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Book Review

Sand, Wind, and War. Memoirs of a desert explorer.

By Ralph Bagnold
Foreword by Luna B. Leopold, Paul D. Komar and Vance Haynes
University of Arizona Press, Tucson
xii + 209 p., 1990, US $29.95

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The pioneers in the study of sedimentology were men of curiosity, rather than men who were the products of a scientific training. Nor, despite the relevance of sediment movement to so many problems of civil engineering, did they tend to be engineers; in that discipline, the simplistic concepts formulated in the 18th century endured, with little revision, until the middle of the next century. Instead, the important principles of this subdiscipline of geology and geomorphology were elucidated by persons whose wide-ranging intellectual curiosity had been piqued. Foremost among them, of course, was the Sheffield scientist Henry Clifton Sorby, whose discoveries of the 1850s were not to be effectively followed up for a century. By then, the author of this autobiography had contributed his own distinctive approaches to the understanding of the processes of sediment accumulation, approaches that were likewise to prove of lasting significance.

As the authors of the Foreword comment mildly, "It is unusal to find a professional soldier who is known for his contributions to intellectual and scientific thought" (p. ix), but then Ralph Bagnold was, in many ways, an unusual person. He was born in England in 1896 and died there in 1990, a lifespan during which the whole world changed drastically (a matter upon which he reflects in the last chapter of this elegantly written and posthumously published autobiography). Part of Bagnold's childhood and that of his elder sister Enid, destined to be a novelist (*National Velvet*, filmed in the 1940s, was perhaps her most famous book), was spent in Jamaica. In later years, Ralph was to work in almost every country of north Africa and the Middle East, Ireland, India, China, Cambodia, Japan and Tanganyika, to go on expeditions to Newfoundland and the Arctic, and to undertake researches into river flow and sediment transport in Wyoming. His was a rich and varied, as well as a long, life.

Ralph was born into a military family and was never seriously to contemplate any other career. Moreover, his father — a Royal Engineer officer — "was trained to earn his men's respect by acquiring a working knowledge of all their trades" (p.9) and was determined his son should do likewise:

> I was obsessed by pipes, probably because of the same underlying pleasure in their continuity that one gets from model railways, and possibly stimulates archaeologists to trace the long backward extension of time. I learned to make complete models of household drainage systems in plasticine [modeling clay]. I was given plenty of plasticine. In that warm climate it remained soft and easily worked. I would roll it into thin sheets, cut then into strips, and roll these lengthwise around a pencil. With a little moulded collar on one end, the pipes fitted together nicely. I moulded little W.C.s [toilets] and joined them to the main drain, delighted with my achievment when water ran through the system without a leak. A small streamlet ran above the house, a relic of the supply to the old waterwheel. With Daddy's encouragement I dammed it and diverted the water into a new cemented channel. No doubt he was pleased to see his son learning something of hydraulics. For my fifth birthday I asked for and was given a cold chisel and a hammer to cut a water channel through the surface of a small rock outcrop. I once misjudged, and water poured into the house, but I proudly rectified matters with cement.

All these experiments were undertaken before his sixth birthday: he notes "to my mother I must have been a messy child"! When his family returned to England and bought a large house on Shooters Hill near Woolwich Arsenal, of which his father had been given charge, there was space for both father and son to have their own workshops, and Ralph's investigations merely enlarged in scale. He had the remarkable experience of riding in perhaps the first monorail vehicle, designed by his father's friend Louis Brennan and never to be commercially exploited (p. 14-15), and he witnessed some early experiments on the fluorescence of minerals (p. 170. His engineering studies began while at Malvern School and were continued at the School of Military Engineering in Chatham. They paid off during his highly hazardous First World War service in France and Flanders, when, by the application of logical thinking concerning shock-wave paths, he succeeded in splitting neatly in half, for detailed examination, an unexploded German shell of a new type (p.25).

