

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
20 November 2008 (20.11.2008)

PCT

(10) International Publication Number
WO 2008/138038 A1

(51) International Patent Classification:

C22B 3/04 (2006.01) *C22B 3/06* (2006.01)
C22B 3/08 (2006.01) *C22B 3/20* (2006.01)
C22B 23/00 (2006.01)

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(21) International Application Number:

PCT/AU2008/000645

(22) International Filing Date: 12 May 2008 (12.05.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

2007902547 14 May 2007 (14.05.2007) AU

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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Published:

— with international search report

(54) Title: LOW Eh LEACH WITH SULFUR RECYCLE

(57) Abstract: A process for leaching nickel and/or cobalt containing laterite or partially oxidised laterite ore including the steps of : a) providing a laterite or partially oxidised laterite ore; b) leaching the ore in a leach step with an acid in the presence of a reducing agent, to produce a leach discharge containing nickel and/or cobalt values; c) recovering the nickel and/or cobalt from the leach discharge leaving a nickel and/or cobalt barren discharge liquor; and d) treating the discharge liquor to recover at least a portion of any sulfur present as sulfur dioxide and/or sulfuric acid; wherein the reducing agent is present in a sufficient amount to lower or maintain the Eh of the leach step such that the majority of the iron (III) present in the leach process is converted to the iron (II) state.

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LOW Eh LEACH WITH SULFUR RECYCLE

Field of the Invention

5 In general, the present invention relates to a new hydrometallurgical method of leaching nickeliferous lateritic ores, to recover nickel and cobalt values. In particular, the present invention provides a method of acid leaching nickel and cobalt containing laterite or partially oxidised laterite ores together with a reducing agent, such as sulfur dioxide, to obtain a low Eh leach which leads to the conversion of the majority of any iron present
10 in the iron (III) state to the iron (II) state. This leads to a process where the sulfur present in the leach may be recycled while producing a more environmentally acceptable residue.

Background of the Invention

15 Laterite nickel and cobalt ore deposits, generally contain oxidic type ores, limonites, and silicate type ores, saprolites in the same deposits. The higher nickel content saprolites tend to be commercially treated by a pyrometallurgical process involving roasting and electrical smelting techniques to produce ferronickel. The power requirements and high iron to nickel ore ratio for the lower nickel content limonite and limonite/saprolite blends
20 makes this processing route too expensive, and these ores are normally commercially treated by a combination of pyrometallurgical and hydrometallurgical processes, such as the high pressure acid leach (HPAL) process or the Caron reduction roast-ammonium carbonate leach process.

25 Other acid leaching techniques have been developed to exploit lateritic nickel ores in the past decade, apart from conventional HPAL. For example, enhanced pressure acid leach (EPAL) is described in U.S. patent 6,379,636 in the name of BHP Billiton. Atmospheric agitation leaching with iron precipitation as jarosite is described in U.S. patent 6,261,527 also in the name of BHP Billiton, and atmospheric agitation leaching
30 with iron precipitation as goethite is described in Australian application 2003209829 in the name of QNI Technology. A process for direct atmospheric leaching of saprolite component is described in U.S. patent 6,379,637 in the name of Curlook.

Heap leaching is a conventional method of economically extracting metals from low grade ores and has been successfully used to recover materials such as copper, gold, uranium and silver. Generally it involves piling raw ore directly from ore deposits into heaps that vary in height. The leaching solution is introduced on to the top of the heap
5 to percolate down through the heap. The effluent liquor is drained from the base of the heap and passes to a processing plant where the metal values are recovered.

Heap leaching has been proposed in recovery processes for nickel and cobalt and is described for example in U.S. patent 5,571,308 and 6,312,500, both in the name of
10 BHP Billiton, but it has not yet been used commercially. However, it offers promise of a low capital cost process, eliminating the need for expensive and high maintenance, high pressure equipment required for the HPAL process.

