The adequate mineral nutrition of farm animals depends upon a number of inter-related factors. In the first place, there must be a sufficient supply of those minerals required for the normal functioning of the body processes. In the second place, efficient mineral nutrition depends upon the existence of a proper ratio between certain elements, for example calcium and phosphorus. Then there is the assimilation factor, usually referred to as vitamin D, which makes for a more efficient assimilation of calcium and phosphorus. Finally, there is the question of the harmful effect of certain elements when present in excessive amounts in the ration.

With all of these factors pasture is concerned, and the question of mineral nutrition on pasture is of major importance in view of the fact that over long periods pasture grass is the sole feed, particularly for certain species, in contrast to the conditions found in dry lot or in stable feeding where the ration consists of several feeds and where a deficiency of a certain element in one feed may be balanced by an excess in another. In view of this fact it is not surprising to note that the lack of adequate mineral nutrition first came to the attention of stockmen through observations on pasture and that the most extreme cases of malnutrition and disease which have been recorded as due to mineral deficiencies are those which have been observed on pasture.

OBSERVATIONS ON MINERAL TROUBLES ON PASTURE

Beginning with the middle of the last century one finds in the animal husbandry literature reports from many parts of the world of studies of diseases of grazing animals occurring on certain areas and not occurring on other areas, and these reports indicate that these troubles had actually been noted much earlier. The troubles have been reported under a variety of names, such as osteomalacia, pica, and several local terms, but the symptoms had much in common—lameness, bone weakness, emaciation, and depraved appetite, especially a craving for bones or earthy material. Large death losses over widespread areas are recorded.

That inadequate mineral nutrition was involved in the development of the troubles was evidently recognized in Germany as early as 1859. Von Gohren (1) reports that in that year in an area near the Rhine a disease was widespread which was characterized by brittle bones. He states that it was apparently the result of a lack of minerals in the fodder due to an unusually dry season and he refers to the use of bonemeal as a cure. Later, Grouven (2) analyzed the crops from areas where bone weakness was exhibited by the animals

1Paper read as part of the symposium on "Pasture Management Research" presented at the joint session of the New England Section of the Society and Section O of the A. A. A. S. held in New York City, December 28, 1928.
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3Reference by number is to "Literature Cited," p. 705.