity to meet other volunteers who share in K–12 geoscience education. Watch for more details at the meeting registration and the PEP booth. Finally, don't forget to save Monday, November 6, from 4:00 to 6:00 p.m., to participate in the Earth Science Educators' Social Hour, the Rock Raffle, and the Share-A-Thon. If you have a tempting rock, mineral, or fossil sample to donate to the Rock Raffle, please call us at (800) 824-7243 for more information. Thanks! ■

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that Bretz (1923a) had introduced, but rejected after further study. Flint (1938) proposed that the normal process of channel aggradation by proglacial outwash streams was followed by dissection to leave remnants of a fill that locally resembled bar forms.

Subsequent papers at the 1940 meeting reiterated various hypotheses for the origin of the Channeled Scabland. E. T. Hodge (1940) presented his scenario involving glacial erosion in the scablands associated with complex damming and diversions by river ice. I. S. Allison (1940) presented a synopsis of Flint's fill hypothesis and contrasted it with his own ice-jam theory. In a later paper Allison (1941) pointed to key shortcomings in the Flint hypothesis.

The eighth speaker in the session was Joseph Thomas Pardee, who rose to speak on "Ripple Marks(?) in Glacial Lake Missoula." The modest title and the low-key delivery were deceiving. Pardee quietly described the "ripple marks" at Camas Prairie (Fig. 2), an intermontane basin in northwestern Montana. He described their size as "extraordinary," heights of up to 15 m and spacings of as much as 150 m (Pardee, 1940). His written discussion (Pardee, 1942) also had an understated title, "Unusual Currents in Lake Missoula." His work, dating back to before Bretz's studies, clearly demonstrated that Lake Missoula was the source of catastrophic floods through the Channeled Scabland. He noted that about 2000 km^3 of water were held in the lake. Moreover, the glacial dam impounding this lake had clearly failed suddenly, with a resultant rapid draining of the lake. Evidence for this failure included severely scoured constrictions in the lake basin, huge bars of current-transported debris (Fig. 3), and the giant current ripple marks. However, Pardee (1942) did not state the connection to the Channeled Scabland. Perhaps he generously left that point to Bretz.

In the summer of 1952, Bretz, then nearly 70 years old, returned for his last summer of fieldwork in the Channeled Scabland. The purpose was to investigate new data that had been obtained in surveys for the Bureau of Reclamation's Columbia Basin project. H. T. U. Smith accompanied him, acting in the field as "skeptic for all identifications and interpretations" (Bretz et al., 1956, p. 761). George E. Neff of the Bureau of Reclamation pointed out many new exposures of flood sediments.

Bretz returned from the 1952 field season with a wealth of new data. The U.S. Bureau of Reclamation had been especially generous in supplying maps, aerial photographs, and sedimentological information. Bretz wrote the extensive report over the next year. In that paper (Bretz et al., 1956), the most convincing evidence for cataclysmic flooding proved to be the presence of giant current ripples on bar surfaces (Fig. 4). These showed clearly that bars 30-m high were completely inundated by phenomenal flows of water. Numerous examples of giant current ripples were found on the same bars that Flint had interpreted as normal river terraces. Such features could have been produced only by the flow velocities associated with truly catastrophic discharges.

J. T. Pardee may have been wrong in his 1922 interpretation of scabland flood bars, but his 1940 description of giant current ripples proved to be the key point for convincing skeptics of the cataclysmic flood hypothesis. His first paper on glacial Lake Missoula was published in 1910, only one year after he began his 32 year career with the U.S. Geological Survey. His last paper on the subject appeared in 1942, the year after his official retirement from government service on May 30, 1941, at the age of 70. His recognition of the giant current ripples of Lake Missoula was followed by the documentation of 15 scabland ripple fields by Bretz et al. (1956) and nearly 100 by Baker (1973) and Baker and Nummedal (1978) (Fig. 4). The hydraulics of the cataclysmic flows have proven to be physically consistent with the various geomorphological field evidence (e.g., O'Connor and Baker, 1992). Unresolved issues remain as to the numbers, sizes, and timing of the late-glacial floods (Baker and Bunker, 1985; Waitt, 1985), which have now been named for Lake Missoula (Bretz, 1969), the source that was so well documented by Joseph Thomas Pardee.

Figure 2. Giant current ripples at Camas Prairie, north of Plains, Montana. The ripples are composed of foreset-bedded gravel and consist of ridges up to 15 m high, spaced as much as 200 m apart. They cover approximately 10 km^2 of northern Camas Prairie.

Figure 3. Giant flood bar at the mouth of a small tributary to the Flathead River valley near Perma, Montana. Described as "gulch fills" by Pardee (1942), the deposit is an eddy bar (Baker, 1973) formed during the rapid draining of glacial Lake Missoula. The low terrace in the foreground consists of lacustrine silt emplaced by the reformation of glacial Lake Missoula after its cataclysmic draining phase.

