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THE BEHAVIOUR OF MAGNETITE AS RETAINING COVER IN THE SLUICE BOXES

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ABSTRACT A number of experiments, in a magnetic sluice with rectangular box cross section dimensioned 1200/200/ 100 mm were earned out The sluice box was placed over a magnetic unit in which permanent magnets were incorporated to create a magnetic field over the sluice bottom The magnetic field strength increased along the direction of flow of the treated suspension The investigations were earned out by using a model suspension for determination of the possibilities of fine cassitente recovery by detention in magnetite floes Detained magnetic fraction like dendrite fiocs of magnetite create a sluice coating with high detention ability The coarsest aggi égales from detained magnetic fraction, mainly over the strong magnetic field zones, peimits a hea\y mineial concentration to take place within a form similar to classical sluices riffles The retention of heavies can be achived by means of fixing within the volume of magnetite floes The role of the hydiodynamics conditions was observed in a search for better recovery The experimental results indicate that the optimal /one ior maximum recovery depends on the relationship between % solids and flow rate The hydiodynamics conditions a! lower flow-rales and lower pulp solids were the most favourable (60% recovery) bul the heavy particle recovery slightly (50%) in hydrodynamic conditions of 10 1/min and 10% pulp-solids, but the kinetics ol the process was considerably better 50-60% recovery of fine heavy particles with a ratio of concentration 20 shows that the magnetite floes could successfully be employed as captive coatings in sluice boxes

INTRODUCTION

Preliminary investigations on the prospects of a magnetic bottom sluice having 600 mm length were earned out to iccovcry plaeu gold from construction sand The feasıbıhh of the method was confirmed by the tesl results indicating <Ɪ2 ° o stage recovery of tree gold (Patcheııcff S Stoev 1089) By means of fractional analysis il was established that gold particles under iOOmm piulominate in the yielded concentrate I best icsulls stiplemented by a visual observations militated the necessity for a detailed study of the conditions for heavy mineral concentration in a magnetite enver

Tin experiments are tamed nut in a 1200mm long and 200mm width sluice I he sluice is laid over the magnetic unit in which pu marient magnets are incorporated toi the uealion of bottom niagnetie field the magnetisation ol winch following pulp dnietion - ! i< I Detaiiud magnetic fraction like ruugll deridnU lines create ı soil eoating with high contaet ability ,u the sluıeı bottom The eoaisest agg égales ol the dclained ıiM-metıe fraction in imlv ovei the stroii!; ina^nelic In Id /ones permil heavy pillules conti nu Hion to In hau like elassn slum riffles Except this, heavies can be fixed also within the volume of the magnetite fiocs originating from the pulp bearing magnetite 7 he ability of the magnetic capture coating lo produce various concentrate zones characiensed by a definite retention capability for particles i>i/e and shape indicates that there is a possibility lo both deiain fine and coarse heavy panicles I he magnetic fraction contained in ihe flowing continuous suspension permit over coating captuied heavy paıtıcles to be packed into magnetite floes and keep high contact ability on the capture coating The process of deposition by packing is limited by the thickness ol the fixed layer along the bottom m mucin fraction Thickening causes a decrease ot the magnetic foui acting on the surface layei ol niai'tn-lru pari« *U* from the point of view of tin hvliodynannc lone, pulp flow can pre fen ruitall\ ıflt 11 tin uidgneiilc panicles on the smhuc eniumlr M lı>ıı II On hydrodynamic fortes die expiissly ilonnn ml On* packing ot nonmat' 't lie liai I inn (ı a-.es ΠΙ tin . /one and may continue in some ol ıhı lui lowing unsatutated /ones

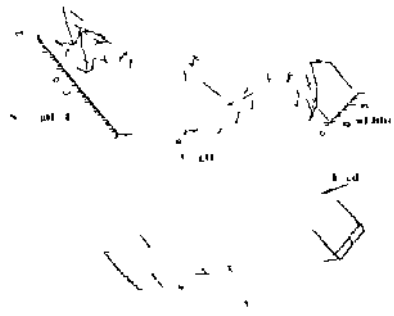


Figure I Magmik held/ones

A partial meelianieitl detachment of the captured magnetite pailimits liom the surface of magnetite aggregates b\ the flowing suspension and the eventual filling ol then places by low coercive magnetite panicles is possible The exchange of magnetic parlkks between the suspension and conteniiatc coaling bungs about a state of high contan aclıvıiv as rtgaid 10 the relatively slowly moving particles in the botloni laver

The results ol ilu cxpennui is give a broad idea of the possibilities and ctlıcıeıuv of the method and could serve loi Inline definition of the technological conditions

