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Presentation of the Roebling Medal of the Mineralogical Society of America for 1985 to Francis John Turner

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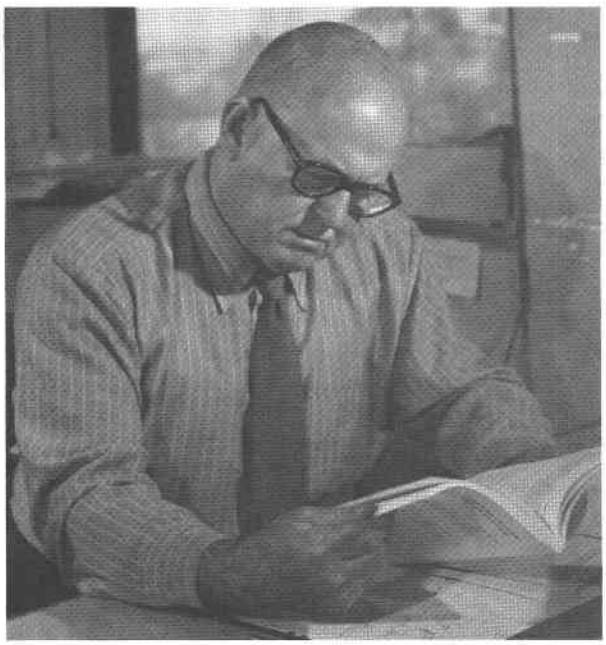
Mr. President, Members and Friends of the Society:

I have been asked to introduce Francis Turner, this year's recipient of the Roebling medal. This is an unconventional task. First, Frank is not here. He is presently recovering from a stroke which he suffered last summer. But even if he were here, he would not need an introduction because almost every earth scientist knows him either through reading his books as an undergraduate or graduate student, by applying his research results and ideas or by hearing at least one of the many tales about him which circulate. It is fair to say that Berkeley is only slowly recovering from the Turner syndrome—18 years after his retirement we still have graduate students coming for no reason other than U.C. is where Frank Turner is.

Rather than going over all of his achievements, I will try to highlight a few, but I would also like to share with you the content of recent discussions I have had with Frank in the hospital in which he reminisced about the most important events in his life. I am therefore combining two speeches—an introduction and his acceptance.



Francis John Turner was born on April 10th, 1904, in Auckland, New Zealand. In 1921 he entered the University College of Auckland to study geology, and, under the influence of Professor J. A. Bartrum, acquired a broad background in virtually all branches of the science, from mineralogy to paleontology. He still remembers fondly the pioneering fieldwork he did with Hector and Bartrum when geologic mapping was almost as dangerous as learning to walk again at age 81. Presently he is struggling to free himself from the wheelchair. The other day he said, "I cannot afford to fall. Yesterday I lost my balance and it was like in the old days on South Island when I slipped and fell down a 20-ft cliff."

After graduating with a bachelor's degree he worked briefly as a geologist for the New Zealand Geological Survey while completing his master's thesis. In 1926, at the age of twenty-one, he accepted the position of lecturer in the Department of Geology at Otago University in Dunedin. It was here—stimulated, no doubt, by the head of the department, W. N. Benson—that his interests in igneous and metamorphic processes matured, and that he developed the skills with the polarizing microscope that have placed him among the world's expert petrographers.

At the University of Otago he carried on extensive field investigations and published many studies of metamorphic regions in the South Island, culminating in his monograph on the Otago Schist—a work that still stands as one of the best documented petrographic studies of a region of low-grade metamorphism—and on the metamorphic and plutonic rocks of Lake Manapouri, a then almost inaccessible region in Fiordland. His work earned him the D.Sc. degree from the University of New Zealand in 1934. At that time, New Zealand was a very isolated place without laboratory facilities. Fortunately Benson had an excellent library, and it opened a whole new dimension for Turner who was fascinated by the classic European texts in petrology by Grubenmann, Goldschmidt, Niggli, Schmidt, and Sander. This required great translating skills for somebody not familiar with foreign languages. Along with E. B. Knopf and H. W. Fairbairn in the United States and F. C. Phillips in Britain, Turner became one of the first English-speaking geologists to take a serious interest in the new field of petrofabrics, or structural petrology, as it was later to be named by E. B. Knopf.

It was at his wife Esme's insistence that Frank Turner applied for fellowships to travel abroad, and in 1938, he was awarded a Sterling Fellowship. This led him on his first journey outside New Zealand, on the same day that the ominous Munich Pact was signed in Germany. He

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was going to work with Mrs. Eleanora Knopf, then at Yale University, on the structural petrology of metamorphic rocks.

