Book Reviews

The Nuclear Age: Britain's Role

The Greatest Power on Earth. The International Race for Nuclear Supremacy. RONALD W. CLARK. Harper and Row, New York, 1981. x, 342 pp. + plates. $13.95.

Journalist turned free-lance author, Clark is one of our day's most prolific writers. This book is, by my count, his 55th since 1948, his 12th on science and science-based technology, and his second on the origins of the nuclear age. Not surprisingly, he has based it largely on prior studies that have described how scientists and engineers, urged on by statesmen and soldiers, translated implausible conjectures about subatomic energy into deadly realities between 1939 and 1954. Yet Clark does more than provide a lively rendering of earlier historical research. He presents the results of his own archival work, chiefly in the Public Record Office (London) and the Cherwell and Tizard papers. And he makes good use of this evidence in reiterating the thesis—first espoused by the British during World War II and subsequently developed by Clark himself in *The Birth of the Bomb: The Untold Story of Britain's Part in the Weapon That Changed the World* (1961) and by Margaret Gowing in *Britain and Atomic Energy 1939–1945* (1964)—that Britain played a significant role in the opening of the nuclear era.

British physicists, according to Clark, were initially as skeptical as most of their colleagues around the world about the immediate prospects for fission weapons. In April 1940, however, a secret committee of British physicists was established to consider the possibility raised by the refugees Frisch and Peierls that a superbomb might be made from uranium-235. The MAUD (Ministry of Aircraft Uranium Development) Committee proceeded to canvass the problem from all angles, including Halban's proposal that a heavy-water and uranium pile be used to generate fissile plutonium. In July 1941 it recommended an all-out effort to develop uranium-235 bombs. This recommendation was soon approved by Churchill, and a bomb project was organized under the code name Tube Alloys. Meanwhile, the MAUD Committee's report was being used by Bush and Conant in the United States both to focus the American physicists' inquiries and to secure Roosevelt's support. The British report played, that is, a decisive role in the initiation of both the British and the American bomb projects.

From this juncture, Britain's role in the technical arena was relatively unimportant. The British were too hard pressed by the Germans to allocate the requisite resources to their project. Moreover, on account of differences regarding postwar objectives, the British had little access to the American project until fall 1943, by which time they were too far behind to make more than minor contributions. Despite being eclipsed in the technical arena, Britain, as represented by Churchill, played an important role in setting policy. Churchill's influence was especially pronounced on the issue of disclosure to the Soviet Union. In August 1943 he persuaded Roosevelt of the desirability of nondisclosure to third parties. Thereafter he managed to thwart Bohr and others who, in hopes of averting a nuclear arms race, were advising that Russia be officially informed of American progress. Churchill, it is evident not only from Clark's account but especially from Martin Sherwin's *A World Destroyed: The Atomic Bomb and the Grand Alliance* (1975), regarded such thinking as hopelessly optimistic about Soviet intentions. He seems to have assumed that an arms race was inevitable and hence that America and Britain should have as great a lead as possible. Alas, Churchill was probably correct, as Clark suggests, in thinking that early disclosure would not have prevented the postwar competition.

This supposition, however, contradicts Clark's oft-repeated view that the development of nuclear weapons introduced a new stage in world politics. Indeed, present global armaments indicate that statesmen and soldiers still do not comprehend the havoc their arsenals can wreak.

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Oak Ridge in Wartime

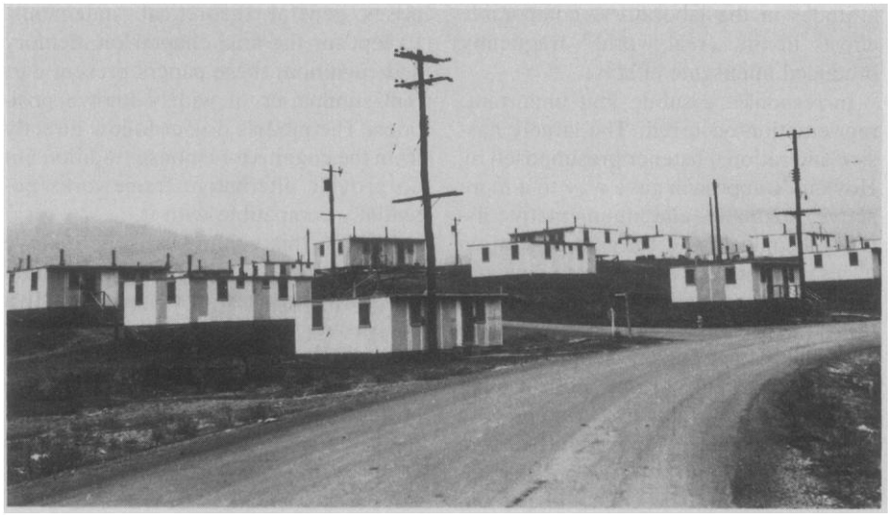
City Behind a Fence. Oak Ridge, Tennessee, 1942–1946. CHARLES W. JOHNSON and CHARLES O. JACKSON. University of Tennessee Press, Knoxville, 1981. xxiv, 248 pp., illus. Cloth, $18.50; paper, $9.50.

In their introduction to *City Behind a Fence*, the authors propose to partially remedy what they consider to be a "curious oversight" in earlier works on the history of the Manhattan Project. They point out that until now historians have failed to adequately examine the three secret support communities established and directed by the Army in conjunction with the wartime atomic weapons development program. They argue that Oak Ridge, Tennessee, Hanford, Washington, and Los Alamos, New Mexico, are worthy of study "if only because the successful operation of these communities was so crucial to the successful conclusion of the Manhattan Project's atomic mission."

