

Memorial to Sigurdur Thorarinsson

1912–1983

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Professor Sigurdur Thorarinsson died of a heart attack on February 8, 1983, at the age of 71. Sigurdur had just relinquished his professorial post at the University of Iceland and was engaged on two major projects that had long been waiting for his attention: a book on the volcanology of Iceland and another book to commemorate the 200th anniversary of the Laki Fires of 1783. Sigurdur appeared in reasonably good health and active as ever, and we all expected that he had before him at least a decade of research and writing.

Sigurdur Thorarinsson was born on January 8, 1912, at the farm Hof in Vopnafjörður, eastern Iceland. The ash fall from the catastrophic Askja eruption of 1875 had displaced the family from its farm in Jökuldalur to the Vopnafjörður region the year his father

was born. Among the main themes in the work of Sigurdur Thorarinsson was to be the thousand years' struggle of the Icelanders with fire and ice.

The young Sigurdur was a precocious child, and the local minister *cum* teacher urged that he be sent to school at a time when few farmers in eastern Iceland could afford such luxury for their children. He enrolled in the Akureyri High School in 1926 and graduated there in 1931 with high distinction in every subject. Swaying towards studies in literature and the classics on the one hand and the natural sciences on the other, he decided in favor of the latter, partly because of the influence of his geology teacher and partly because of the lack of science-educated manpower in Iceland at the time.

Sigurdur Thorarinsson enrolled at the University of Copenhagen in 1931 but transferred a year later to the University of Stockholm where he studied physical geography and geology, and petrology and botany as supporting subjects. He received his degrees of fil.kand. in 1938 and fil.lic. in 1939, writing his theses on the movement and drainage of the Icelandic glacier Hoffellsjökull, and on ice-dammed lakes in Iceland. At this time the University of Stockholm had such eminent professors as Gerard de Geer, known for his varve-chronology; Lennard von Post, pioneer in pollen analysis; and Hans W:son Ahlmann, the geomorphologist with whom Sigurdur was later to collaborate for many years.

The dice determining the future work of Sigurdur seem to have been cast early. His lifelong association with the glacier Vatnajökull and its subglacial volcanoes began when he returned from Sweden in the spring of 1934 to investigate the effects of the Grimsvötn eruption and the accompanying jökulhlaup in the river Skeidara. That same summer he started looking into layers of volcanic ash in soil sections in Iceland with the aim, inspired by von Post, of tracing its Holocene vegetational history through pollen analysis. This, of course, marked the beginning of his most important work, the tephrochronological research that, besides its obvious volcanological importance, has provided an extremely useful interdisciplinary dating tool in Iceland. Thus, the tephrochronological techniques are now an indispensable part of researches in Icelandic archaeology, climatic

history, vegetational history, settlement history, and even glaciology. Through his tephrochronological research Sigurdur unraveled the history of ablation in Iceland, tracing its causes to deteriorating climate, natural catastrophies, and human activities. He became one of the first environmentalists in Iceland, advocating harmonious intercourse between Man and Nature.

In that summer of 1934 Sigurdur happened to be in Akureyri when a large earthquake took place near Dalvík, some 40 km away, on which he wrote his first scientific paper "Das Dalvík-Beben in Nordisland" (1937).

In the summers 1936–1938 Sigurdur Thorarinsson participated in the Swedish-Icelandic expeditions on the Vatnajökull glacier, directed by J. Eythorsson and H. W:son Ahlmann, resulting in a paper still much quoted by glaciologists, "Present Glacier Shrinkage and Eustatic Changes of Sea-level" (1940).

In the summer of 1939 he participated in a joint Nordic archaeological excavation in Thjorsardalur, a region in South Iceland laid waste by the 1104 Hekla eruption. Here his tephrochronological technique, using volcanic ash layers as marker horizons for dating, was applied for the first time, along with pollen analysis, resulting in the discovery of an ash layer deposited just about the time of settlement in Iceland, and now called the Landnam (Settlement) layer. The material collected in this expedition he used for his doctoral thesis at the University of Stockholm, "Tephrochronological Studies in Iceland" (1944). Here he introduced the term "tephra" as a collective term for airborne volcanic ejecta, or pyroclastics, having found the word in Aristotle's *Meteorologica* where it was used for volcanic ash. This term has since been internationally accepted, as well as the word "tephrochronology" which he coined for the methods used for dating with help of volcanic ash.

