

Book Reviews

The Hydrogen-Bomb Decision: A Reappraisal

The Advisors. Oppenheimer, Teller, and the Superbomb. HERBERT F. YORK. Freeman, San Francisco, 1976. xii, 176 pp. \$6.95.

This is an important book, disclosing for the first time what went on behind the scenes during the years from 1949 to 1955 when the United States government first deliberated whether to build hydrogen bombs and then successfully did so. An appendix contains the text, written in 1949 but only declassified in 1974, of the report of the General Advisory Committee to the Atomic Energy Commission, advising against a high-priority program to develop the bomb. This GAC report, the main part written by Oppenheimer with supplementary statements by Conant and by Fermi and Rabi, is by itself worth the price of the book. It is a historical document of rare quality, brief, factual, and eloquent. It stands among committee reports as the Gettysburg Address stands among political speeches. The real tragedy of the hydrogen bomb debate was that there was no debate. As Oppenheimer said at the time, "Wisdom itself cannot flourish, nor even truth be determined, without the give and take of debate and criticism." York, who was the first director of the Livermore weapons laboratory and had a major role in the development of the hydrogen bomb, did not see the GAC report until 1974. He has written this book in an objective and unemotional style. It is written as history rather than as a personal memoir. Nevertheless his quiet words reveal a sense of outrage. A quarter of a century too late he understands that he was, during all his years of dedicated work and high responsibility, a blinkered horse.

The main theme of the book is a detailed analysis of the recommendations of the GAC and of the arguments by which the recommendations were supported. York concludes that the advice of the GAC was not only right, but right for the right reasons. President Truman, and most of the political leaders he consulted, thought otherwise. Truman reasoned that the danger to American secu-

rity, if he refrained from rushing ahead with the development of the hydrogen bomb, without any guarantee that the Soviet Union would also refrain, was too great to be acceptable. This was the point on which the opponents of the GAC too easily won their case. They had only to ask "What happens if we give up on the hydrogen bomb and the Russians go ahead?" to make the GAC position appear softheaded and unsound. In fact, however, this question was faced and answered satisfactorily in the GAC report. Conant gave the answer in his part of the document: "To the argument that the Russians may succeed in developing this weapon, we would reply that our undertaking it will not prove a deterrent to them. Should they use the weapon against us, reprisals by our large stock of atomic bombs would be comparably effective to the use of a super."

York devotes a chapter to a discussion of the "worst case" scenario, considering what would have actually happened year by year if the advice of the GAC had been accepted in 1949 and if the Soviet hydrogen bomb program had nevertheless gone full steam ahead. He demonstrates convincingly that nothing disastrous would have happened. The first Russian thermonuclear experiment in 1953 would have been detected (as it actually was) and would have immediately triggered a massive American effort, so that the first American hydrogen bombs would have become available in 1955 or 1956 instead of in 1954. During the interval of two or three years in which the Russians would have been technically "ahead," they could not conceivably have built up a stockpile of thermonuclear weapons to equal our stockpile of fission weapons. So the judgment of the GAC is vindicated, that even in the worst case the danger to American security would not have been critical. And to balance this admitted danger, the advice of the GAC held out the hope of establishing an international agreement to ban the development of hydrogen bombs in perpetuity.

In addition to recommending against a

hydrogen-bomb program, the GAC report recommended in favor of a variety of programs for the multiplication and proliferation of fission weapons. The GAC advocated tactical nuclear weapons and suggested a sharp increase in production facilities for plutonium and other fissionable materials. In making these recommendations, they were responding to the political pressures that decreed that something drastic must be done in response to the first Soviet bomb test of August 1949. The GAC felt driven to make a major response to the Russian test; they were determined that the response should not be the hydrogen bomb; therefore they pushed tactical nuclear weapons instead. What happened thereafter was the fate that usually attends such compromises. Truman gave the go-ahead to tactical nuclear weapons, not instead of, but in addition to, the hydrogen bomb. The well-meaning attempt of the GAC to choose the lesser of two evils resulted in a huge and dangerous escalation of tactical nuclear weapons, which are now deployed in all shapes and sizes, in many parts of the world, beyond all need or reason.

Another important chapter of York's book describes the history of the Soviet nuclear weapons program. With characteristic thoroughness, York, instead of relying on translations, has gone to the original Russian sources for his evidence. He is able to piece together a surprisingly detailed picture of the main characters and events in the Russian program.

To conclude this review I wish to raise a point on which I am in disagreement with York. This is a question of emphasis rather than of fact, and it deserves a more careful discussion than I can give it here. I consider that York greatly exaggerates the ultimate importance of hydrogen bombs in human affairs. He shares the belief, which was strongly expressed both by the GAC and by their opponents in 1949, that they were taking part in one of history's most momentous decisions. But history played a trick on all of them. It turned out in the end that the Teller-Ulam discovery of 1951 which made hydrogen bombs possible also made hydrogen bombs unnecessary. In other words, if the highest hopes of the GAC had been realized, if Truman had followed their advice and if an international renunciation of hydrogen bombs had been successfully maintained, the general shape and destructive power of strategic weapons in 1976 would not have been greatly different from what they are.