Clearly, however, that was not the only or even the primary motivation for this book. Much more, the project stems from the authors' interest in and proximity to Oak Ridge itself. They view the origin of the unique and still somewhat incongruous city as a "fascinating episode in American social history." They request that their book be evaluated on the basis of their success in answering the question: "What must have been the nature of the 'secret city' and what did it mean to live there in the war period?"

Stating that the technical activities at each of the three major Manhattan Project sites have already been given much attention, the authors concentrate on the organizations and people responsible for the management and operation of the Oak Ridge "townsite" itself. They consulted voluminous records of the Manhattan Engineer District of the Army Corps of Engineers (the MED headquarters were moved to Oak Ridge in 1943); they examined the papers of Leslie R. Groves, the leader of the MED; and they systematically reviewed newspapers and periodicals from the region and elsewhere. To supplement these written sources, the authors conducted approximately 75 one-hour interviews with Oak Ridgers who had lived in Oak Ridge or in the surrounding counties during the war.

It is noteworthy that the authors did not consult records of the industrial or university contractors who built or operated the major facilities of the Clinton Engineer Works (the code name given the entire Oak Ridge project), nor did they obtain access to the existing man-



"Victory cottages," each containing two family units, Oak Ridge, December 1947. [From *City Behind a Fence*]

agement or administrative files generated within the research and production facilities themselves. Although such records are not preserved in every case, those that are available could have helped provide the valuable perspective of the workplace—a perspective that is almost totally absent from *City Behind a Fence*. Even the recollections gleaned from the tape-recorded interviews are all cited anonymously; and attitudes and opinions are never meaningfully correlated with the experiences of the subjects on the job.

From *City Behind a Fence* we do learn a great deal about the planning, organization, and operation of the townsite; we learn of the often difficult relationships between Oak Ridgers and their Tennessean neighbors; about racial segregation and discrimination and the associated rationalizations; about the incessant population pressure and its effects (the population of Oak Ridge ballooned from the planned 13,000 to more than 75,000 during the course of the war); about the Army's efforts to keep a low profile while maintaining ultimate authority over nearly every aspect of town life; and about the direct and indirect effects of the Army's insistence on the strictest of security measures. This information and the insights provided by the authors are in many cases new and valuable. They indeed contribute to our ability to understand the atomic bomb project for what it was: a centrally planned scientific, technical, industrial, and social enterprise of unprecedented complexity.

Whether the account actually reveals what it must have been like to live in Oak Ridge during the war is not so clear. In any case, there is little in *City Behind a Fence* to shed light on the closely related question of what it must have been like to work there. And it must be asked whether the decision to discuss the town as isolated from the workplace, leaving the latter to the technical histories, in fact reflects the specializations of the historians more than it is a meaningful or appropriate division of the subject matter at hand. The separation of life from work in wartime Oak Ridge will, I suspect, seem especially arbitrary to those readers of *Science* who have an interest in and some familiarity with the extraordinary and consuming efforts of the scientists, engineers, managers, technicians, and other workers at the various Oak Ridge plants.

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Observations in the Infrared

Infrared Astronomy. Papers from a symposium, Kona, Hawaii, June 1980. C. G. WYNN-WILLIAMS and D. P. CRUIKSHANK, Eds. Reidel, Boston, 1981 (distributor, Kluwer Boston, Hingham, Mass.). xvi, 376 pp., illus. Cloth, $47.50; paper, $23.50. International Astronomical Union Symposium No. 96.

Infrared astronomy has grown explosively over the last 15 years, and the symposium of which this book is the proceedings represented a milestone in the maturing of the field. Instead of the accustomed potpourri of instrumental techniques and observational results, the conference sessions were limited to the infrared aspects of planetary astronomy, interstellar clouds and star-forming regions, galactic structure, and galaxies. The proceedings consist of the 21 review papers presented at the symposium together with the discussions that followed them. The book is a surprisingly well-balanced and up-to-date overview of current research in these fields and should be valuable to a much wider audience than infrared specialists.

Four papers dealing with infrared spectroscopy of the atmospheres of planets, satellites, and asteroids and spectrophotometry of their surfaces provide an impressive catalog of results yielded by these techniques. D. Morrison points out that with the advantages of hindsight it is clear that infrared observers were detecting the effects of volcanism on the Jovian satellite Io long before Voyager. It seems clear from the paper that infrared techniques will continue to play an important role in planetary astronomy, particularly in the study of objects inaccessible to space missions and in studies of atmospheric structure and composition and long-term temporal variations.

Ten of the papers are devoted to infrared studies of molecular clouds and regions of star formation. The archetype of such regions, the Orion molecular cloud, has now been studied in great detail with a wide variety of observational techniques. The improved observations have revealed a progressively more complex situation, and the extraordinary level of activity at the cloud core is far from the previous picture of an interstellar cloud gently condensing to form stars. Observations of a growing number of similar regions attest that the Orion scenario is the rule rather than the exception. It seems that infrared is living up to its early promise of allowing the investigation of star formation processes in molecular clouds but that the road to a full understanding of the processes may be long and hard.

Papers on galactic structure and extragalactic sources make up a substantial part of the proceedings. The paucity of pre-1976 papers referred to in these papers is testimony to the rapid expansion of the field. Three reviews, "Infrared studies of the stellar content in extragalactic systems" (M. Aaronson), "Rapid star formation in galactic nuclei" (G. H. Rieke), and "The infrared properties of active extragalactic nuclei" (B. T. Soifer and G. Neugebauer), cover the application of current infrared techniques to a spectrum of extragalactic objects ranging from spiral galaxies through Seyferts to quasars and BL Lac objects. The nature of the "nonstellar" component of the infrared flux of many nuclei is only beginning to be specified. Though rapid star formation and thermal emission by