

Memorial to Anna I. Jonas Stose 1881-1974

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Anna Isabel Jonas Stose was born in Bridgeton, New Jersey, August 17, 1881. She married George Willis Stose in September 1938; he died in 1960. Anna died October 27, 1974, at the Lutheran Nursing Home, Ocean View, New Jersey. Except for steadily failing eyesight, which led to about two years of blindness, her physical and mental health were good until she suffered a massive stroke about ten days before her death. Burial was in the Overlook Cemetery, Bridgeton, New Jersey. No near relatives survive her.

Anna, the only child of George and Mary Hughes Gilbert Jonas, was extremely proud of her Cape May, New Jersey, ancestry. Among her forebears were Israel Hughes, a plantation owner on "Cape Island"; Aaron Bennett and William Eldredge, late 18th- and early 19th-century Delaware River pilots; Peter and John Carson, early Swedish whalers; and Joseph and Hannah Gorham Whilldin who, along with several other whalers and their families, emigrated from New England to Cape May during the early 1690s. Hannah Gorham, a granddaughter of John Howland (one of the Pilgrims who came to America on the *Mayflower*), was a special source of pride to Anna. One verse and one chorus of a rather long poem that Anna wrote on her 90th birthday express her deep feelings about her heritage and her native south New Jersey:

Strip the years from off my shoulder
Carry me back where I would be
To the Homestead of my forebears
On Cape Island by the sea.

Carry me back to old Cape May
Where the Howlands came to stay
And Poseidon and his trident
Rule the ocean waves as in Ancient days.

The complete poem was published in the June 1971 issue of *The Cape May County Magazine of History and Genealogy*.

Anna's formal education included attendance at Friends Central School of Philadelphia, Pennsylvania, and both undergraduate and graduate work at Bryn Mawr College. She received her A.B. in 1904, her A.M. in 1905, and the Ph.D. in 1912. While at Bryn Mawr, she was a demonstrator in the geological laboratories from 1905 to 1906 and the assistant curator of the college's Geology Museum from 1908 to 1909. Her mentor was the first *grande dame* of American geology, Florence Bascom. Two of her college classmates were the geologists Eleanora Bliss Knopf (1881-1974) and Julia Gardner (1882-1960). The more than 50 years of mutual devotion (albeit not without tiffs) of these three is almost legendary.

Anna was a staff member of the Department of Geology and Invertebrate Paleontology of the American Museum of Natural History from 1916 to 1917; cashier for the family

business (the Williamstown Glass Company) during part of World War I; and geologist with the Maryland and Pennsylvania geological surveys from 1919 to 1937, the Virginia Geological Survey from 1926 to 1945, and the United States Geological Survey from 1930 until her retirement in 1954. She was elected a Fellow of the Geological Society of America in 1922 and was a long-time member of the American Geophysical Union and the Washington Academy of Science. She also held membership in the Society of Mayflower Descendants and the Cape May County Historical and Genealogical Society.

Throughout her career Anna was a controversial figure. She had a tendency to be impetuous and nearly always said exactly what was on her mind, often interspersed with salty expletives. She was a keen observer in the field but on occasion seems to have extrapolated a good observation a bit further than was warranted. In many cases, the facts on her field maps and in her rather voluminous notes became modified by ideas, so that her published maps tended to become somewhat schematic cartoons.

These imperfections notwithstanding, Anna's contributions to the understanding of Appalachian geology are monumental. She first collaborated with Eleanor Bliss (later Knopf) in southeastern Pennsylvania and adjacent Maryland. She extended her reconnaissance mapping southwestward through the Piedmont and Blue Ridge Provinces, alone and with George Stose. She was largely responsible for the crystalline rock delineations shown on both the Geologic Map of Virginia (1928) and the Central and Southern Appalachians part of the Geologic Map of the United States (Stose and Ljungstedt, 1932, U.S. Geological Survey map). She and her coworkers were, for all practical purposes, the first to widely apply the then-advancing petrographic and structural techniques to Appalachian investigations. She was the first to recognize several Appalachian sequences involving deformation; magmatism; faulting, shearing, and mylonitization; and both progressive and retrogressive metamorphism. Her geographic and geologic coverage was truly "mind-boggling," especially when one considers the times and conditions under which she worked. It seems very likely that Anna Isabel Jonas Stose observed and recorded more exposures of more rock units in the crystalline Appalachians than any other geologist has or probably will in the future. Although she made mistakes, she also recorded many observations and offered a number of interpretations that have stood the test of time. Moreover, she gave all subsequent Appalachian geologists a basic picture to modify and perfect—a picture that was largely blank when she began her work.