Fortunately for us, history has been impartial. Not only the highest hopes but

also the deepest fears of the GAC have been proved illusory. The GAC report is suffused with a feeling of horror of the hydrogen bomb as an open-ended weapon having no limit to its destructive power. It was this open-endedness that was the GAC's primary reason for opposing it. Oppenheimer was particularly oppressed by the nightmare of an undeliverable weapon. Suppose it had turned out, as Oppenheimer feared, that the smallest feasible hydrogen bomb was too heavy to be carried by air. Then the only way to use it would be to put it into a ship or a submarine and detonate it offshore. But then there would be coastal defenses, and the easy response to coastal defenses would be to go further offshore and increase the yield by another factor of ten. Within a few years you would have had ships filled with lithium deuteride, each having an explosive yield in the range of tens of thousands of megatons: in other words, doomsday machines. This was the nightmare that lay behind Oppenheimer's famous remark, "I am not sure the miserable thing will work, nor that it can be gotten to a target except by oxcart."

The reality turned out to be very different from the nightmare. The biggest hydrogen bombs ever built in the United States were those of the first generation, tested in 1954. Since those days the efforts of our designers in Los Alamos and Livermore have been dominated by the belief that small is beautiful. Instead of inventing undeliverable weapons, the designers have tailored their bombs to fit inside smaller and smaller vehicles. In no country have the political authorities shown any desire to build doomsday machines. The hydrogen bomb remains in theory an open-ended weapon, but in practice its destructive power has remained limited to the levels that military men consider reasonable. Our existing weapons are bad enough in all conscience, but they are not significantly worse than they would have been after 30 years of development of fission bombs alone. The step from fission to hydrogen bombs turned out in the end to be not so crucial as it seemed at the time. As Dylan Thomas said in one of the greatest of war poems, "After the first death, there is no other."

York is correct in his assessment that a golden opportunity was missed when Truman rejected the advice of the GAC in 1950. But the importance of this opportunity did not lie in the hydrogen bomb itself. Much more importantly, the GAC report gave Truman an invitation to speak frankly with Stalin and with the people of the world about the great politi-

cal issues involved in the control of nuclear weapons. If Truman had seized this opportunity whole-heartedly, we could perhaps have begun to halt the nuclear arms race in 1950 instead of in 1970. Whether there was any real hope, with the Korean war about to begin and Stalin far advanced in senile paranoia, is another unanswerable question.

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Vegetation and Culture

Plants, Man and the Land in the Vilcanota Valley of Peru. DANIEL W. GADE. Junk, The Hague, 1975. viii, 240 pp., illus. Dfl. 70. *Biogeographica*, vol. 6.

As in most mountainous areas in the tropics, cultural, natural, and physical interactions in the Andes are complex. The precipitous topography produces many ecological niches; this and the rich flora have allowed the development of a varied, stable, and productive agriculture, with abundant adventives and wild species for minor or supplementary uses. Gade describes the resultant system for a



Agricultural scene in Peru. "This scene is most likely to occur in . . . February. Early potatoes (*maway*) are being harvested under an overcast sky. Meanwhile a dog, two foxes and some birds are menacing the corn crop which is in the 'milk' stage. A woman stands on the field margin and beats a drum to frighten the animals out of the field. Dogs and foxes are still regarded as threats to maize, and [women] and children are still enlisted to frighten pests away. In colonial times a religious rite involved 'excommunicating' pests . . . , but this custom has apparently died out, at least in the Vilcanota Valley." [From *Plants, Man and the Land in the Vilcanota Valley of Peru*]

valley that is representative of much of the Andes and yet unique, the "Sacred Valley of the Incas," known for its great terraces and magnificent ruins, especially Machu Picchu. From tundra-like puna, pasture for several cameloids, sheep, and cattle, down past zones of potatoes, maize, *arracacha*, coca, and manioc, to the tropical forest, the landscape of the Vilcanota (or upper Urubamba) Valley is sweeping and varied. The crops, agricultural techniques, and trade patterns reflect a long, complex history.

Half the book is a detailed ethnobotanical description of cultigens and useful nondomesticates. Accounts of the nomenclature, morphology, varieties, and uses of the plants, cultivation techniques, and the geography and history of the region provide a background to discussions of other matters.

Those interested in introducing new specialty crops might find the delicious *llacón* or *oca* as interesting as the important large-kerneled Blanco Imperial or Cuzco maize now popular in the United States. The protein-rich pseudo-cereals *kañiwa* and *kiwicha* might be used elsewhere in the world where dry or cold areas predominate; since in Peru these plants are losing ground to more commercial crops, germ plasm sampling is needed. Perhaps *Jatropha ciliata* or *Hydrocotyle alchemilloides* could prove as useful to pharmacologists as Andean *Cinchona*.

If the productivity of crops in the Andes is to be raised, their variation and ecological potential must be understood. The Andean people's love of color has led to innumerable cultivars of maize, potato, and *oca*. Texture, flavor, and disease resistance affect the acceptance of new potato varieties as much as yield. Several wheat cultivars, adapted to various zones, might be important within one township.

There is considerable discussion of the zonation of the region. Topographical, climatic, vegetational, ethnobotanical, and traditional views are presented, and a variety of terms are used: "Vilcanota gorge," "the zone between 2400 meters and 1500 meters," "the warmer mesothermal zone," "*ceja de la montaña*," "the region of subtropical starch crops," and "*chaupiyunga*" all refer to the same part of the valley. More discussion of the interactions of factors and the establishment of smaller, more inclusive zonal units would have clarified matters. The distributions of crops might have been better presented by zonal diagrams than by the many maps the book includes.

How representative is the Vilcanota Valley? Every valley and region in the