Until it was cut short late in 1939 by the outbreak of war in Europe, this period in New England opened new scientific horizons for Frank Turner. He also had access to techniques and equipment previously unavailable to him in New Zealand, including the universal microscope stage. Most importantly he met the young David Griggs. As Frank tells it, it was quite accidental. Jim Bell, one of Knopf's students, was mapping the Shonkin Sag pluton from one side and ran into Griggs, a Harvard student who was mapping it from the other side. Griggs—through Turner and Knopf—became interested in petrofabrics, which started one of the most rewarding scientific programs in petrology.

There are details about Griggs that fascinated Turner and in many ways determined his own scientific career. One is the tale of Griggs climbing in the Austrian Alps and suffering a bad accident. Sander, alerted by Knopf, intervened at just the right moment to prevent the amputation of Griggs' leg. Because of his injuries, Griggs took up flying and visited Frank in New Haven by plane, an extraordinary experience for Turner, who grew up in a poor environment. The accident, Sander, the airplane, were, of couse, also events that led Griggs to fly combat missions in Germany and to develop radar, which again was significant in establishing his experimental program at UCLA after the war.

Turner had to return to New Zealand for the war years where he continued to teach at Otago. He began work on what was to become the first truly modern monographic treatment of both the petrology and the structure of metamorphic rocks. Drawing on his vast and scholarly knowledge of the work of his predecessors and incorporating the newest information available to him, he produced a major treatise, published as Memoir 40 of the Geological Society of America.

In 1946 a second opportunity to leave New Zealand, and this time permanently, came with an invitation to join the faculty of the University of California in Berkeley. Chairman Howell Williams discovered him, was impressed, and offered him a job. This was quite unusual: as Frank points out, prior to his appointment at Berkeley, it was inconceivable for anybody to join the faculty who had not taken, as a student, the Berkeley Hills field course. Under Turner's influence this tradition turned to the contrary when at one point over half of its faculty were foreigners.

Under the influences of F. J. Turner and, soon afterward, of J. Verhoogen, the Berkeley department replaced its old-fashioned program of descriptive field geology with a quantitative, analytical, experimental, and theoretical approach that dominated postwar geology. The Department of Geology and Geophysics soon gained international recognition and, during the years that followed, attracted a vigorous young faculty, as well as students and visiting scientists, many of whom came specifically to work with Turner. Between 1950 and 1960 Berkeley had a tremendous impact on earth sciences, and former students (many now in leading faculty positions all over the world) remember it as a time of excitement and inspiration, with little routine and constant changes. One of the first foreign visitors was Eskola. Turner took him to see some glaucophane schists that they discussed while sitting on a boulder in the midst of poison oak on top of Cutting Boulevard just north of Berkeley. Turner thought they represented parts of the greenschist facies while Eskola argued otherwise, stimulating Frank's interest. This led subsequently to the establishment of a low-temperature, high-pressure blueschist facies.

It is refreshing to be reminded of the lack of University administration at a time when UC had about the same number of students as it has today. Frank needed a universal stage and wrote to University President Gordon Sproul. When Frank called up and timidly inquired, Sproul asked: "Are they any good?" Turner replied, "They sure are. A Russian, Fedorow, invented them and there are none on the West Coast." "O.K.," Sproul said, "then get twelve and send me the bill." Today even assistant deans are inaccessible to most faculty. As Department Chairman, Turner was perhaps more authoritarian than some of his colleagues liked: "We talked to everybody to get their opinion and then made a decision. We never had a meeting," but things got done.

In 1951 during his first sabbatical leave with a fellowship from the Guggenheim Foundation, Frank took a trip around the world, eager to meet people and to see different geologic terrains. Memorable were trips to Innsbruck to visit Sander, and a field trip to the Highlands with Fairbairn, arranged by McIntyre. During this year the Turners became aware of European wines. There are rumors of an infamous blind tasting party with McIntyre which established Frank's reputation. Turner recognized immediately a green wine which he had seen in a store earlier: "Neuchatel, 1947," which made perfect sense because McIntyre had just returned from Wegmann. Then Turner played his game. He picked up a glass: "This is not a California or French wine." The guests became interested. He sniffed: "I would not be surprised if it were a Swiss wine." General silence. Sniffing again, "The nose identifies it as Neuchatel." The rest was crazy. Tasting: "The palate puts it as 1947" (which was the only year when wines were good enough to be exported), "it is from vineyard so-and-so on the south slope above the town"—where all the vineyards are but only one of them was big enough to export. It was like a student who identifies minerals by the particular shape they have in the collection. But those of you who know Frank can confirm that he later lived up to the reputation of a true connoisseur.