In all of these processes, the Eh is typically maintained at a sufficiently high level that
15 the iron is predominantly in the iron (III) state during the actual leach. Typically, the Eh during an acid leach process of a laterite ore is in the range of from 600-900 mV.

The solids residue from such processes may be environmentally unfriendly, as they may contain a large proportion of iron as jarosite. Jarosite is not a stable compound
20 and slowly releases acid as it weathers, which could have negative environmental impacts.

The use of sulfur addition to a magnesium sulfate roast has been proposed in recent patent applications which focus on the recovery/rejection of magnesium from leach
25 solutions, where crystallised magnesium sulfate is converted to magnesium oxide and sulfur dioxide following the addition of elemental sulfur. Such projects aim to avoid the negative environmental input of rejecting magnesium sulfates to brine ponds and improved economy by the re-use of magnesium oxide. However, such steps have not been applied to other elements such as iron, which are commonly present in nickel and
30 cobalt leach processes. The present invention aims to overcome or at least alleviate one or more of the difficulties associated with the prior art by developing a process where iron is converted to the iron (II) state during a laterite leach process, which will result in a more environmentally acceptable residue, while recycling the sulfur for further use in the leach process.

The above discussion of documents, articles and the like is included in the specification solely for the purpose of providing a context for the present invention. It is not suggested or represented that any or all of those matters formed part of the prior art base or common general knowledge in the field relevant to the present invention as it existed in Australia before the priority date.

Summary of the Invention

The present invention relates to a process that involves a low Eh leach of nickel and cobalt containing laterite ores. The process involves leaching the ores in the presence of a reducing agent to lower the Eh of the leach process, which leads to conversion of the majority of iron in the iron (III) state to the iron (II) state, and allows the integration of sulfur recycling into the process.

Accordingly, in one embodiment, the present invention resides in a process for leaching nickel and/or cobalt containing laterite or partially oxidised laterite ore, including the steps of:

- a) providing a laterite or partially oxidised laterite ore;
- b) leaching the ore in a leach step with an acid in the presence of a reducing agent to produce a leach discharge containing nickel and/or cobalt values;
- c) recovering the nickel and/or cobalt from the leach discharge leaving a nickel and/or cobalt barren discharge liquor; and
- d) treating the discharge liquor to recover at least a portion of any sulfur as sulfur dioxide and/or sulfuric acid;

wherein the reducing agent is present in a sufficient amount to lower or maintain the Eh of the leach step such that the majority of iron (III) present in the leach process is converted to the iron (II) state.

The process is particularly applicable to pressure, atmospheric or heap leach processing of laterite ores or combinations of these processes. In a preferred embodiment, the leach discharge is a slurry and the process of the invention includes a solid/liquid separation step where a solid residue is separated from the slurry to produce a nickel and/or cobalt rich product leach solution. In an alternative embodiment, the

nickel and/or cobalt may be recovered directly from the leach slurry by resin-in-pulp techniques.

5 In one embodiment, the leach step may be conducted as a heap leach process. The laterite ore may be piled in one or more heaps and the acid, together with the reducing agent, allowed to percolate through the heap or heaps to produce the leach discharge containing the nickel and/or cobalt values. A plurality of heaps may be established and leached in a counter current process. The leach discharge recovered from the heap leach process is generally a solution containing the nickel and/or cobalt values. The
10 presence of the reducing agent in the leach step lowers the Eh of the leach resulting in the majority of the iron (III) present being converted to iron (II) state.

The reducing agent in the leach step is generally a sulfur containing compound or gas, which in a preferred embodiment, is sulfur dioxide. In one embodiment, the sulfur
15 dioxide recovered following treating the barren discharge liquor may be recycled for use as the reducing agent in the leach step. Alternatively, other sulfur containing components could be used such as metabisulfite, dithionite and thiosulfate.