2 I Xi'l RlMl MM Ml [HODS

The cxpuimuiis «u ı eıiıud oui in a pilot scale cquipme+ii toıisi ıiıı^ ol ı pulp mixer, sluice box drainage rtsuvmi nul hoses (Itgure 2) I he sluice slope Uris It) i[1] ill tests I In. dısp$_{i}$rsıty of the pulp of dp]no\imdUl\ is mainlimid -.ohds by weight 40% within llie mixe ı 1 lie Ilım ı ile and pulp solids ioi an cxpeiinient win ıon|ıullulb\ means of addition of w.ilci in slime U ı d is will ı \cilically moving the

I iii solid plı i i DI ıi i u in! model suspension eoiisisi of i|iini/ si ni IA d at 100-2 SO nim mahnen tc I l u ı J mm) in 1 eassitente .is heavy panicles (*'P* . MiO wiib /n up to 30mm)

Duiiiu the e\p ı mints ılu ı cenam amounl of setlini on the slu u button ilu sluice was 11 moved b\ del ichmi, lu bos liom magnetic unu I he cniieciiliaU leıı \ı d liom ilk box was collet kıl and dm d 1 he dni. o ni i in i ık ıi-, divided nil o n mow size ranges by screening After **that each range** underwent magnetic separation

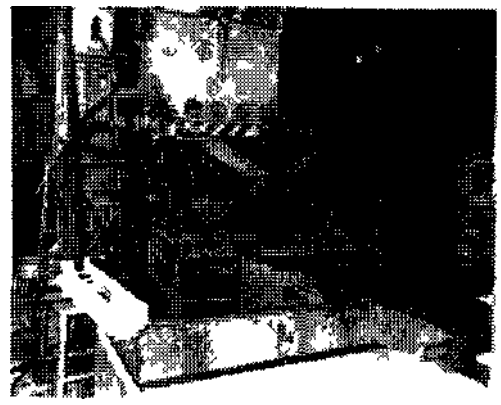


Figure 2 Experimental equipment

The magnetic traction with a size **between 100-** 200mm was returned for use **again as model of** working magnetic traction and **the nonmagnetic** fraction with size below **40mm is analysed for Sn** The tailing from **the** lest process **was collected, the** water was decanted off and **the sand fraction was** used again {Figure 3)

3 RESULTS AND DISCUSSION

Before the mam technological **characteristics of the** concentration with a magnetic **sluice to be studied,** some preliminary experiments **were carried out for delermining the working cycle duration and the** optimum content of magnetic **fraction in the** suspension According to the results of **the our** prtvious expcnments a constant **0 7% grade of** magnetite was established in all tests **The clean up** cycle depended mainly on **the concentrate volume retained** on **the sluice bottom**

The curves drawn at Figure 4 show **the dependence** ot eassıtcı le recovery vs pulp solids **and flow rate It** is obvious **thai theic** is **a trend obtained from the** experimental iesu!ts **liom which it is possible to make** conclusion that the recovery **of eassitente** is maximum HI low How rates **ant** low **pulp solids** Sımıl ıi final tesulls were obtained **when the flow** rales became higher and pulp solids **increase From** the results piesented il is possible to assume **that a** satisfactory cassıteıile recovery could **be obtained if** theie is .i svnehronous change **in the flow rates and** pulp solids (B Pdtthc|icfl R llelincht, 1992)

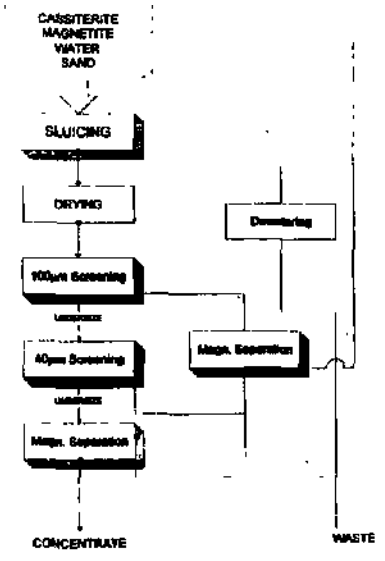


Figure 3. Experimental flowsheet

From the resuhs presented at Figure 5, it is possible to observe the dependence of magnetite content in the retained concentrate vs *on pulp solids* and flow rate changes The trend of the presented curves is very similar to the curves explained at Figure 4, which confirms a common trend of dependence of magnetite content (recovery) vs synchronous variations in pulp solids and flow rate The analysis ofthe test results indicates the functional dependence of the recovery of fine cassitente upon the solids content and the flow rate of the treated suspension. At lower values of these parameters, the recovery is higher (up to 69 %) unlike the cases of high flow rate at low density or high density at low flow rate (up to 15% recovery). In order to achive maximum recovery at very high flow rates ofthe treated pulp it is necessary to increase the solids content of the suspension or vice versa. Therefore an optimal result may be achieved at different values of the flow rates and respective soJtd phase content

