CC/NUMBER 22
MAY 30, 1983

This Week's Citation Classic

Ponnamperuma F N. The chemistry of submerged soils.
Advan. Agron. **24**:29-96, 1972.
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Submerged soils have a low redox potential and a neutral pH. Oxygen, nitrate, and sulfate are absent; carbon dioxide, ammonium, and sulfide are present. Iron, manganese, and phosphorus become soluble. The decomposition of organic matter produces an array of transitory substances ending as carbon dioxide, methane, and humus. [The *SCI*® indicates that this paper has been cited in over 170 publications since 1972.]

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March 10, 1983

"In August 1970, while I was seated in the auditorium of the University of Arizona during a session of the annual meeting of the American Society of Agronomy, I felt a pat on my shoulder. When I turned around, I saw Nyle C. Brady, the editor of *Advances in Agronomy*. He asked me whether I could write a chapter on the chemistry of submerged soils for *Advances in Agronomy*. I agreed but took no further action until sometime after I had received a reminder about the deadline for the submission of the outline.

"The outline was conceived in a flash while I was pacing in the moonlight on the deck of a cruise ship. It was hastily jotted down in my cabin while my two sons were in the ship's nightclub. On my return from the vacation, in July 1971, the outline was polished, typed, and mailed to Brady. His response was as gratifying as it was disconcerting: he suggested that the length of the paper be increased from the stipulated 50 pages to 80 pages.

"The task of writing a review paper on the chemistry of submerged soils was not easy. It involved identifying and reviewing papers on the electrochemistry, chemistry, and biochemistry of submerged soils, lake muds, and ocean sediments. The papers covered subjects from sewage to thermodynamics and a time span from 1913 to 1971. The adventure involved excursions into: physical, inorganic, and organic chemistry; thermodynamics; bacteriology; and biochemistry. But the going was rough because I had forsaken pure science 30 years before.

"For my story of the chemistry of submerged soils, I gleaned material from over 200 publications in the subject area and a dozen textbooks in pure science. The plot involved physical, biological, and chemical agents. But the actual writing followed a long and chequered course because of an intense personal problem. I could not meet the deadline that the editor generously extended three times. Then I received a cable: unless the manuscript was in his hands within two weeks, it would have no place in *Advances in Agronomy*. The ultimatum worked: the manuscript was completed, edited overnight by Stephen Breth, corrected the next morning, and rushed to catch the afternoon mail.

"Flooding a dry soil cuts off its oxygen supply. Aerobic microorganisms use up the trapped oxygen and become quiescent or die. Then anaerobic microorganisms use oxygen-rich soil components in their respiration and set in motion a series of electrochemical, chemical, and biological changes that profoundly affect the quality of the soil as a medium for plant growth, its role in eutrophication of lakes, and its capacity to act as a sink for pollutants.

"The paper described the salient features of submerged soils; explained some of them quantitatively in terms of biochemistry and physical, inorganic, and organic chemistry; and showed the implications of the peculiar properties of submerged soils for soil genesis, limnology, crop production, and pollution control. The most comprehensive and integrated coverage of the chemistry of submerged soils up to that time was compressed within 67 pages of the widely read review, *Advances in Agronomy*. That accounts for its wide use. A review[1] on a similar topic is going into press soon."

1. **Ponnamperuma F N.** Effects of flooding on soil. (Kozlowski T T, ed.) *Flooding and plant growth*. New York: Academic Press. In press, 1983.