In one embodiment, the nickel and/or cobalt may be recovered from the product leach
20 solution by adding a sulfiding agent to a product leach solution to precipitate the nickel and cobalt as sulfides, leaving a nickel and cobalt barren discharge liquor. Alternatively, the nickel and/or cobalt could be recovered from the product leach solution by other known processes, such as ion exchange or solvent extraction techniques, and leave a nickel and/or cobalt barren discharge liquor.

25 The nickel and/or cobalt barren discharge liquor includes other ions such as ferrous iron, aluminium and magnesium. In one embodiment, these ions may be removed or recovered by crystallising them as their sulfates by cooling or refrigerating the discharge liquor. Alternatively, they may also be crystallised by subjecting the discharge liquor to
30 evaporation. Additional sulfuric acid may be added to assist in the crystallisation process.

The solid crystallised sulfates may then be separated from the discharge liquor and heated within the range from 550°C to 800°C in the presence of elemental sulfur to

produce metal oxides and sulfur dioxide gas. The metal oxide will generally be considered as reject material, but may in some circumstances, be retained for further processing or other commercial uses.

- 5 The sulfur dioxide gas that is produced in this step can be recycled to the start of the leach step as a source of the reducing agent, together with the remaining discharge liquor. Optionally some of the sulfur dioxide gas may be used for sulfuric acid generation for use in the leach process or the crystallisation step.

10 **Detailed Description of the Invention**

The process is particularly applicable to processing laterite ores. In one embodiment, the limonite component of the laterite ore is first leached with sulfuric acid under low Eh conditions to produce a primary leach slurry and then the saprolite component is added to the primary leach slurry to complete leaching of the ore and to aid in neutralising the
15 leach slurry. The pH of the leach slurry can be further adjusted with a base, such as limestone, to precipitate any ferric iron that may remain to form a neutralised leach slurry.

In other embodiments, the as mined ore mixture of limonite and saprolite may be
20 leached together, or the separated limonite and saprolite components may be leached in parallel, or any combination thereof. The processing of the saprolite and limonite component may be tailored to optimise ore handling costs and/or sulfuric acid usage.

In a process particularly applicable to pressure and/or atmospheric leach processing
25 under low Eh conditions, the leach slurry is at least partially neutralised as outlined above. The neutralised leach slurry preferably undergoes a solid/liquid separation step such that the solid residue is separated from the leach slurry to form a neutralised product leach solution. In a preferred embodiment of the invention, nickel and cobalt are recovered from the product leach solution by adding a sulfiding agent such as
30 hydrogen sulfide or sodium hydrosulfide to the product leach solution to form a sulfide slurry, and precipitated from the sulfide slurry as nickel and/or cobalt sulfides, leaving a nickel and cobalt barren discharge liquor. In this process, because the dissolved iron in the product leach solution is in ferrous form, it will not precipitate as a sulfide, and so remains in the discharge liquor, to be disposed of with other metals as metal oxides

following crystallisation of ions remaining in the discharge liquor, and does not become an impurity in the mixed nickel and/or cobalt sulfide.

Alternatively, the nickel and/or cobalt may be recovered from the product leach solution by other known techniques such as solvent extraction and ion exchange. The nickel and cobalt may also be recovered directly from a leach slurry by resin-in-pulp techniques.

The discharge liquor, which is substantially free of nickel and cobalt following the nickel and/or cobalt recovery step, can then be cooled or refrigerated to crystallise any ferrous iron, aluminium, magnesium and other ions that remain in solution as their respective sulfates either separately or as a mixture of sulfates. Additional sulfuric acid could be added at this stage to assist in the crystallisation process. Further solid/liquid separation could then be employed to remove the solid crystallised sulfates.

An alternative to cooling or refrigerating the discharge liquor to crystallise the metal sulfates, is to subject the discharge liquor to an evaporation step to produce the metal sulfates.

After separating the crystallised solids from the discharge liquor, the remaining discharge liquor together with condensed vapour, is then recirculated as part of the leach solution in the leach step.