The test results indicate that could be assumed that the recovery of heavy fine particles by means of a short magnetic sluice is function of the relaUonship between pulp solids and flow rate - R=f[k(Q,T)] , where ;

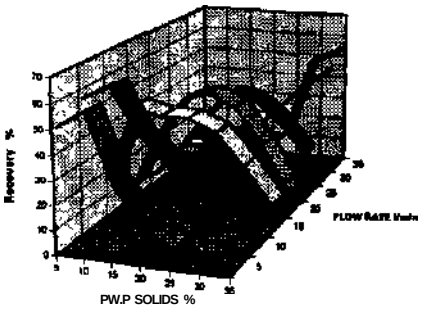


Figure 4. Recovery of Cassitente v/s **pulp solids** and flow rate.

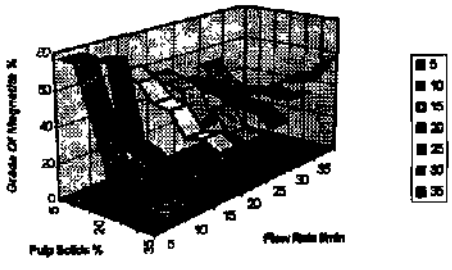


Figure 5 Grade of Magnetite m the **concentrate** v/s pulp solids and flow rate.

R- recovery
Q- flow rate
T- pulp solids
k- coefficient of sluice dimensions

The functional dependence of **the cassitente** recovery vs pulp solids and flow **rate relationship (in** natural logarithmic scale) is presented **at Figure 6.** Curve 1 at the Figure 6 presents **the trend** of distribution of experimental data, while Curve 2 presents the fitted distribution with **a coefficient** of' reliability of 0 85. Curve 2 obtained **possess a Gauss** distribution form of the dependence **of cassitente** recovery on Ln Q/T parameters playing **the** main **role** in the process The process could be described by **the** following equation:

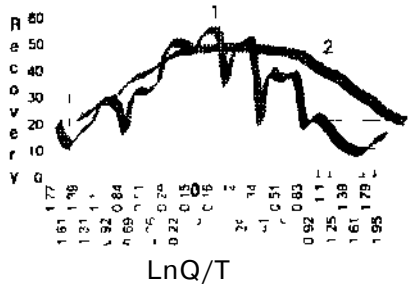
$$R = A.e^{b\ln(k\frac{Q}{T})^2}$$

where A and b aie the Lodïkients of the equation with values of

A 39 1067
b- -0 7925
k=1

and the equation hnalK tesulls in the the following form

$$R = 39.1067.e^{.07925\ln(\frac{Q}{T})^2}$$



hgure O I unUıoıul dLpuuluue of the cissıeıılc recovery on pulp soluls <nid lUm t ate relationship

4 CONCI USION

The expenmentaJly determined dependence of the process of concentration of fine heavy particles by means of magnetic sluice yields a model of hypothetical^ optima! areas of better performance as a function ol Q/T relationship, which could be successfully applied for all types of magnetic sluices

The process of packing of the valuable components by magnetite floes has a practical significance in view of cost-effective concentration of fine heavy particles

From the processing point of view it is more feasible to maintain the process wrth higher flow rate and high pulp density due to the increased capacity

5 RI TERENCES

B Palchejıeff, I Nısh kov , S Stoev, 1989, *Magnetic shine box with high umtaU ability for heavy fine minetah.* Proceeding of the 13th International Precious Metals Institute Conference, Montreal, Canada, IPMI, 255-260 ,

B Palchejıeff, Nısh kov 1989, *Magnetic gravity content! ation of low grade heavy mineral placer deposits,* MMIJ/IMM Joint Symposium Today's Technology for the Mmmg and Metallurgical Industries " Kyoto, lapan, ELSEVIER,343-346

B Palthejıefr.l Nısh kov, R Helfncht, C Bishofberger 1991, *On a po\\ibtlit\ fin magnetically enhanced giavii\ tonte titrât ion,* Alluvial Mining International Conlercnce, London, England, ELSEVIER 347-363

B Pdiiheiiefi 1 Nısh kov. R Helfncht, C Bishofberger 1992 *Kenn et y of fine cassi write by means of a mayjhiii shine* Aufbereitungs lechnik, 8 ,427-431