which the chloride of sodium is no longer able to hold in solution. It is necessary, therefore, to have recource to a further separation, the cost of which more than absorbs the value of the silver. This process is of no economic value. There is another method of separating the silver from the copper, which consists in converting the precipitate into sulphate of copper, but, as the market for this is limited, this method is only applicable to a limited extent.

"After much research, I have arrived at the following mode of separation. It is founded on the fact that iodide of silver is nearly insoluble in solution of chloride of sodium at ordinary temperatures.

"The mineral roasted with common salt undergoes, as has been before stated, several successive washings, but only the first three waters contain a notable quantity of silver.

"We have found by experience that the two first waters contain about 80 per cent., and the three first 95 per cent., of the total quantity of silver dissolved. According to analysis of one of these waters, marking 1·24 on the areomètre, a cubic metre of this liquor contains:—

| | Grammes. |
|---|---|
| "Sulphate of soda ... ... ... ... ... | 144·171 |
| Chloride of sodium ... ... ... ... ... | 63·914 |
| Chlorine (in combination with other metals) ... ... ... | 66·143 |
| Copper ... ... ... ... ... ... | 52·855 |
| Zinc ... ... ... ... ... ... | 6·857 |
| Lead ... ... ... ... ... ... | 0·571 |
| Iron ... ... ... ... ... ... | 0·457 |
| Lime ... ... ... ... ... ... | 0·743 |
| Silver ... ... ... ... ... ... | 0·0437 |
| | 335·7547 |

"Minute quantities of arsenic, bismuth, and other are omitted in this analysis. The above is only given as an example, for the silver here given as 43·7 grammes varies in our operations from 25 to 75 grammes to the cubic metre, according to the richness of the mineral and the degree of concentration of the liquors. We only employ the first three washings. These are poured into a wooden cistern, and allowed to remain till the solid matters in suspension settle; and, in order to employ the quantity of iodide absolutely necessary, we commence by determining the quantity of silver contained in the liquor. To effect this, a given quantity is taken and diluted with water; a little hydrochloric acid is added, to retain the copper in solution; then a weak solution of iodide of potassium is added drop by drop, which converts the soluble chloride of silver into insoluble iodide; at the same time, by the addition of a solution of acetate of lead, we throw down a heavy plumbic precipitate, which entangles all the silver. This precipitate is dried and melted with a flux, with addition of metallic iron. The resulting lead button is cupelled, and the quantity of silver held in the liquor thus determined. The clear assayed liquor is then run into another vessel, where the quantity of iodide of potassium shown by the assay to be required is added, diluted with a quantity of water equal to about one-tenth of the cupreous liquor. The whole is then agitated, and afterwards allowed to settle for forty-eight hours. The supernatant liquor is then clear. This is drawn off, and the vessel again filled for a fresh operation, and so on (the iodide of silver not being quite insoluble, about 5 grammes to the cubic metre remain in solution and pass into the copper). After every fiftieth charge, the accumulated deposit is collected. It consists principally of sulphate of lead, iodide of silver, and salts of copper: the latter are easily separated by a washing with weak hydrochloric acid. The deposit, thus freed from copper, is decomposed by metallic zinc, which, in presence of water, rapidly and completely reduces the silver, with the formation of soluble iodide of zinc. The following are the products:—

"(1.) Soluble iodide of zinc, which is filtered off, and, after 'tritration,' is used instead of iodide of potassium in the subsequent operations to precipitate fresh quantities of silver.

"(2.) A deposit, rich in silver, composed in great part of lead in the state of metal and of sulphate of lead, besides several other substances. The following assay of a dried sample will give an example:—

| | |
|---|---|
| "Silver ... ... ... ... ... ... | 5·95 |
| Gold ... ... ... ... ... ... | 0·06 |
| Lead ... ... ... ... ... ... | 62·28 |
| Copper ... ... ... ... ... ... | 0·60 |
| Oxide of zinc ... ... ... ... ... | 15·46 |
| Oxide of iron ... ... ... ... ... | 1·50 |
| Lime ... ... ... ... ... ... | 1·10 |
| Sulphuric acid ... ... ... ... ... | 7·68 |
| Insoluble residue ... ... ... ... ... | 1·75 |
| Oxygen and loss ... ... ... ... ... | 3·62 |

"This analysis shows that all the iodine of the iodide of silver has combined with the zinc and become soluble, since the deposit does not contain any, or only traces. The gold appears here for the first time. It must have existed in the mineral, and it would appear that, in the operation of roasting, chloride of gold is formed, which, rendered more stable by the presence of chloride of sodium, is not reduced at the low temperature of this roasting. This chloride therefore enters into solution with the silver, and is precipitated with it by the iodine. It is now easy to separate from these products the precious metals by the ordinary processes of fusion for matters containing gold and silver.

"During 1871 we operated on 16,300 tons of roasted pyrites, from which we extracted—gold, 3,172 grammes; silver, 333,242 grammes—being a little more than 20 grammes of the precious metals to the ton, which produced 80,800 francs, after deducting cost of melting and refining. The special expense of separation of the precious metals is about 10,400 francs; in this is included 137