The crystallised metal sulfates may then be reduced to their metal oxides and sulfur dioxide gas generated by heating the metal sulfates in the presence of elemental sulfur in a reducing atmosphere. This is preferably done at a temperature within the range of from 550°C to 850°C. Additional energy may be required for this step, as even though the reactions for the expected elements are exothermic, the dehydration of the precipitated solids may require additional heat.

The remainder of the discharge liquor can then be recycled to the leach step. The discharge liquor can be combined with all, or a portion of the sulfur dioxide gas to form the leach solution for the leach process, with the sulfur dioxide acting as the reducing agent to produce the low Eh leach conditions. A portion of the sulfur dioxide gas may

be used to generate sulfuric acid as required, to supplement the acid used for the leach step, or for use in the crystallisation step.

The process of the invention provides the benefit in that the metal oxides that are recovered are more environmentally acceptable than say, for example jarosite, and may be used for alternative commercial purposes. Further, a significant proportion of the sulfur that would normally be lost to tailings is recovered and reused within the leach process, minimising raw materials costs and further reducing waste discharge.

10 Detailed Description of the Drawings

Figure 1 shows a proposed flowsheet for the process of the invention.

Figure 2 is a graph showing the higher iron level in the product leach solution at lower leach Eh levels.

Figure 3 is a graph showing the percentage of iron precipitated at various Eh levels.

The proposed flowsheet shown in Figure 1 illustrates a preferred embodiment of the invention. Whereas this flowsheet is illustrative of a preferred embodiment, it should not be considered as being limiting upon the scope or ambit of the invention described.

Figure 1 illustrates a low Eh leach step (1) where an ore (3) is leached in multiple separate tanks. The limonite component of the laterite ore is leached with sulfuric acid in the presence of a reducing agent in the first tank (5) to produce a primary leach slurry, which is then transferred to the second tank (7) where the saprolite component is added to undergo further leaching and partially neutralise the leach slurry.

Limestone (9) is added to the primary leach slurry (11) to complete neutralisation of the leach slurry.

The solid leach residue (13) is then separated from the neutralised leach slurry (15) leaving a neutralised product leach solution. A sulfiding agent (17) such as hydrogen sulfide or sodium hydrosulfide is added to the neutralised product leach solution (19) precipitating nickel and cobalt sulfides to form a sulfide slurry (21). The nickel and

cobalt sulfide solids are separated off (23) leaving a discharge liquor barren of nickel and cobalt (25).

The barren discharge liquor then undergoes a cooling and/or refrigeration step (27) to crystallise any ferrous iron, aluminium, magnesium and/or other ions that remain in the solution as their sulfates either separately or as a mixture of sulfates. The crystallised sulfate solids are then heated with elemental sulfur in a reducing atmosphere (29) to produce metal oxides (31) and sulfur dioxide gas (33).

An alternative to cooling/refrigeration is to subject the discharge liquor to an evaporation process (35) where the solids are crystallised as sulfates. The remaining discharge liquor is condensed (37) for recycle to the leach process.

Sulfuric acid generated in the process may be combined with the recycled discharge liquor and the remaining portion of the sulfur dioxide gas in a mix tank (39) and recycled for use as the low Eh leach solution (40) in the leach step (1).

Figure 2 illustrates a process where the saprolite slurry has been added to the limonite slurry and demonstrates that at lower Eh levels (450mV) the iron from the saprolite can be seen to leach. This is due to the iron being in the ferrous form, from which it is unable to precipitate.

Figure 3 further illustrates that at higher Eh levels (for example 800mV) results in a higher percentage of the iron precipitating from the solution, which will usually be in the form of jarosites and goethites. At lower Eh (450mV) less iron precipitates as the iron will be substantially in the ferrous form.

Examples

Example 1

Separate samples of limonite and saprolite were leached at normal atmospheric acid leach Eh conditions, and also at low Eh conditions and the resulting metal recoveries to solution compared.

Table 1 below gives the composition of the ore samples.