DISCUSSION

The Spokane Flood controversy has been cited as an illustration of the role of hypotheses in geological science. Emphasis in previous work centered on the role of the "outrageous hypothesis" (Davis, 1926) proposed by Bretz. Formal scientific publications provided the major source for description of the controversy. However, correspondence among the participants reveals a more complex and human character to the controversy. Hypotheses in geology have a profoundly human dimension. Though often associated with single individuals, usually the authors of key scientific papers, hypotheses may emerge from exchanges with colleagues over controversial explanations. The multiple working hypotheses described by Gilbert (1886) and Chamberlin (1890) are worked out among the members of a scientific community. Similarly, the eventual acceptance of a controversial explanation by that community is also a human process. The Spokane Flood controversy provides an excellent example of the social dimension to achieving reliable scientific knowledge.

Figure 4. Giant current ripples at Spirit Lake, Idaho. The partial forest cover indicates the immense scale of these bed forms.

ACKNOWLEDGMENTS

I thank Brian K. McDonald for sharing the results of his archival research into correspondence relating to the Spokane Flood controversy. Conversations with the late J Harlen Bretz provided the stimulus for my original research into the history of the controversy.

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Penrose Conference Scheduled

Tectonic Evolution of the Gulf of California and its Margins

April 16–21, 1996

A GSA Penrose Conference, "Tectonic Evolution of the Gulf of California and its Margins," will be held April 16–21, 1996, in Loreto, Baja California Sur, Mexico. Loreto, a small fishing and tourism town, with direct air service from Los Angeles, is located within the Gulf extensional province on the Gulf of California. The conveners of the conference are Paul Umhoefer, Joann Stock, and Arturo Martín.

This conference will focus on the tectonic development of the Gulf of California region during the past ~15–20 m.y. The Gulf of California is one of two examples on Earth of active oblique-rift plate boundaries. The Gulf of California, and its link to the San Andreas fault system, received much attention during the early days of plate tectonics as a demonstration of the simplicity and the kinematic consistency of the transform model. As a geologically young and currently active plate boundary, the Gulf of California has been the subject of continued investigation by many geoscientists. Because it is an active and accessible plate boundary, it is the focus of a growing community of researchers. However, this region has not received the attention it merits, particularly with respect to integration of marine- and land-based research, and the analogues it may provide to the development of other oblique continental rifts, young oceanic rift systems, and transform-type plate boundaries.

The objectives of this Penrose Conference are to assess the state of knowledge of the Gulf of California region, investigate areas and topics of greatest potential future research, and stimulate collaboration on future research projects in both earth and ocean sciences. In order to assess the tectonics of the Gulf of California and its margins, the conference will cover all aspects of the subject, including relation to the San Andreas fault, plate motions, marine geology and geophysics, seismotectonics, magmatism, structural geology, tectonic geomorphology, stratigraphy and paleontology, geodynamics and modeling of rifts, and comparison to other young rifts. The geographic range of the conference encompasses the marine realm of the Gulf of California and its mouth and the onshore margins in Jalisco, Sinaloa, and Sonora on the east, the Salton Trough in California on the north, and the eastern margin of the Baja California peninsula on the west.

The four and one-half day conference will commence with a late-afternoon summary of the southern San Andreas system and plate motions. The next day and a half will involve sessions on the deep marine areas and margins of the Gulf of California. Then we will spend a day and a half on a field trip in the Loreto area, led by Paul Umhoefer, Becky Dorsey, and Larry Mayer, during which we will examine structures, rock units, and landforms related to the formation of the Gulf of California. On the last day of the conference, we will compare the Gulf of California to other rifts and discuss experimental, analytical, and geodynamic modeling of oblique rifts.

We are especially interested in having a conference that is truly international and involves many researchers from Mexico and the United States, as well as outside North America. Our predecessors said it nicely 20 years ago, when they summarized the first Penrose Conference on the Gulf of California in the February 1975 *Geology:* "… the conference ended with discussion of where and when to hold the next Gulf of California conference. Hopefully, this would occur in Mexico, particularly in light of the need to establish better liaison with Mexican scientists." We couldn't have said it better.

The conference will be limited to about 70 participants. The conference fee has not yet been established, but we hope that it can be less than $750. The fee will include ground transportation from/to the Loreto airport, registration, food, field trip, and double-occupancy lodging. Limited support is available for some graduate students, and we are attempting to obtain partial support for Mexican geoscientists and some participants from outside North America.

