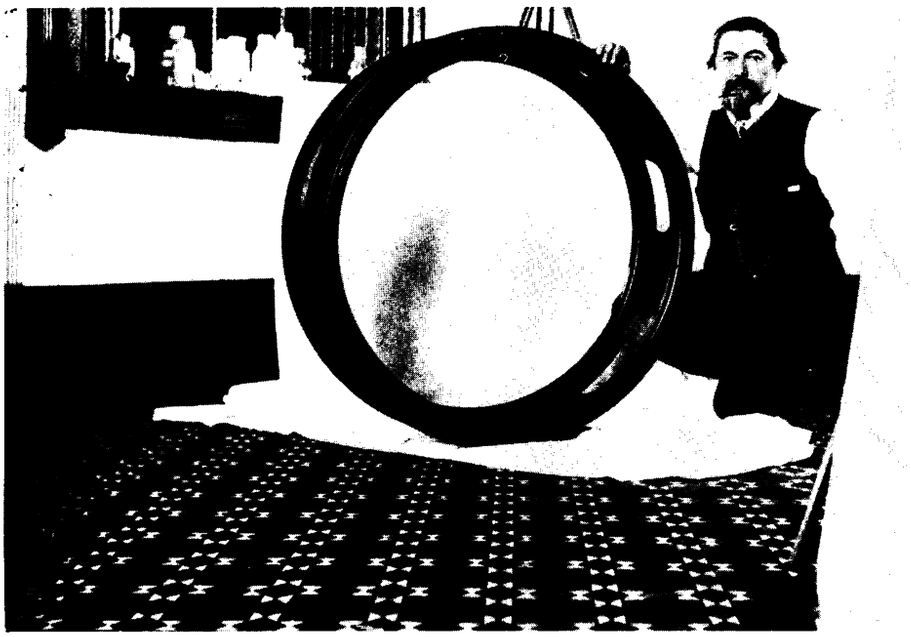

"Richard S. Floyd with the 36-inch lens on Mount Hamilton, 1881." [From *James Lick's Monument*; courtesy of the Mary Lea Shane Archives of the Lick Observatory]

and Swasey, who with the assistance of ideas borrowed from Howard Grubb did the mechanical work, to produce a state-of-the-art observatory. All of this effort was overseen and coordinated by Floyd, who developed heart disease during this labor and died, only 47, but two years after the dedication of Lick Observatory. Perhaps more to the point, "saga" provides a categorization of a book that is neither monograph nor biography. There is too much detail of Floyd's life to call this a monograph on the history of Lick Observatory, but too little analysis of Floyd and too much about James Lick, the eccentric millionaire who selected an astronomical observatory as his monument, and the other characters who were involved in the building of Lick Observatory to view it as simply a biography.

Unfortunately, the experience of reading this book is not as pleasurable as it should be. Repetitions and extraneous details abound. The presentation sometimes becomes quite confusing. There is also the frustration of inaccurate citations. In one set of four footnotes citing correspondence from the Smithsonian Institution Archives (pp. 13–14), two of the footnotes cite the wrong dates for the letters and a third reverses the author and recipient (and is in the wrong place in the text). This pertains to the one collection of manuscripts Wright cites that I know well and may be an aberration, but I recommend care in using the citations.

Despite the book's problems, I recommend it to anyone interested in the history of American science and the history of astronomy. It provides a different perspective of the events and reminds us of the men and women behind the scientists.