Table 1. Ore Sample analysis

	Al %	Ca%	Co%	Cr%	Fe%	Mg%	Mn%	Ni%	Si%
Limonite	1.9	0.03	0.15	1.7	42.9	2.5	0.85	1.6	5.6
Saprolite	0.85	0.13	0.17	1	17.2	11.3	0.45	2.5	17.7

Table 2 gives the metal recoveries when the leach conditions were typical atmospheric acid leach conditions.

Table 2 Normal Goethite producing atmospheric acid leach metal extractions

	Al	Ca	Co	Cr	Fe	Mg	Mn	Ni
	Ext %	Ext %	Ext %	Ext %	Ext %	Ext %	Ext %	Ext %
Limonite leach	75.63	48.56	95.59	32.56	91.93	85.01	96.37	96.42
Saprolite leach	66.21	22.88	90.34	36.94	26.55	79.88	94.05	77.02
Saprolite alone	45.33	17.00	85.74	44.33	--135.23	78.76	89.69	64.70

Limonite/Saprolite ratio 1
 Acid/Limonite ratio 1.35
 Acid/(Lim+Sap) ratio 0.67
 Operating Eh Limonite 650 (initial) - 695 (end)
 Saprolite 575 (initial) - 520 (end)

5

Table 3 shows the metal extractions obtained when using the low Eh ferrous ion producing conditions. Clearly the saprolite leach results under these conditions results in a significant improvement of both cobalt and nickel extraction.

Table 3. Low Eh Leach metal extractions

	Al	Ca	Co	Cr	Fe	Mg	Mn	Ni
	Ext %	Ext %	Ext %	Ext %	Ext %	Ext %	Ext %	Ext %
Limonite leach	79.98	57.74	95.77	45.31	92.66	87.32	97.02	96.57
Saprolite leach	83.21	28.11	97.75	62.60	93.16	85.94	97.23	95.96
Saprolite alone	90.37	21.33	99.48	91.79	94.38	85.63	97.62	95.58

Limonite/Saprolite ratio 1
 Acid/Limonite ratio 1.35

Acid/(Lim+Sap) ratio 1.25
 Operating Eh Limonite 640 (initial) - 630 (end)
 Saprolite 450 (initial) - 435 (end)

Example 2

Saprolite leaches were carried out using filtered limonite leach solution from the limonite leach tests at three different Eh conditions. The results are indicated in Table 4 and demonstrate that nickel and cobalt extractions from saprolite at the lower Eh conditions are superior.

10 Table 4. Saprolite only leach tests at varying Eh

	Al	As	Ca	Co	Cr	Fe	Mg	Mn	Ni
Target Eh	% Ext	% Ext	% Ext	% Ext	% Ext	% Ext	% Ext	% Ext	% Ext
450	72.66	47.39	74.28	94.06	68.91	38.10	93.27	96.10	89.18
575	9.15	-110.60	25.12	76.24	4.27	-168.87	77.54	88.30	61.97
800	11.34	-120.56	21.58	63.81	4.76	-172.94	77.65	59.16	60.79