During his ten years of study and work in Sweden, Sigurdur Thorarinsson did not restrict his activities to geology. Always a prolific writer, he wrote extensively in the Swedish press on various subjects, ranging from politics to literature, from travelogs to Iceland's position in the war. He associated with the intelligentsia of science, humanities and politics of that time, and formed ties of friendship that remained true until the day he died. In Sweden he also met his wife to be, Inga Backlund, to whom he was married in 1939. His father-in-law was the mathematician Sven Backlund who was one of the architects of the Swedish utopia. Last, but not least, Sigurdur became imbued with the tradition of the Swedish ballade, which traces its heritage to Bellman; it was partly through his light-hearted poetry and his ballade-singing that Sigurdur was so well known and popular amongst his countrymen.

After the war Sigurdur Thorarinsson returned to Iceland where he became director of the geological and geographical divisions of the Museum of Natural History in 1947. In 1950–51 he was appointed associate professor at the University of Stockholm, and in 1968, when a program in the natural sciences was taken up at the University of Iceland, he took over the first professorship in geology and geography.

Sigurdur Thorarinsson's grapplings with the volcano Hekla began for earnest during the excavation in 1939 and were to continue from then on. The 1947/48 eruption of Hekla was the first one in Iceland to be closely studied by geoscientists, and Sigurdur wrote many articles on his researches there, including three volumes in the monograph series *The Eruption of Hekla 1947–1948* published by the Icelandic Science Academy. Amongst these is his authoritative work *The Eruptions of Hekla in Historical Times. A Tephrochronological Study* (1967). From then on Sigurdur observed every eruption occurring in Iceland for three and a half decades and wrote on most of them.

Through his tephrochronological researches, Sigurdur Thorarinsson unraveled the eruption histories of many of Iceland's most active volcanoes in addition to Hekla:

Kverkfjöll (1950), Öraefajökull (1958), and Grimsvötn (1974), all in the glacier Vatnajökull, and Katla beneath the glacier Myrdalsjökull (1975). The dating of the various tephra layers he accomplished chiefly through the study of written annals and documents, for which his linguistic aptitude served well, for Sigurdur belonged to the generation of European scholars who had learned considerable Latin; he also was quite fluent in German and French apart from the Scandinavian languages and English. Through these investigations he discovered a number of tephra layers that had to be attributed to unknown and unrecorded eruptions, and whose source and age he could glean from his profiles. Strange as it may seem, some of the greatest eruptions in historical times in Iceland have gone unrecorded or have merely been mentioned in passing in the Sagas, such as the great 1104 Hekla eruption, previously mentioned, and two very large eruptions from the first century of settlement in Iceland, the one giving rise to the "Settlement layer," and another now widely equated with the Eldgja lava flow. It was a great source of satisfaction to Sigurdur when some of the tephrochronological results were substantiated by independent evidence from cores of the Greenland ice sheet, providing more exact age datings.

As the years passed the activities of Sigurdur Thorarinsson in volcanology and the various applications of tephrochronology gradually overshadowed his other fields of interest. An exceptionally gifted and prolific man, however, he followed and frequently wrote on various other subjects without doing much systematic research himself. Thus he remained the "grand old man" of Icelandic glaciology, having been a member of the board of the Iceland Glaciological Society from its foundation in 1950, and its president since 1969, although the brunt of the research was passed into younger hands. The subjects of his articles in the last ten years included such diverse topics as polygon surfaces and palsen, glaciology and remote sensing, history and archaeology, bibliography and book reviews, climatology and nature conservation, in addition to volcanology and tephrochronology. In all, Sigurdur wrote over 200 articles on various scientific subjects, and an even greater number of popular nature and of general interest, including one book of sociological essays.

As previously said, he pioneered a movement of nature conservation in Iceland and drafted the first legislation enacted on that subject; he was also a member of the board of the Nature Conservation Council from its foundation in 1956. Interested in Nordic cultural cooperation, he instigated and actively supported the foundation of the Nordic Volcanological Institute in Iceland and was a member of its board from the beginning. From 1964 onwards he organized and guided annual excursions of Nordic geologists and physical geographers in Iceland and was a member of numerous Nordic institutions and boards.

