

portion of this carbonate present in springs depends mainly on the proportion of free carbonic acid, which retains the lime in solution. On the loss of carbonic acid by exposure and evaporation, the carbonate is thrown down as a white precipitate. This deposition is frequently brought about by the action of living plants. (Book III. Part II. Sect. iii. § 3.) Water saturated with carbonic acid will at the freezing-point dissolve 0.70 gramme and at 10° C. 0.88 gramme of calcium-carbonate per litre. Calcareous springs occur abundantly in limestone districts, and indeed may be looked for wherever the rocks are of a markedly calcareous character. In some regions, they have brought up such enormous quantities of lime as to form considerable hills (see, p. 622).

*Ferruginous or Chalybeate Springs* contain a large proportion of ferrous sulphate (iron-vitriol, copperas) in the total mineral ingredients, and are known by their inky taste, and the yellow, brown, or red ochry deposit along their channel. They may be frequently observed in districts where beds or veins of pyritous ironstone occur, or where the rocks contain much iron-disulphide in combination, particularly in the waters of old mines. By the weathering of this sulphide (marcasite), so abundantly contained among stratified rocks, ferrous sulphate is produced and brought to the surface, but in presence of carbonates, particularly of the ubiquitous carbonate of lime, is decomposed, the acid being taken up by the alkaline earth or alkali, and the iron becoming a ferrous carbonate, which rapidly oxidizes and falls as the familiar yellow or brown crust of hydrous peroxide. The rapidity with which ferrous-carbonate is thus oxidized and precipitated was well shown by Fresenius in the case of the Langenschwalbach chalybeate spring. In its fresh state the water contains in 1000 parts 0.37696 of protoxide of iron. After standing twenty-four hours it was found to contain only 87.7 per cent of the original amount of iron; after sixty hours 62.9 per cent, and after eighty-four hours 53.2 per cent.<sup>87</sup>

*Brine-Springs* (Soolquellen) bring to the surface a solution in which sodium chloride greatly predominates. Springs of this kind appear where beds of solid rock-salt exist underneath, or where the rocks are impregnated with that min-

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<sup>87</sup> Journal für Prakt. Chem. lxiv. 368, quoted by Roth, op. cit. i. p. 565. The river in the Vale of Avoca, Ireland, formerly contained so much ferrous sulphate, carried into it by mine-waters, that its bed and banks for several miles down to the sea were covered with an ochreous deposit.