In the post-First World War period, Bagnold studied engineering at Cambridge University, then rejoined the army in 1921, serving in rebellion-torn Ireland for three perilous years before being posted to Egypt. There he determined upon exploration of the many desert regions still unmapped. By adapting Model T Fords for use on sand surfaces in arid conditions and developing emergency supply and repair kits, he was able to successfully lead four pioneer expeditions (1927-1930) into the Qattara Depression, across the Great Sand Sea, and to the Gilf Kebir Plateau and Uweinat Mountains on the border with Sudan. His book *Libyan Sands* (1935) recounted these experiences.

Although promotion as major took Bagnold away for three years to the Northwest Frontier of India, his curiosity about the north African desert remained unassuaged. In 1932 he contrived to return briefly to Egypt and to lead an expedition that travelled from Cairo across Egypt far down into Sudan, returning by a different route that included a loop into Chad: 3,700 miles in all, the longest journey yet made in the eastern Sahara.

Although posted next to the Far East for two years (1933-1934), Bagnold's curiosity concerning the processes of formation and movement of sand dunes had been thoroughly aroused. His ponderings concerning these questions resulted in two papers, presented to the Royal Society in London (1936, 1937), and the writing of a book that was to become a classic, *The Physics of Blown Sand and Desert Dunes* (1941).

In 1934, the onset of a tropical disease caused Bagnold to be sent back to London and discharged from the army as a perma-

nent invalid; but he was no such thing. Within a few months he had recovered so completely that he served as assistant leader to a Public Schools Exploring Expedition to Newfoundland in 1935, accompanied the Solar Eclipse Expedition to Japan in the spring of 1936 and, on the way back, detoured to what was then Tanganyika and climbed Mount Kilimanjaro!

By then he was busily conducting wind-tunnel experiments on sand movement, and decided that a further Sahara expedition was necessary to check his experiment observations against desert realities. The expedition of 1938 took him again to the Great Sand Sea, the Gilf Kebir Plateau, and the Uweinat Mountains of southwest Egypt, then into Sudan to make a first crossing of the Great Sand Sheet, where he was greatly impressed by the "singing" of the dunes (p. 118).

Upon the outbreak of the Second World War, Bagnold's supposedly invalid condition was forgotten and he was recalled to the army as a reservist. He was to have been posted to east Africa, but his ship was damaged in a collision and had to go to Port Said for repair. Bagnold took the opportunity to make a quick visit to Cairo. There he was effectively "annexed" by General Wavell, and his whole service thereafter was in Egypt. It proved a very effective service, for Bagnold was encouraged by Wavell to organize and equip the Long Range Desert Group (originally staffed, rather oddly, by soldiers from New Zealand). This highly moble unit harassed the Italians in Libya so effectively as to halt their advance into Egypt (p. 129-131) and helped also to induce the French troops in Chad to forsake the Vichy Government and support the Free French cause (p. 133-135).

Following his father's death in 1944, Bagnold — now a colonel — was granted release from further war service and returned to England to settle family affairs. He was astonished to discover that, on the strength of his researches, he had been elected a Fellow of the Royal Society. Soon he was employed by Anglo-Dutch Shell and doing further travelling (1947-1949). There were to be visits in later years, as speaker or adviser on desert dune movement, to Qatar, Algeria, the Sinai and Jordan, Kuwait and Abu Dhabi.

However, by then Bagnold's interests had shifted. He had become concerned with the movement of sand- and gravel-sized particles in water, and had begun experiments in a Perspex flume, in which their movement could be watched (p. 154-155). This led to a consideration of the whole question of the physics of water-borne sand (p. 161-164) and to a collaboration with Luna B. Leopold of the United States Geological Survey, reaching full fruition in experiments on rivers in Wyoming, which caused the classic engineers' concepts of those processes to be finally jettisoned. For his part in this work and his earlier researches, Bagnold was successively awarded the Warren Prize of the National Academy of Sciences, the Penrose Medal of the Geological Society of America, the Wollaston Medal of the Geological Society of America and, most fittingly of all, the Sorby Medal of the International Association of Sedimentologists (no mean achievement for an amateur who did not even consider himself as a geologist!)

This is a fascinating life story, lucidly and modestly told, and highly recommended to anyone interested in military history or the history of geology and exploration. I enjoyed it thoroughly.