

"It is asserted that it would be impossible to thoroughly oxidize the sulphur by burning, and that a lower sulphide would result, which would melt and enclose the fine particles of gold, rendering the subsequent extraction more difficult. Mr. Latta's evidence, which is of a practical nature, is very decisive in regard to the question. He states that roasting has the effect of converting the gold on the exterior of the quartz into globules and covering them with a ferruginous glaze, which is prejudicial to the proper extraction of the precious metal. He has microscopically examined raw and burnt quartz-washings from the lowest blankets, and found most particles of gold in the latter.

"Except in the instances of Messrs. Heywood and Kayser, and the gentlemen examined at Stawell, those of the witnesses who advocate burning do so, not because they believe it to be the more efficacious method, but because there is less wear and tear of machinery, and by such method a greater quantity of stuff can be crushed in the same time; but it will be observed on reference to the Stawell evidence, that barely an appreciable quantity of pyrites (one ton to one thousand tons of quartz) is met with in the main reefs of the district, and consequently little is known there with reference to their treatment. In all cases it is necessary that the cost of fuel be moderate.

"Mr. Heywood considers that many substances are removed during the process of roasting which would tend to interfere with amalgamation, and that the loss of mercury is less. Mr. Kayser thinks that fine gold is run into a globular form during roasting, and is then more easily amalgamated. On the other hand, Mr. John Lewis, the manager of the New North Clunes Company, is very emphatic in his condemnation of burning, for he says: 'I would burn quartz previous to crushing if the pyrites were not to be saved; but if they were needed I would crush raw.' After a careful consideration of this portion of the question, the Board is of opinion that crushing raw is the best method of treatment, except where pyrites are absent; then burning might be adopted, if fuel is easily obtainable, in order to economize wear and tear of machinery in crushing.

#### *"Methods of Concentration."*

"Dealing with the next question in its natural sequence, we come to the process of concentration (this term meaning, of course, the separation of the various descriptions of pyrites from the crushed material). In one instance the use of shaking-tables is advocated, and in one or two others self-acting jigging machines are regarded as very good; but the great majority of witnesses are in favour of using Borlase's concave buddle, with Munday's patent scrapers. The importance of finding out and directing public attention to the best pyrites-saving machine cannot be over-estimated; and from the information collected in connection with this buddle the Board have deemed it advisable to attach a plan, a section, and a description of the machine to this report, as they believe it the best at present in general use. Some of the gentlemen examined are of opinion that a classification of the sand operated on according to size of grain should be made; but the balance of evidence is to the effect that the use of the buddle renders classification unnecessary, the loss of pyrites not being more than 5 per cent. We are of opinion, however, that classification will ultimately be found beneficial, and must eventually be adopted. An 18ft. or 24ft. machine, making seven or eight revolutions per minute, is recommended.

#### *"Methods of Roasting."*

"A very important portion of the subject under inquiry, and one which demands great attention, is the best method of dealing with the pyrites after concentration. The evidence on this point is almost unanimously in favour of roasting. One or two witnesses depose to having attempted to extract the gold by grinding and amalgamating raw; but these attempts have almost invariably resulted in a greatly-increased loss both in gold and mercury. The losses occur through the presence of arsenic and sulphur in the material operated upon, causing what is technically termed flouring, by chemical as well as by mechanical action. Mr. Bland, manager of the Port Phillip Company, Clunes, has kindly placed at the disposal of the Board some letters and reports received by him from Dr. Percy and other eminent Home authorities in connection with this difficulty, and copies thereof will be found attached. Some little information has also been obtained relative to the mode of extraction by a metallurgical treatment of the ore, and attention is directed to the evidence of Messrs. Ulrich, Newbery, Quist, Leigh and Moore, relative to this matter; but so little is really known of a thoroughly reliable character regarding it that the Board cannot do more than recommend the process to the notice of persons interested, in the hope that further experiment may demonstrate clearly its actual value.

"It would, however, appear from the evidence that ores containing antimony in large quantities can only be effectually treated by this method. For roasting, reverberatory furnaces, with inclined floors, are almost universally recommended; and, as these appear to be the best at present in general use in the colony, a plan and description of one has been attached to this report. Attention is also drawn to the plan of an inclined cylindrical furnace, on the principle of Hocking and Oxland's patent; the special advantages claimed for this description of furnace over others being on account of the self-acting motion imparted to the pyrites, which motion obviates the continual raking of the "stuff" by manual labour, as at present, and because the gradual presentation of fresh surfaces to the flame is thoroughly and regularly effected. The roasting requires both care and time. It should be carried to the complete decomposition of the arsenides or sulphides, or, in other words, until the arsenic and sulphur are dispelled, and the ores become what is technically called 'sweet.' From twelve to eighteen hours are required for the calcining, the time depending upon the stuff treated, that containing the largest quantity of sulphur and arsenic taking the longest period to calcine. There is a conflict of opinion with regard to the admission of quartz-sand into the furnace with the ores, some of the witnesses asserting that the pyrites should be as pure as possible, as the introduction of quartz causes (in the subsequent process