was not ascertained, but this outer bar probably does play an important part.

Geological importance: The "rip-currents" must be an important factor in the transportation of fine sediment out from the beach, since they are observed to have considerable sediment suspended in them. Probably they are one of several causes for the well-sorted condition of many beach sands.

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A HYPOTHESIS TO EXPLAIN BROWN ROOT-ROT OF HAVANA SEED TOBACCO

Two types of root-rot are known to affect Havana seed tobacco grown in the Connecticut Valley. Black root-rot is caused by the fungus *Thielavia basicola* (Berk. and Br.) Zopf. The conditions under which it develops are understood, and practicable methods for its control in the field are known. On the contrary, little is known about the cause and nature of brown root-rot, the other type. No causal organism has been demonstrated to be associated with it. It has puzzled plant pathologists and agronomists for years. Brown root-rot produces brown lesions on the roots, causes malformation, stunting and decay of the roots, dwarfing of the plant, spindly growth and low yields.

Within the past several years, while at the Massachusetts Agricultural Experiment Station, the writer and his associates conducted researches which bore directly or indirectly on the cause and nature of brown root-rot of tobacco. The results are here briefly summarized and a hypothesis is presented for the possible benefit of those interested in the subject.

(1) In unsterilized water cultures, ammonium compounds, amino acids and certain amides were toxic to tobacco plants and caused symptoms very similar to those of plants affected by brown root-rot in the field. In sterilized media containing these forms of nitrogen growth was slow, but the roots were not injured. These experiments indicated that the browning and rotting of the roots in unsterilized media was a secondary effect caused by common decay organisms. Comparative experiments with several other crop plants showed that tobacco is one of the more sensitive crop plants to toxicity of unoxidized forms of nitrogen.

(2) The most highly oxidized form of nitrogen, namely, nitrate, was most readily and completely assimilated by tobacco, if the plant was grown to maturity. Neither brown nor decaying roots nor other symptoms of brown root-rot resulted from the use of nitrate nitrogen, except in the latter growth stages when ammonium nitrate was used. In the early growth stages ammonium nitrogen from any source caused more rapid growth than did nitrate nitrogen, and there were no apparent ill effects, but in the later stages ammonium nitrogen caused decay of the roots, even when used in low concentrations. When plants with diseased roots were transferred from ammoniacal solutions to nitrate solutions, they recovered, and new, healthy roots were produced.

(3) Chemical analysis of tobacco plants grown in water cultures containing ammonium and nitrate nitrogen, respectively, showed considerably higher percentages of nitrogen in tops and roots of plants supplied with ammonium nitrogen. The tops of field-grown plants which showed symptoms of brown root-rot were found to contain more total nitrogen than did normal field plants, but litle or no difference was found in the nitrogen content of the roots of the same plants. However, it was impossible to get a fair sample of affected roots due to obvious inherent difficulties.

(4) Appreciable quantities of ammonia were found in tobacco field soils in the early part of the growing season. Little difference, however, was found between soils whose crops were affected and those which were not affected by brown root-rot. This may be explained by a possible rapid, preferential absorption of ammonia by the young plants.

(5) Soil amendments which were found in some cases to reduce or eliminate brown root-rot of tobacco grown in infested soil were peat and mono-calcium phosphate, both of which will absorb or inactivate ammonia to some extent. Sodium and calcium nitrates when added to infested soil, did not materially reduce brown root-rot. The tobacco was grown in a soil having a pH of about 5.0, and in a soil of that reaction a preferential absorption of ammonia is to be expected. In such a strongly acid soil nitrate nitrogen would probably be absorbed in only small amounts, even if present in large quantities, so long as ammonium and other basic forms of nitrogen were present. The addition of lime did not reduce brown root-rot infection, except in the latter part of the growing season and its ameliorating action was thought to be due to its enhancement of the nitrification process.

(6) Brown root-rot of field tobacco was observed to be worst in the early part of the growing season. It decreased in the latter part of July, when nitrification was found to be at its peak. Fields with mild or moderate infestation of brown root-rot often improved considerably or entirely recovered during the latter part of the growing season if conditions for nitrification were favorable. The disease was worst in cool, wet seasons, when conditions for nitrification were least favorable.

(7) Brown root-rot could not be transferred from one soil to another by inoculation with small amounts of infested soil, either in the greenhouse or in the field. It was reduced or eliminated by drying infested soil in the air, either at room or higher temperatures.

