ionizing radiation (neutrinos or neutrettos). The greater the depth, the more important the non-ionizing component becomes and at 1000 m depth it may strongly exceed the number of ionizing particles. The non-ionizing radiation produces along its path secondaries (photons, electrons) which give rise to a cascade shower."

Wataghin and Santos[5] have performed experiments to study the shower-producing radiation at depths of 50, 250, and 400 m water equivalent. Their conclusions are as follows, "At 50 m two different kinds of showers were observed: (a) showers produced by an ionizing radiation of not less than 17 cm range in lead, and (b) very soft showers produced by a non-ionizing radiation which probably are not due to a cascade process.

"In the second and third stations (250 and 400 m) the measurements have shown that the shower-producing radiation is non-ionizing and that the ionizing shower particles have a range smaller than 17 cm of lead."

It is difficult to describe a process to explain all of these experiments; however, most of the experiments indicate that there are two types of rays at great depths—one with a maximum range of about 400 meters and one with a much greater range. Professor Clay believes that the first group consists of mesotrons and the second of protons. Barnóthy and Forró[3] say that the first group consists of mesotrons, but the second group is a non-ionizing group detectable because of soft ionizing secondaries. There is still a third possibility, that is, that the first type is a non-ionizing ray and the most penetrating rays are mesotrons. The data at the present time are not sufficiently complete to enable one to decide which is the correct explanation. There may be three types of penetrating rays. Certainly more experiments should be performed to determine the nature of the penetrating rays.

[5] G. Wataghin and M. Damy de Souza Santos, Annaes da Academia Brasileira de Sciencias **11** (March 31, 1939).

Discussion

D. K. Froman, *McGill University*, and **J. C. Stearns,** *University of Denver:* It is interesting to note that the data presented by Mr. Wilson in regard to the absorption of showers agree so completely in detail with shower absorption data obtained at altitudes of 6000 and 14,000 feet, respectively.[1] Not only do the absorption curves show the same rate of absorption but they exhibit a plateau in the same region as do the ones obtained at high altitudes, and the cut-off occurs at the same thickness of lead. This is strong confirmation that the showers observed by Wilson are electron-photon showers of the cascade type.

[1] Froman and Stearns, Phys. Rev. **49**, 473 (1936); Phys. Rev. **49**, 414 (1936); Phys. Rev. **50**, 787 (1936).