Assumed Lim / Sap
 ratio 1
 Assumed Acid
 (Lim+Sap) ratio 0.687

CLAIMS

1. A process for leaching nickel and/or cobalt containing laterite or partially oxidised laterite ore including the steps of:
- 5
- a) providing a laterite or partially oxidised laterite ore;
 - b) leaching the ore in a leach step with an acid in the presence of a reducing agent, to produce a leach discharge containing nickel and/or cobalt values;
 - c) recovering the nickel and/or cobalt from the leach discharge leaving a nickel and/or cobalt barren discharge liquor; and
 - 10 d) treating the discharge liquor to recover at least a portion of any sulfur present as sulfur dioxide and/or sulfuric acid;
- wherein the reducing agent is present in a sufficient amount to lower or maintain the Eh of the leach step such that the majority of the iron (III) present in the leach process is converted to the iron (II) state.
- 15
2. A process according to claim 1 wherein the leach discharge is a slurry and the nickel and/or cobalt are recovered from the slurry by:
- i) subjecting the slurry to a solid/liquid separation step to produce a solid residue and a nickel and/or cobalt rich product leach solution; and
 - 20 ii) recovering the nickel and/or cobalt from the product leach solution.
3. A process according to claim 1 wherein the leach discharge is partially neutralised to assist in removal of any iron (III) present.
- 25
4. A process according to claim 1 wherein the leach step includes the following steps:
- a) dividing the laterite or partially oxidised ore into its limonite component and saprolite component;
 - 30 b) leaching the limonite component with an acid in the presence of the reducing agent to produce low Eh conditions to produce a primary leach slurry; and
 - c) adding the saprolite component to the primary leach slurry to complete the leach step and aid in neutralising the leach slurry.

5. A process according to claim 4 wherein the pH of the primary leach slurry is further adjusted with the addition of a base to aid in precipitation of any iron (III) that may remain in the primary leach slurry.
5
6. A process according to claim 5 wherein the base is limestone.
7. A process according to claim 2 wherein the nickel and cobalt is recovered from the product leach solution by solvent extraction, precipitation as a sulfide, ion
10 exchange, or other known technologies, leaving a nickel and/or cobalt barren discharge liquor.
8. A process according to claim 7 where the nickel and/or cobalt is recovered by precipitation as a sulfide by adding a sulfiding agent to the product leach solution
15 to precipitate nickel and/or cobalt sulfides and form a sulfide slurry, and separating the solid nickel and/or cobalt sulfides from the sulfide slurry.
9. A process according to claim 8 wherein the sulfiding agent is hydrogen sulfide or sodium hydrosulfide.
20
10. A process according to claim 1 wherein the leach step is either a high pressure, atmospheric pressure or heap leach process, or any combination of these processes.
- 25 11. A process according to claim 2 where the nickel and/or cobalt is recovered from the leach slurry by resin-in-pulp techniques leaving a nickel and/or cobalt barren discharge liquor.
12. A process according to any one of the preceding claims wherein the reducing
30 agent is a sulfur containing compound or gas.
13. A process according to claim 12 wherein the sulfur containing compound or gas is selected from metabisulfite, dithionite, thiosulfate or sulfur dioxide.

14. A process according to claim 12 or 13 wherein the sulfur containing gas is sulfur dioxide.
- 5 15. A process according to any one of the preceding claims wherein the Eh during the leach step is lowered or maintained to be within the range of approximately 350 mV to 550 mV.
- 10 16. A process according to any one of the preceding claims wherein the discharge liquor is cooled or refrigerated to crystallise any metal ions that are in solution as their respective sulfates.
- 15 17. A process according to any one of claims 1 to 15 wherein the discharge liquor is subjected to an evaporation step to crystallise any metal ions that are in solution as their respective sulfates.
18. A process according to claim 16 or 17 wherein additional sulfuric acid is added to assist in the crystallisation step.
- 20 19. A process according to any one of claims 15 to 17 wherein the metal ions include ferrous iron, aluminium and magnesium ions, either separately or as a mixture of sulfates.
- 25 20. A process according to any one of claims 15 to 18 wherein the crystallised sulfates are precipitated from the discharge liquor and heated in the presence of elemental sulphur in a reducing atmosphere, to produce metal oxides and sulfur dioxide gas.
- 30 21. A process according to claim 17 wherein the precipitated solids are heated at a temperature within the range of from 550°C to 850°C.
22. A process according to claim 17 wherein at least a portion of the sulfur dioxide gas is recirculated to the leach process for use as a reducing agent and/or a further portion of the sulfur dioxide gas is used to generate sulfuric acid for use in the leach process or crystallisation step.

