Book Reviews

Steps Not Made

The Great Inertia. Scientific Stagnation in Traditional China. WEN-YUAN QIAN. Croom Helm, Dover, N.H., 1985. xiv, 155 pp. $27.50.

Wen-yuan Qian's *The Great Inertia* is cast in the form of a challenge to Joseph Needham's monumental *Science and Civilisation in China*, a study that Derek J. de Solla Price has called possibly "the last great traditional and comprehensive work of human scholarship." According to Needham, Chinese achievements in several of the sciences considerably surpassed those of pre-1500 Europe. Why, then, did China subsequently fall behind in its alleged progress toward modern science? Why did the Scientific Revolution, particularly "the mathematization of hypotheses about Nature" and "the testing of them by controlled experiment," first take place in Europe and not in China? Needham cites the "feudal-bureaucratic" character of the traditional Chinese state and the capacity of Chinese society to absorb scientific and technological innovations without generating intellectual or cultural crises as barriers to the type of scientific breakthrough that occurred in the 17th-century West. Chinese civilization, he says, seems to have been equipped with "a set of feedback mechanisms, restoring the status quo after all perturbations, even those produced by fundamental discoveries and inventions."

Some critics of Needham have argued that his discussion of why premodern China failed to develop modern science implicitly casts traditional Chinese science as a mere prelude to the type of scientific development that occurred in the post-16th-century West. Needham's answer to this question, moreover, implies that modern science should have arisen naturally, sooner or later, in almost any advanced civilization had certain barriers been removed or inhibiting conditions corrected. But does it really make any more sense to ask why such civilizations failed to produce modern science than it does to ask why they did not spontaneously develop Cubist art, serial music, or voodoo economics? As Albert Einstein once remarked, "One has not to be astonished that the Chinese sages have not made these steps. The astonishing thing is that these discoveries were made at all."

Wen-yuan Qian does not, however, question Needham's general evolutionary view of the history of science. Nor does he challenge Needham's argument that traditional China might have independently produced modern science had certain obstacles to its development been removed. He even agrees that political and social institutions and ideologies, what Qian calls the "software" of scientific culture, are decisive in stimulating or inhibiting the development and application of scientific knowledge. Both Needham and Qian, in other words, are primarily "externalists" insofar as they emphasize political and social influences on scientific change.

Despite this significant area of agreement, Qian takes quite a polemical approach to Needham's work. He accuses Needham of having greatly overestimated the achievements and potential of traditional Chinese science and technology. Science in late-traditional China, Qian argues, far from being poised on the edge of a world-historical breakthrough, was essentially stagnant or inert. Qian attributes this "great inertia" not to any innate cultural or intellectual incapacity but primarily to political conditions. Modern science, he contends, could never have developed under such a powerful and pervasive system of autocratic rule and ideological control as that which supposedly prevailed in imperial China. For scientific development requires "political tolerance and social encouragement" (p. 29), qualities which, Qian asserts, were much more common in the premodern West than in late-traditional China. Contemporary China, Qian argues, has unfortunately continued the imperial tradition of political repression and ideological control, thus condemning the country to continued scientific stagnation and cultural backwardness.

Qian's bleak picture of the political landscape of imperial China might well be challenged on empirical grounds. Though certain features of premodern Chinese politics and society undoubtedly inhibited the development of science and technology, as Qian contends, traditional China was not so monolithic or autocratic as he seems to believe. His impression that Chinese emperors enjoyed "absolute and limitless power" (p. 115) could be corrected by reading such recent works of American scholarship as Ray Huang's *1587, A Year of No Significance*. The figure of the hapless *Wan-li* Emperor (reigning from 1573 to 1619), who "was not free to leave the palace, let alone the capital," hardly fits the stereotype of the absolute Oriental despot. Qian's idea that Confucianism was little more than an ideological rationalization for despotic controls largely ignores the considerable cosmological and religious dimensions in Confucian thought. It does scant justice to a millennial intellectual tradition of great complexity and profundity.

In brief, Qian is not able to argue convincingly for his hypothesis that "software decides" the course of scientific development because he shows insufficient appreciation and knowledge of aspects of this software, particularly of the political institutions and intellectual traditions of premodern China. One must recognize, however, that Qian's jaundiced perceptions of the traditional Chinese state might be colored by his unhappy experiences under "communist totalitarianism" (p. 3) in Mao's China, where he was branded as an "ideological counter-revolutionary" (p. 2).

If Qian's explanation for the alleged stagnation of science in imperial China is unconvincing, his critique of Needham's view of how science in traditional China might have developed into modern science deserves more serious consideration. Needham, while generally maintaining an evolutionary view of the history of science, rejects the hypothesis that modern science must have emerged in the way it did in the 17th-century West, with the science of mechanics taking the lead. He argues that several roads to modern science are conceivable, only one of which was through the development of mechanics. Chinese achievements in the field of magnetism, he claims, indicate that China might have produced a "field physics without going through the stage of 'billiard-ball' physics."

But Needham's hypothesis, Qian contends, fails to take into account the inherent logic of the development of physics, as well as the historical relationships between classical mechanics and electromagnetism. For the latter developed historically from the former; field physics did not so much overthrow billiard-ball physics as extend it. Moreover, if studies of magnetic phenomena had been capable of providing the impulse for the rise of modern science, they would be more

likely to have done so with William Gilbert, whose researches on magnetism were "more complete, more scientific and more intellectually stimulative" (p. 44) than anything achieved by Chinese investigators.