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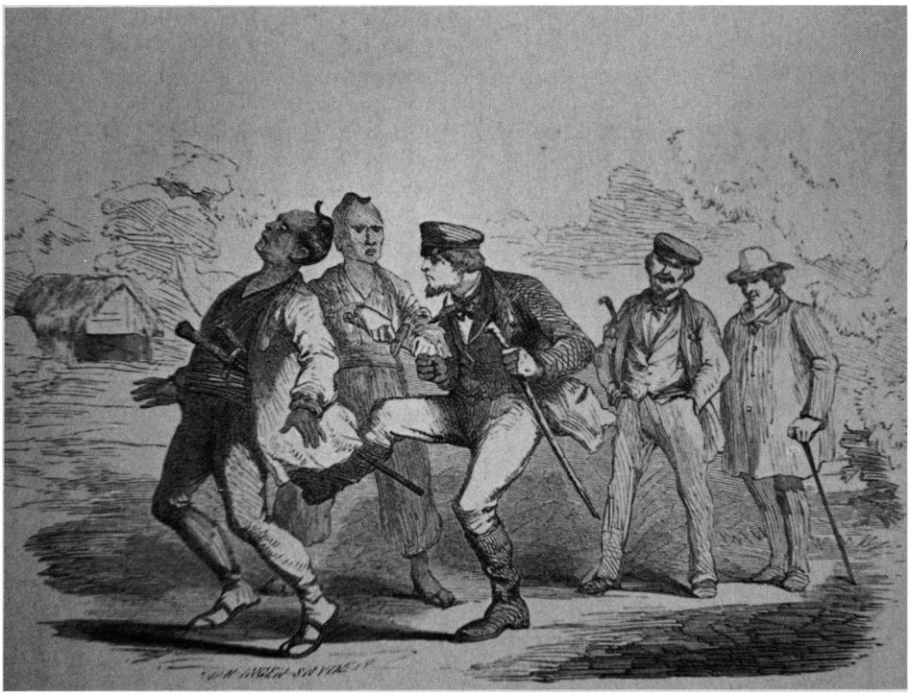
Explorations

New Lands, New Men. America and the Second Great Age of Discovery. WILLIAM H. GOETZMANN. Viking, New York, 1986. xiv, 528 pp., illus. $24.95.

Those who view internalist historiography of science as an affront to history will be cheered by this book, for its author seeks to regain the historical context of an era he persuasively labels "the Second Great Age of Discovery." The new age opened with Charles Marie de La Condamine's 1735–49 expedition to South America to test Newton's hypothesis that the earth is an oblate spheroid. Here was novelty for, impelled by thirst for knowledge, not plunder, the expedition summoned an astronomer, a mathematician, a botanist, a surveyor, and engineers and equipped them with the latest apparatus. Later in the century, James Cook's three great Pacific voyages confirmed the character of the new age by employing artists as well as scientists. Goetzmann throughout pays tribute, well deserved but rarely accorded, to the exploring artist. "Science and art came together to change the thought of Europe" (p. 39) and thenceforth to range the world together in harmony or discord, as might be, but forever indispensable to one another.

As befitted the offspring of Enlightenment thought, the new American republic entered the new age of discovery early with the Lewis and Clark Expedition, dispatching even before its return Stephen Long's and then an unbroken train of others, culminating three decades later in the United States Exploring Expedition, largest of all overseas scientific exploring expeditions under sail. The record of American achievement remains astonishing. Whereas 30 years before ships had entered American harbors only by charts published abroad, by 1860 Americans had mapped the nation, charted its coasts—and China's, Japan's, and many Pacific island groups' as well—discovered the Antarctic continent, and won for themselves world preeminence in geology and oceanography. Along the way, exploration nurtured specialization in the sciences, spawned distinguished careers in art as well as the sciences, and established the first great federal institutions of science. In the two decades just before, the Civil War Congress published 60 works on exploration of the American West alone. All this from a people committed (it was charged abroad) to an intellectually meager utilitarianism and (it was proclaimed at home) to the principles of equality and least government. Goetzmann notes the remarkable fact that, leaving aside the succession of geological surveys financed by the states, federal subsidy of the sciences and the arts at times represented a quarter to a third of the federal budget, a ratio never since approached or even glimpsed.

Having proceeded through the whole of the 19th century, Goetzmann pulls up sharply at the threshold of the Third Great Age of Discovery—averts the eye, one might almost say, from an age "highly organized, team-oriented, and ultimately the creature of impersonal systems analysis" (p. 453). He has detected the early signs of its approach among the first generation of "closet" (an epithet not consistently embellished with quotation marks) naturalists—the microscopist Jacob W. Bailey, the ornithologist John Cassin, Asa Gray at Harvard poring over plants arrived by post—all distilling for science the meaning of specimens gathered by explorers, the peace of their laboratories unbroken by the keenings of marauding Sioux. Goetzmann takes note of their signal contributions and, though sniffing elitism, well understands that it was they who clinched the achievement. But they never fill his horizon, for his sympathies clearly lie with those who had to deal with the whole rattlesnake and not just its skin and whose



Van Ingen Snyder, "An American officer and his friends accord the Japanese officials little respect," as reproduced in A. W. Habersham, *The North Pacific Surveying and Exploring Expedition, or My Last Cruise*. [From *New Lands, New Men*]

sweat made possible the "quantum leap" (p. 269) that science took in the 19th century.