As might be expected for a pioneer field-oriented geologist, Anna was solely or jointly responsible for several of the currently used names for rock units and structures in the Central and Southern Appalachians. Among the better known ones are the Ordovician Cocalico Shale and Conestoga Limestone of southeastern Pennsylvania; the Precambrian Hartley Augen Gneiss and the Precambrian (or Eocambrian or Cambrian) Peters Creek Schist of southeastern Pennsylvania and adjacent Maryland; the Lynchburg and Lovingston Gneisses and the Petersburg and Striped Rock Granites of Virginia; the Mount Rogers Volcanic Series of southwestern Virginia and adjacent North Carolina and Tennessee; the Martic thrust of Pennsylvania and Maryland; and the Fries and Holston Mountain thrusts which extend southwestward from southwestern Virginia. She also was solely or jointly responsible for the introduction and (or) extension of some of the major hypotheses relating to correlation of certain metamorphic units and to mechanics of some of the major structures within the province.

Her work and ideas on the Martic thrust, first published in collaboration with Eleanor Bliss (Knopf), serve as an example: The type area is near Martic Forge, southeastern Pennsylvania—an area of "imperfect exposure, complexity of deformation, variation in intensity of deformation, original changes in lithologic characters, and lack of known fossils, so that interpretations are impeded" (F. M. Swartz, 1948, *Bulletin of the American Association of Petroleum Geologists*, v. 32, p. 1512). As a result of their mapping, Mrs. Knopf and Anna suggested that the Wissahickon Schist, which they believed to be Precambrian, is in thrust contact with the Ordovician Conestoga Limestone that crops out directly to the west of the Wissahickon. They named the hypothesized thrust the Martic fault. Later, Anna

extended the fault contact along the strike both northeastward in Pennsylvania and southwestward in Virginia. In the meantime, several geologists questioned the fault interpretation, noting that no fault is exposed at Martic Forge and that they believed the fault interpretation was based on the misconception that the Wissahickon is Precambrian. These other geologists supported some version of an alternative interpretation, whereby the Wissahickon-Conestoga contact represents a more-or-less conformable sedimentary relationship. A few dissenters rather disparagingly referred to the contact as the "Martic line," a term which has become rather entrenched in geological literature. It now appears that major faulting indeed occurred within a zone parallel to and including the originally suggested Martic fault at the type locality even if not over the full length of the extended strike zone later suggested by Anna.

Geological literature about the Brevard Zone presents a similar story: Anna was the first to recognize that the Brevard Zone rocks represent a fault zone. She hypothesized that the zone marks a major thrust fault. Subsequently, some other geologists suggested an alternative interpretation under which the zone became the trace of a large strike-slip fault. This latter alternative gained wide acceptance for several years. Today, however, it is thought that Anna's original interpretation may be more nearly correct.

Currently, in fact, it seems that more and more of Anna's and her collaborators' once-controversial interpretations of Appalachian structures are being found to be fundamentally correct (albeit most with some modifications)—for example, their ideas about the Cartersville thrust of Georgia and the Fries thrust of Virginia and their once seemingly discredited view that the Reading Prong of Pennsylvania consists of several klippen. Nonetheless, it also appears that some of the tenets that Anna long championed may not prove to be acceptable—for example, her carrying of the Wissahickon as far to the southwest of its type locality area as Georgia.