As a measure of the esteem in which Sigurdur Thorarinsson was held at home and internationally as a scientist, he was elected Dr. *h. c.* of the University of Iceland in 1961 and member of the Icelandic Science Academy in 1946, the Geological Society of London in 1954, the Danish Royal Academy in 1957, the German Naturalist Academy Leopoldina in 1961, the Royal Science Academy of Göteborg in 1968 and of Lund (Sweden) in 1969, the Royal Science Academy of Norway in 1971, of Sweden in 1971, of Finland in 1975, and the Explorer's Club, New York, in 1978. He was an honorary member of various societies, including the Geological Society of America, 1973, and the International Glaciological Society, 1973. He was the recipient of various honours and medals, including the Spendiarioff Prize of the 20th International Geological Congress, 1960; the Back Prize of the Royal Geographical Society (London), 1967; the Clara-Lachmann Prize and the Steno Medal, 1969; the Vega Medal, 1970; and the Vitus Berling Medal,

1976. He gave invited lectures at about 110 different universities and conferences in all the inhabited continents of the globe.

Sigurdur Thorarinsson was in many ways the personification of Icelandic geology, and in his day, publically, by far the best-known earth scientist in Iceland. As a member and long-time chairman of the geology department and board member of the Science Institute of the University of Iceland, he advocated, both directly and indirectly by his own example, that the earth sciences "step into the 20th century" in attitudes and methods; in this, and in his sharpness of mind and quickness in grasping the interesting and salient aspects of the issues, he remained in many ways the youngest amongst us in spite of his 70 years. He was a remarkable man, and his a remarkable career.

SELECTED BIBLIOGRAPHY OF SIGURDUR THORARINSSON

- 1937 Das Dalvik-Beben in Nordisland: *Geografiska Annaler*, v. 19, p. 232–277.
- Vatnajökull. The main geological and topographical features of Iceland: *Geografiska Annaler*, v. 19, p. 161–175.
- 1938 (with H. W:son Ahlmann) The Vatnajökull glacier: *Geographical Review*, v. 28, p. 412–438.
- (with H. W:son Ahlmann) Vatnajökull. The ablation: *Geografiska Annaler*, v. 20, p. 171–233.
- Über anomale Gletscherschwankungen mit besonderer Berücksichtigung des Vatnajökullgebiets: *Geologiska Föreningen af Stockholm Förhandlingar*, May–Oct., p. 490–506.
- 1939 (with H. W:son Ahlmann) Vatnajökull. The accumulation: *Geografiska Annaler*, v. 21, p. 39–66.
- 1940 The ice-dammed lakes of Iceland: *Geografiska Annaler*, v. 21, p. 216–242.
- Present glacier shrinkage and eustatic changes of sea-level: *Geografiska Annaler*, v. 22, p. 139–159.
- 1943 Oscillations of the Iceland glaciers during the last 250 years: *Geografiska Annaler*, v. 25, p. 1–54.
- (with H. W:son Ahlmann) Vatnajökull. Scientific results of the Swedish-Icelandic investigations 1936–37–38: ESSELTE, Stockholm, 306 p.
- 1944 Tephrochronological studies in Iceland. The Thjorsa valley and its destruction (in Swedish): Ejnar Munksgaard, Copenhagen, 217 p.
- 1949 Some tephrochronological contributions to the volcanology and glaciology of Iceland. *Glaciers and climate: Geografiska Annaler*, v. 31, p. 239–256.
- The approach and beginning of the Hekla eruption: *The eruption of Hekla 1947–1948*, v. II, no. 1, p. 1–23.
- 1950 The eruption of Mt. Hekla 1947–1948: *Bulletin Volcanologique*, Ser. II, no. 11, p. 157–168.
- 1951 Laxargljufur and Laxarhraun. A tephrochronological study: *Geografiska Annaler*, v. 33, p. 1–80.
- Notes on patterned ground in Iceland: *Geografiska Annaler*, v. 33, p. 144–156.
- 1953 Some new aspects of the Grimsvötn problem: *Journal of Glaciology*, v. 2, p. 267–274.
- 1954 The tephra-fall from Hekla on March 29, 1947: *The eruption of Hekla 1947–1948*, v. II, no. 3, 68 p.
- 1956 *Hekla on fire*: Hanns Reich Verlag, Munich, 32 p.