In this case, Qian's background as a physicist provides him with a valuable perspective on Needham's theory of how a Chinese analogue of the Scientific Revolution might have occurred. However, Qian's focusing so narrowly on the issue of scientific revolutions and progress makes it difficult for him to visualize Chinese science in the context of the culture and society in which it arose. Chinese scientists of premodern times may not have split the atom, recombined DNA, or formulated the anthropic principle. But the science and technology they developed were in many respects well adapted to Chinese civilization, perhaps more so than modern science would have been. They provided a unified worldview, a coherent and profound explanation of man's place in the cosmos, a technology generally appropriate for the social and economic needs of the time, and even a basis for the conduct of human relations. Can the same be said for present-day science?

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The Australian Coastline

Coastal Geomorphology in Australia. B. G. THOM, Ed. Academic Press, Orlando, Fla., 1984. xvi, 349 pp., illus. $45.

Australia has some 30,000 kilometers of coastline containing a diversity of environments, including expanses of barrier beaches and dunes, estuaries in all stages of evolution, the sheltered coast behind the Great Barrier Reef, and shorelines fringed by mangroves. This natural laboratory has attracted coastal scientists throughout the years, but in the last decade there has been an explosion, a renaissance, of research on the Australian coast. The major themes of this research are reflected in this volume, which contains contributions by many of the leaders in that research.

Australian contributions have been important to studies of sea level, Australia in the 1950's and '60's being the center for the so-called "Indo-Pacific school," which maintained that sea level had been 2 to 4 meters higher within the past few thousand years. The last decade has seen numerous Australia-wide studies of relative sea-level change, and the results of these are evident in virtually every paper in this volume. It is now apparent that there has been a local and regional variability in sea-level histories governed by land-level changes, but for the most part the results indicate a rapid rise in sea level to about 7000 years ago followed by a nearly constant level with respect to the land. This pattern contrasts with observations in North America and Europe, the sources that previously have dominated our models for coastal evolution, where the rise in sea level with respect to the land has continued up to the present (in part owing to land subsidence).

This difference in sea-level history has produced a contrasting coastal response in Australia, landward-migrating barrier islands being a rarity, for example. The pattern instead is one of a seaward progradation of the shoreline whenever adequate sources of beach-forming sediments are available. This pattern is especially apparent from the several papers that report on "morphostratigraphic" studies that combine the observed morphology of the present-day coast with the stratigraphy of the underlying sediments, which has been determined by drilling. For example, a chapter by Grindrod and Rhodes reports on a mangrove-fringed coast where drilling, carbon-14 dating, and pollen analysis document in detail a sequence of deposits that result from the sea-level transgression followed by a nearly horizontal seaward advance of the deposits during the time the sea level has remained constant. In a similar way, in an investigation of the origin of a chenier plain in northern Australia by Chappell and Grindrod the nearly constant sea level permitted the researchers to focus on the role of mud availability versus the production of the shells that form the cheniers. This morphostratigraphic approach is also followed in papers on the origin and evolution of estuaries (Roy), episodic dune formation (Pye and Bowman), barrier-island development (Thom), and the longer-term Quaternary history of sea level as revealed in coastal-plain beach ridges in South Australia (Schwebel) and Tasmania (Bowden and Colhoun).

Researchers investigating the response of coral reefs have achieved some of the best control documenting changes in sea level. Marshall and Davies summarize the results of a reef-drilling program, 69 holes that penetrate from 6 to 76 meters, the "stratigraphy" and numerous carbon-14 dates revealing the reestablishment of the reefs under the rising sea level. Hopley explores the concept of a "high energy window," a period during which reef growth could not keep pace with the rising sea and so did not protect the adjacent coast from ocean waves. Hopley compares rates of reef growth with rates of sea-level rise and reviews the evidence from the coast itself in the form of boulder beaches and other features that indicate higher energy levels between 8500 and 6000 years ago.

The "process studies" approach to Australian coastal research, as it is defined by Thom in his introduction, is represented chiefly in a chapter by Short and Wright, which summarizes the authors' numerous contributions over the past decade on the subject of the role played by wave energy level and beach-sediment grain size in controlling the nature of beach processes and geomorphic response. In this useful paper, the authors synthesize their results from several beaches into a process-controlled model that should be applicable over the full ranges of normally encountered wave and sediment conditions.

This carefully edited and handsomely bound volume provides a good summary of the coastal research that has been under way in Australia during the past decade, with most of the chapters reporting on studies that illustrate this research but have not been published previously. The principal value of the book will be to researchers interested in Holocene sea-level changes, geologists interested in coastal sediment facies, and any coastal scientist interested in beach processes, dunes, estuaries, and coral reefs.

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Stigma

Social Stigma. The Psychology of Marked Relationships. EDWARD E. JONES, AMERIGO FARINA, ALBERT H. HASTORF, HAZEL MARKUS, DALE T. MILLER, and ROBERT A. SCOTT, with a chapter by Rita de S. French. Freeman, New York, 1984. x, 347 pp., illus. $23.95; paper, $14.95. A Series of Books in Psychology.

Twenty-two years ago, the late Erving Goffman wrote the classic *Stigma*. In it, he combined telling anecdotes with keen observation to demonstrate the commonalities associated with such diverse conditions as physical handicap, mental illness, and race. Goffman's breezy and insightful approach stimulated research. But it did not offer a tidy, systematic theory.