In some circles, Anna had the reputation of being unwilling to change her mind once she had made it up. A review of her papers, authored alone and with George Stose, about the relationships between the Blue Ridge "Complex" rocks and the Lynchburg Gneiss indicates quite the contrary: In 1927, she supported an interpretation under which not only the Catoclin Greenstone but also the underlying Lynchburg Gneiss was intruded by granitic gneiss of the Blue Ridge "Complex." In 1935 she demonstrated that locally the Catoclin overlies granodioritic rocks of the complex unconformably and that basaltic dikes genetically related to the Catoclin cut the complex rocks, but she retained the view that the Lynchburg Formation was intruded by granitic rocks of the complex. In 1939 her interpretations were again revised, and from then on she championed the currently accepted concept under which the Lynchburg Formation also overlies the Blue Ridge "Complex" unconformably. About this subject she once wrote to me: "I originally followed previous workers . . . in this error but that does not excuse it!" In the same letter she also reiterated her strong belief in field conferences to help resolve differences of opinion. Especially in her later years, she frequently lamented the fact that such conferences seemed to be going out of style.

Information about the late stages of Anna's active career is given in Hugh Miser's "Memorial to George Willis Stose" in the 1960 Annual Report of the Geological Society of America, pages 145 and 146. Only a footnote will be added here: On one of their climbs near Little Switzerland, North Carolina, Anna (then over 70 years old) convinced George that *he* should stop and rest while *she* would continue the last approximately half mile up to the top and back. Reluctantly he agreed and she finished the climb (all 4 feet, 11 inches, and 100 pounds of her).

In these days when the women's movement is so much in the public eye, it might be considered remiss not to say something about Anna's being one of only a few women in what was very much a "man's profession" throughout her active career. A fact and a perception warrant mention: According to records, when she was an Associate Geologist for the Pennsylvania Survey, "compared to what the records show for . . . others employed at that time, her 1923 rate of \$10 per day plus expenses was a handsome stipend." (Arthur A.

Socolow, personal communication, 1975). James Gilluly, a colleague of Anna's on the U.S. Geological Survey and a past president of the Geological Society of America, has written (personal communication, 1975): "Anna was a fiery old gal with a heart of gold . . . a women's libber before the name was coined . . . a fine *person* whom I respected highly both as a *person* and as a geologist." (italics are mine).

Such respect is widespread among geologists, both those who knew Anna personally and those who knew her only through her published reports. In a recent review article, she was singled out, along with Arthur Keith, for her many contributions to the "general understanding of the broad regional relations" about Blue Ridge geology. Upon hearing that she requested me to prepare her memorial, a number of geologists told me of their ever increasing admiration for various aspects of her work. One of her long-term antagonists has written: "I admire her work more and more as time goes by. I did not fully appreciate her pioneer achievements in my early days." It is noteworthy that Anna has more listings in the author index of *Studies of Appalachian Geology: Central and Southern*, published in 1970, than any other geologist.

Great respect is also due for some of her less-known activities. For example, until now only a few people knew that Anna underwrote all the expenses of a medical education for a son of a black messenger on the staff of the U.S. Geological Survey. She never told anyone—the messenger did.

As can be seen in the appended selected bibliography, Anna's geological publications spanned sixty years. Her first paper, published in 1905, set the stage for her subsequent work, most of which dealt with rocks of the crystalline Appalachians; her last, published in 1965, involved the cataloging of lithologies and possible sources (also within the crystalline Appalachians) of some 18th-century tombstones in old graveyards of Cape May County, New Jersey. In this last paper, after noting possible correlation of some of the rocks of the tombstones with radiometrically dated Early Paleozoic rocks, the then-84-year-old Anna noted, "Thus they belong to the last quarter of time computed for the crust of the earth now visible to man. . . . Earlier events of the formation of the earth and universe are not clear to man and are known only to God, 'Maker of Heaven and Earth, and of all things visible and invisible.' "

As already mentioned, Anna's last publication was a poem. Another verse from that poem seems to afford an allegorically fitting end to this memorial:

Swamp Magnolias and Arbutus
Greet us in the spring
Just a foretaste of the bounty
That other seasons bring.

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