- 1957 The jökulhlaup from the Katla area in 1955: *Jökull*, v. 7, p. 21–25.
- 1958 The Öræfajökull eruption of 1362: *Acta Naturalia Islandica*, v. II, no. 2, 100 p.
- 1959 On the geology and geomorphology of Iceland: *Geografiska Annaler*, v. 77, p. 135–169.
- 1960 Glaciological knowledge in Iceland before 1800: *Jökull*, v. 10, p. 1–14.
- On the predicting of volcanic eruptions in Iceland: *Bulletin Volcanologique*, v. 23, p. 1–14.
- 1961 Population changes in Iceland: *Geographical Review*, v. L1, no. 4, p. 519–533.
- 1962 (with G. E. Sigvaldason) The eruption in Askja 1961: *American Journal of Science*, v. 260, p. 641–651.
- L'Erosion éolienne en Islande à la lumière des études tephrochronologiques: *Revue Géomorphologique*, v. 13, p. 107–124.
- 1963 Askja on fire: *Almenna bókafélagid Publ.*, Reykjavík, 55 p.
- The Svinafell layers. Plant-bearing interglacial sediments in Öræfi, Southeast Iceland, in Löve, A., and Löve, D., eds., *North Atlantic biota and their history*: Pergamon Press, p. 377–389.
- 1964 On the age of the terminal moraines of Bruarjökull and Halsajökull: *Jökull*, v. 14, p. 67–75.
- Sudden advances of Vatnajökull's outlet glaciers 1930–1964: *Jökull*, v. 14, p. 76–89.
- 1965 Surtsey. Island born of fire: *National Geographic Magazine*, v. 128, p. 713–726.
- 1966 Surtsey. The new island in the North Atlantic: Reykjavík, p. 1–47.
- The median zone of Iceland: *The World Rift System*. Geological Survey of Canada, Paper 66-14, p. 187–211.
- 1967 The eruption of Hekla in historical times. A tephrochronological study: *The eruption of Hekla 1947–1948*, v. I, 183 p.
- Some problems of volcanism in Iceland: *Geologische Rundschau*, v. 57, p. 1–20.
- 1968 On the rate of lava and tephra production and the upward migration of magma in four Icelandic eruptions: *Geologische Rundschau*, v. 57, p. 705–718.
- 1969 Glacier surges in Iceland with special reference to the surges of Bruarjökull: *Canadian Journal of Earth Sciences*, v. 6, p. 875–882.
- The Lakagigar eruption of 1783: *Bulletin Volcanologique*, v. 33, p. 910–929.
- 1970 Tephrochronology and medieval Iceland, in Berger, R., ed., *Scientific methods in medieval archaeology*: University of California Press, p. 295–328.
- 1971 Damage caused by tephra fall in some big Icelandic eruptions and its relation to the thickness of the tephra layers: *Acta of the International Scientific Congress of the Volcano of Thera, Athens*, p. 213–236.
- (with J. D. Friedman and others) Observations on Icelandic polygon surfaces and palsa areas: *Geografiska Annaler*, v. 53, p. 115–145.
- 1972 (with J. D. Friedman and others) Infrared emission from Kverkfjöll subglacial volcanic and geothermal area, Iceland: *Jökull*, v. 22, p. 27–43.
- (with G. E. Sigvaldason) The Hekla eruption of 1970: *Bulletin Volcanologique*, v. 36, p. 269–288.
- 1973 (with others) ERTS-I image of Vatnajökull. Analysis of glaciological, structural and volcanic features: *Jökull*, v. 23, p. 7–17.
- (with others) The eruption on Heimaey, Iceland: *Nature*, v. 241, p. 372–375.
- 1974 The history of Grimsvötn eruptions and jökulhlaups in Skeidara (in Icelandic): *Menningarsjóður Publ.*, Reykjavík, 254 p.
- 1975 Katla and its annal of eruptions (in Icelandic): *The Icelandic Travel Club Annual Publication*, p. 129–149.

- 1976 Course of Events: The eruption of Hekla 1947–1948, v. IV, no. 1, 31 p.
- 1977 (with G. Larsen) H-4 and other acid Hekla tephra layers: *Jökull*, v. 27, p. 28–46.
- 1978 Some comments on the Minoan eruption of Santorini, *in* Thera and the Aegian world, Vol. I: Papers presented at the Second International Scientific Congress, Santorini, Greece, p. 263–275.
- 1979 Damage caused by volcanic eruptions with special reference to tephra and gases, *in* Sheets, P. D., and Grayson, D. K., eds., Volcanic activity and human ecology: Academic Press, New York, p. 125–159.
- 1980 (with others) The Sölheimar layer and the Katla eruption of 1357: *Acta Naturalia Islandica*, v. 28, 24 p.
- 1981 Tephra studies and tephrochronology: A historical review with special reference to Iceland, *in* Self, S., and Sparks, R.S.J., eds., Tephra studies as a tool in Quaternary geology: D. Reidel Publishing Company, Dordrecht, p. 1–12.
- The application of tephrochronology in Iceland, *in* Self, S., and Sparks, R.S.J., eds., Tephra studies as a tool in Quaternary geology: D. Reidel Publishing Company, Dordrecht, p. 109–134.