At Berkeley a productive period of research began that culminated in a series of collaborative papers with Griggs and others on experimental rock deformation that forms the roots of almost all modern work on the subject. When I asked him the other day, Frank singled out the work on Yule marble with Dave Griggs as his most significant

scientific achievement, and he refers to Griggs all the time. Interestingly also, Griggs saw the work with Turner as his most exciting research experience. At the beginning of the Yule marble project, Griggs faced Turner with questions sounding more like those of a general preparing an attack than those of a scientist: "Frank, what do we want to do? What do we know? Why do we want to do it?" Very relevant questions that often are not asked when new projects are started. Frank remembered the night (he suffered from insomnia—that's when he wrote most of his books), when in a lucid moment he interpreted the seemingly absurd opposite sense of rotation of lamellae, leading to the concept of internal and external rotations that became the key to explain the development of preferred orientation, interpretation of strain history, and construction of stress axes that still is one of the hot research topics in structural petrology.

Turner made us aware that the study of metamorphic rocks is incomplete without consideration of deformation on a regional, mesoscopic, and microscopic scale. Minerals have defects, and these defects are geologically often more significant than the perfect structure. The calcite studies, the identification of the enstatite-clinoenstatite transformation as a stress-induced process are just two examples. With W. S. Fyfe, J. Verhoogen, and many students (he was particularly fond of girls), he was also instrumental in introducing the application of chemical and thermodynamic principles to metamorphic processes and putting the facies concept on a firm basis. He thought first that metamorphic facies could be defined very rigorously, but as he gained experience he recognized more and more that every geologic situation is unique—which is best expressed in the 1968 edition of *Metamorphic Petrology* and in the MSA presidential address in 1969.

His contribution of 90 research papers and 8 textbooks, many of which contain a lot of original research, left an important mark in the earth sciences. Throughout all of his work is a clarity of thought and expression that sets it apart from the work of many of his peers. His ability to absorb vast quantities of information, then to select significant material and present it as a masterly and readily comprehensible synthesis is virtually unmatched. He also was very modest about his own research: in the 1981 edition of *Metamorphic Petrology,* "Turner" is not referred to in the author index. With his prodigious energy and tirelessly inquiring mind, he was also a gifted teacher, and the generosity with which he has shared ideas has made him a valued colleague. Those who have had the privilege of working closely with him know him also as a delightful companion, a hospitable host, and a loyal friend.

The international scientific community has formally acknowledged Frank Turner's many contributions. He has received many honors and awards, including the Hector Medal of the Royal Society of New Zealand (1951) and the Lyell Award of the Geological Society of London (1969).

In 1956 he, together with John Verhoogen, was elected to the National Academy of Science. At that time he became a U.S. citizen, but failed the citizenship exam the first time because he made fun of the investigator by telling him that he never had a traffic ticket, not even a parking violation, only confessing after endless questioning that "I do not drive, my wife drives." He is a great joker.

Frank Turner actively participated in our society. He loved rock-forming minerals, particularly when they were deformed, and was a great expert in identifying them, in interpreting textural relations, and deriving a history. He hated rare minerals and let everybody know it. In 1969 he presided over the Mineralogical Society, an honor that rarely crosses the Continental Divide.

In some ways it is a pity that the award of the Roebling medal comes when Francis Turner is no longer capable of attending the ceremony. This does not reflect lack of merit—the situation is complicated: candidates need to be nominated. They have to compete with whoever else is nominated that year. On the other hand, it is nice that the award comes to him at a time of his life when very little means a lot, and I can assure you that this is a big event for him. Let me conclude by saying that I believe that petrology would be very different today without Francis Turner.

Two days after the official award of the Roebling medal at the Orlando meeting, we went to visit Frank Turner at the hospital with some colleagues, Charles Gilbert, John Verhoogen, Clyde Wahrhaftig, Lionel Weiss, and a bottle of champagne. Frank took the medal between his teeth: "It is gold all right! I am very pleased. I did not do more than others, but I was always fascinated by discovering new problems along with recognizing that there are no final solutions in geology." And then he spent a long time reminiscing and joking about the old days around Lawson and Bacon Hall.

Added at press time. With much sadness it is noted that Francis John Turner died December 21, 1985.