Long since having established his scholarly credentials as the interpreter of American scientific exploration, Goetzmann in this final volume of his trilogy on the subject provides a popular account of "the good old days of the explorer-adventurer among the winds and currents of storm-tossed seas at the very ends of the earth" (p. 362). In its majestic sweep and narrative power, the book stands as a tribute to a motley crowd of fur traders, Indian portraitists, landscape artists, surveyors, and simple collectors and as a reminder that science derives from intimate engagement with untamed nature.

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Further Letters of Darwin

The Correspondence of Charles Darwin. Vol. 2, 1837–1843. FREDERICK BURKHART and SYDNEY SMITH, Eds. Janet Browne, David Kohn, and William Montgomery, associate editors. Stephen V. Pocock, managing editor. Cambridge University Press, New York, 1986. xl, 603 pp., illus., + plates. $37.50.

With remarkable promptness, the editors of Darwin's correspondence invite us to a second treat. Less than two years after the much-hailed publication of volume 1 and the *Calendar* of the correspondence (see *Science* **228**, 838 [1985]), volume 2 brings the project to the year 1843. There is no need to comment on the thoroughness, exemplary scholarship, and great utility of this edition of Darwin's correspondence, that task having already been performed by reviewers of the previous volume.

The present volume contains 405 letters, covering the period 1837–1843. These were indeed momentous years for the young naturalist. In July 1837, as Darwin tells us in one of the most famous lines of his diary, he

> opened first note Book on "transmutation of species".—Had been greatly struck from about month of previous March—on character of S. American fossils—& species on Galapagos Archipelago.—These facts origin (especially latter) of all my views" [p. 431].

It is clear that readers interested in following the development of Darwin's views on the modification of species through the agency of natural selection should address themselves to the available editions of the notebooks and of the manuscript works of the years 1842 and 1844, which represented Darwin's earliest attempt to formulate his theories in a systematic way. Yet the letters here reproduced contain interesting insights into Darwin's system of work. His growing self-confidence as geologist and naturalist, as well as his formulation of "theories to work by" on the question of species, turned Darwin into a sophisticated detective, capable of extorting important information from colleagues and friends who often would never suspect the importance of what they knew for his great project.

The letters here reproduced show Darwin intent on recruiting the army of naturalists, animal and plant breeders, travelers and surveyors, colonial bureaucrats, and amateur virtuosi to whom over the years he addressed thousands of questions on hundreds of subjects. Darwin soon divulged the secret of his work on species to such friends as Charles Lyell and his cousin William Darwin Fox; to others he simply wrote that variation of forms was a topic he was curious about, and he kept the great majority of correspondents in the dark as to the true purpose of the elaborate questionnaires and requests for information they received.

In September 1843, Joseph Dalton Hooker returned from his voyage of exploration on board H.M.S. *Erebus* and immediately took a leading position in Darwin's army of correspondents. The two had much in common, though the slightly older Darwin must for the first time have felt the senior partner in the exchange of letters and information. The four letters to and from Hooker printed in this volume were in fact the beginning of one of the most interesting scientific correspondences of the century, and it could be argued that Hooker was probably the single most important influence on the development of Darwin's thought after the early encounter with Lyell.

In retrospect, however, Darwin might not have looked on the start of his work on species as the most important event of the years 1837–1843. Indeed, marriage to his cousin Emma Wedgwood and the birth of their first three children were undoubtedly the major events of his life during these years, and not surprisingly they constitute the focus of many of the letters here published. The interest of the family side of the correspondence is more than merely biographical, rich as it is in glimpses of early Victorian upper-class households. Though the relationship between Emma and Charles was based on reciprocal veneration and respect, it was good Victorian Charles who kept the only key to the drawers containing all the keys to cupboards and other locked repositories, and it was with reluctance that