(8) The disease was observed to be worst following

certain crops grown in the same field, particularly corn and timothy sod. It rarely occurred in continuous culture of tobacco, and fields strongly infested with brown root-rot usually recovered after one or two years of tobacco culture. It is thought that the rate of decomposition and nitrification of crop residues is an important factor governing the occurrence of the disease. Its ephemeral character under certain conditions is well established.

Because of the facts presented under 1, 2, 3, 4 and 5, it seems that the unoxidized forms of nitrogen resulting from the decomposition of organic matter are indirectly the cause of brown root-rot. Secondly, because of its ephemeral and transitory character and its relation to the cropping system, as shown under 6, 7, and 8, it appears that the unoxidized form or forms of nitrogen concerned originate from plant residues and possibly, also, from organic nitrogenous fertilizers supplied in large quantities in tobacco culture. Finally, it appears that the rotting of the roots is due to the comparatively high concentration of nitrogen in the roots, or a narrowed carbon-nitrogen ratio, caused by rapid absorption of basic nitrogen. The basic forms of nitrogen are not in themselves toxic in the concentrations usually found in the soil, but produce a condition in the roots which makes them easy prey to decay organisms commonly present in the soil. This explanation of the cause and nature of brown root-rot is presented as a working hypothesis, awaiting further work for its substantiation or disproval.

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NAMES OF AND SYMBOLS FOR THE ARTIFICIALLY RADIOACTIVE ELEMENTS

THE system of naming the artificially radioactive elements, and especially the symbols used for these names, have apparently been adapted from the systematic naming of the naturally radioactive elements which follow radon in the radium family. Due to the number of elements known to be artificially radioactive, a possibility of ambiguity in the symbols has arisen. The symbols for radium F and for radiofluorine are Ra F and RaF; the symbol for radiosulfur and the formula of the compound radium sulfide are both RaS. The first pair of symbols is similar; in the second case, the symbol of an element and the formula of a compound are identical. In the event of a compound composed of two or more artificially radioactive elements, the formula may become very confusing: radiophosphorus radiotriiodide, $RaPRaI_3$, is an example. This could readily be confused with the formula of a molecular compound.

The systematic naming of the later members of the radium family is quite distinct from the naming of the artificially radioactive elements: the first are rad*ium* A, etc., the second, rad*io*phosphorus, etc. One is a member of the radium family of elements; the other is not. To emphasize this difference, it is proposed that the artificially radioactive elements be named in such a way that the element is considered to be of primary importance, and the radioactivity secondary: the radioactivity is indicated by the hyphenated italicized prefix *radio-*; *e.g., radio*-phosphorus. This nomenclature is entirely analogous to that of isomeric organic compounds, such as *para*-nitrophenol, and the emphasis is placed on the element rather than on one of its attributes. The symbol *ra*-P contains only one capital letter, and so can not lead to the confusion now possible in chemical formulae. The symbols mentioned in the first paragraph would become Ra F and *ra*-F, *ra*-S and RaS, and *ra*-P-*ra*-I_3. The subscript and superscript now used for the atomic number and the atomic weight may be included in the usual manner. No confusion is anticipated between the symbol *ra-* for *radio-* and the *r-* (or occasionally *ra-*) which is sometimes used for racemic compounds.

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THE WEATHERING OF FLINT ARTIFACTS

I WANT to get some information about the weathering or patination of flint flakes and artifacts. Under the direction of the Smithsonian Institution Dr. A. R. Kelly has been doing a systematic study of the Indian mounds so numerous in the vicinity of Macon, Georgia. This is said to be the largest enterprise of the kind in the eastern United States, employing several hundred men for nearly two years. I had noted in a deep trench cut through at least four former levels of Indian civilization that there was an increasing amount of patination of the flints at the lower horizons. The study of several lots of 250 to 1,000 artifacts taken from this and other places of study seems to reveal an *average* definite increase for apparent age. The larger number, perhaps all, of these flints are derived from the near-by residuum of the Ocala limestone, one of the local upper members of the Eocene period. This limestone is associated with the unconsolidated sediments of the Coastal Plain, which have not been subjected to metamorphism.

The amount of patination found varies from zero to more than four millimeters, and the effects are found in all types of flints. The more attractive jaspers are undoubtedly affected by actinic rays, but a loosening of their silicic binding material occasionally exceeds the bleaching. Information from Dana, Merrill and others throws little light on the subject. Eoliths from Kent, England, show a different type of patination, which would prove to be affected easily by frost and other weathering factors.

No flints secured from localities of metamorphic