Application deadline is November 1, 1995. Prospective participants should send a letter of application to Paul Umhoefer. The letter should describe briefly your research related to the objectives and plan of the conference, and your phone, fax, and E-mail address, if available. The conference is designed to involve all of the participants in either keynote presentations, short oral talks, poster presentations, or active discussion. Thus, in your letter of application, if appropriate, please indicate a title for your prospective short talk or poster. After the applications are received, formal invitations will be sent out in December 1995.

Please direct any questions to one of the conveners: ***Paul J. Umhoefer,*** Department of Geology, Box 4099, Northern Arizona University, Flagstaff, AZ 86011, (520) 523-6464, fax 520-523-9220, E-mail: pju@nauvax.ucc.nau.edu; ***Joann Stock,*** Seismological Laboratory 252-21, California Institute of Technology, Pasadena, CA 91125, (818) 395-6938, fax 818-564-0715, E-mail: jstock@seismo.gps.caltech.edu; ***Arturo Martín,*** Departamento de Geología, CICESE, P.O. Box 434843, San Diego, CA 92143-4843, (011-52 from U.S.) 617-4-45-01, ext. 2425, fax (011-52 from U.S.) 617-4-49-33, E-mail: amartin@cicese.mx. ■

Estates *continued from p. 169*

by Ruby and Mary. He provided important geological input for the siting of the Grand Coulee and Hungry Horse dams, and he played a major role in the discovery of phosphate deposits. His paper USGS Bulletin 842 (see References list) is considered to be an authoritative and thorough compilation of the ore deposits of west-central Montana. As for his role in the Channeled Scabland controversy, after gradually piecing together the evidence, gathered over a vast area and a long period of time, Joe Pardee reported his conclusions in the 1942 *GSA Bulletin* paper "Unusual Currents in Glacial Lake Missoula," and orally in 1940. These were landmark findings that brought the final piece to the Channeled Scabland puzzle and allowed resolution of the controversy.

Joe Pardee's penultimate published work was "Late Cenozoic Block Faulting in Western Montana," which appeared in the *GSA Bulletin* in 1950. This work consolidates the ideas formed during more than 40 years of field work and observation. Joe Pardee died in 1960 and left his entire estate to Ruby. When she died in 1976, the estate was valued at $1.2 million and her will established a trust for the benefit of Mary, with GSA designated as the remainder beneficiary upon Mary's death. In late 1987 Mary and her husband, Ralph Kelly, each set up charitable remainder unitrusts for their personal estates. GSA was again named as a remainder beneficiary of these unitrusts, in both cases to the extent of a 25% interest. Ralph died soon thereafter, and Mary became the sole income beneficiary of all three trusts. Upon Mary's death last year, these three interests passed to GSA, thereby creating the Joseph T. Pardee Memorial Fund.

Mary Kelly was a journalist, not a geologist, but long summers in isolated Rocky Mountain cabins and field camps with Joe and Ruby had a decided influence on her. Born in the Bitterroot Valley of western Montana, she grew up in Washington, D.C. toward the close of the era of horse-drawn carriages and gaslights. The family traveled extensively because of Joe's field work, and Mary returned to Montana to attend the University of Montana in Missoula, where she earned a degree in journalism. She worked many years for newspapers in Montana and Alaska. She and Ralph met in Great Falls, wed, and moved to Fairbanks, where they wrote and farmed. In 1946 they returned to the family homestead in Philipsburg, Montana. This ranch was their home for the rest of Ralph's life and until Mary entered the nursing home in Missoula.

In their later years the Kellys traveled extensively. Just about every trip ended with an increase in the Philipsburg rock collection. Although neither was trained as a geologist, Mary and Ralph maintained a keen interest in rocks, geology, and landforms. Mary described herself as a geologist "by infusion" as a result of those months in the field with Joe and Ruby in Montana and the Northwest. An example of her writing ability is the memorial she wrote to her father, and which was published in the GSA Bulletin (see References list).

Reflecting on the lives of Joe Pardee and Mary Kelly, it is impossible to establish a point source for the significant wealth that was accumulated over a century. We can only assume it to be a supurb manifestation of frugal, hard-working lifestyles at modest income levels combined with careful, conservative, consistent investing. The camouflage was near-perfect, for in their later years Mary and Ralph were considered by the townspeople in Philipsburg to be old and poor. True, they were old, but they were decidedly not poor. This is not to say that the Pardees and Kellys were miserly. They enjoyed life, they traveled, and Mary evolved into a supporter of every charitable cause that managed to locate her mailing address.

What is the legacy of these unsung lives that are now concluded? Through the Pardee and Kelly philanthropy, many young people will become interested in Earth and science, and many future geologists will receive direct and indirect financial support during their careers. The Pardees and the Kellys were masters at surprise, and they saved the best for last!

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