23. A process according to any one of the preceding claims wherein the acid is sulfuric acid.

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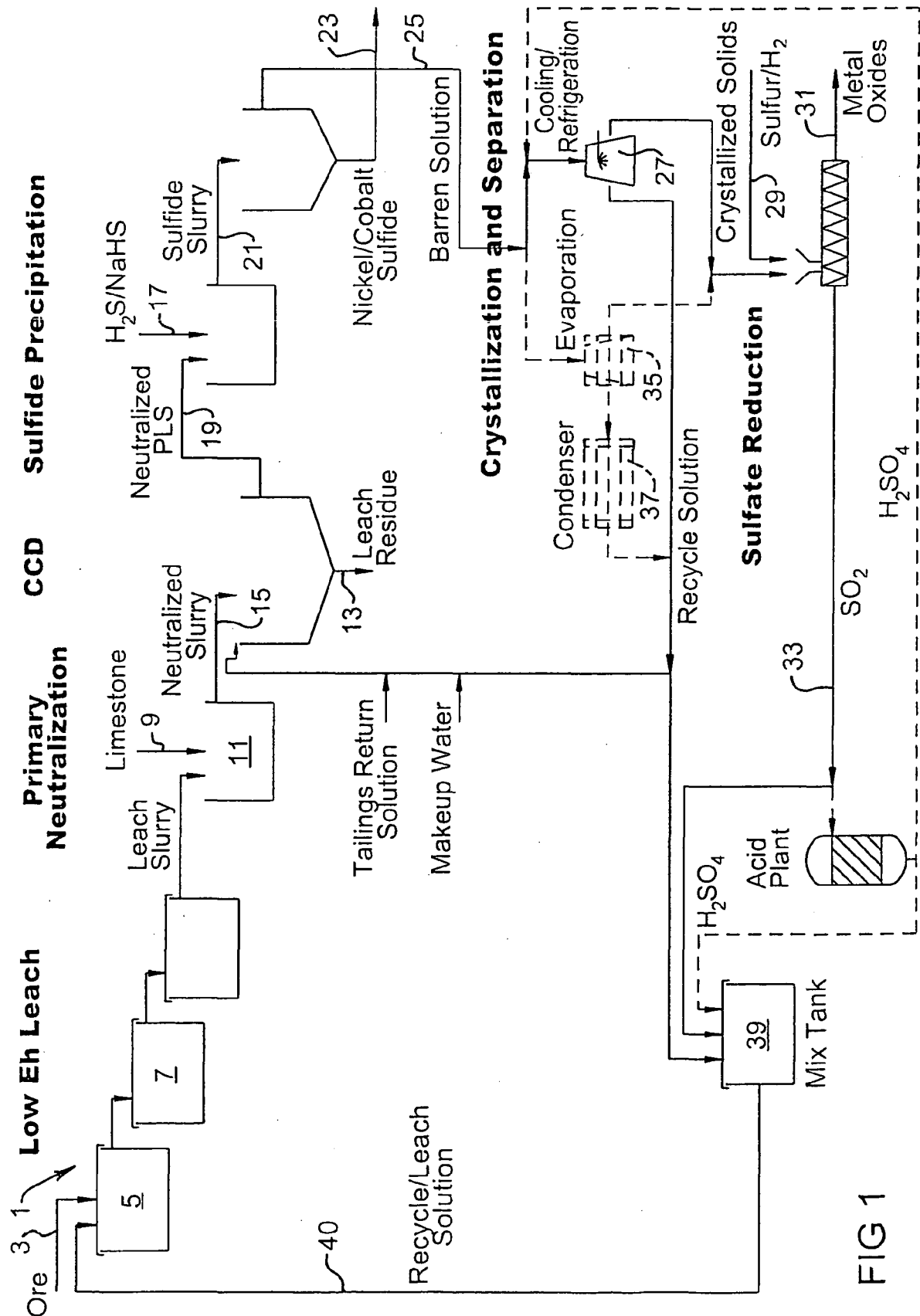


FIG 1

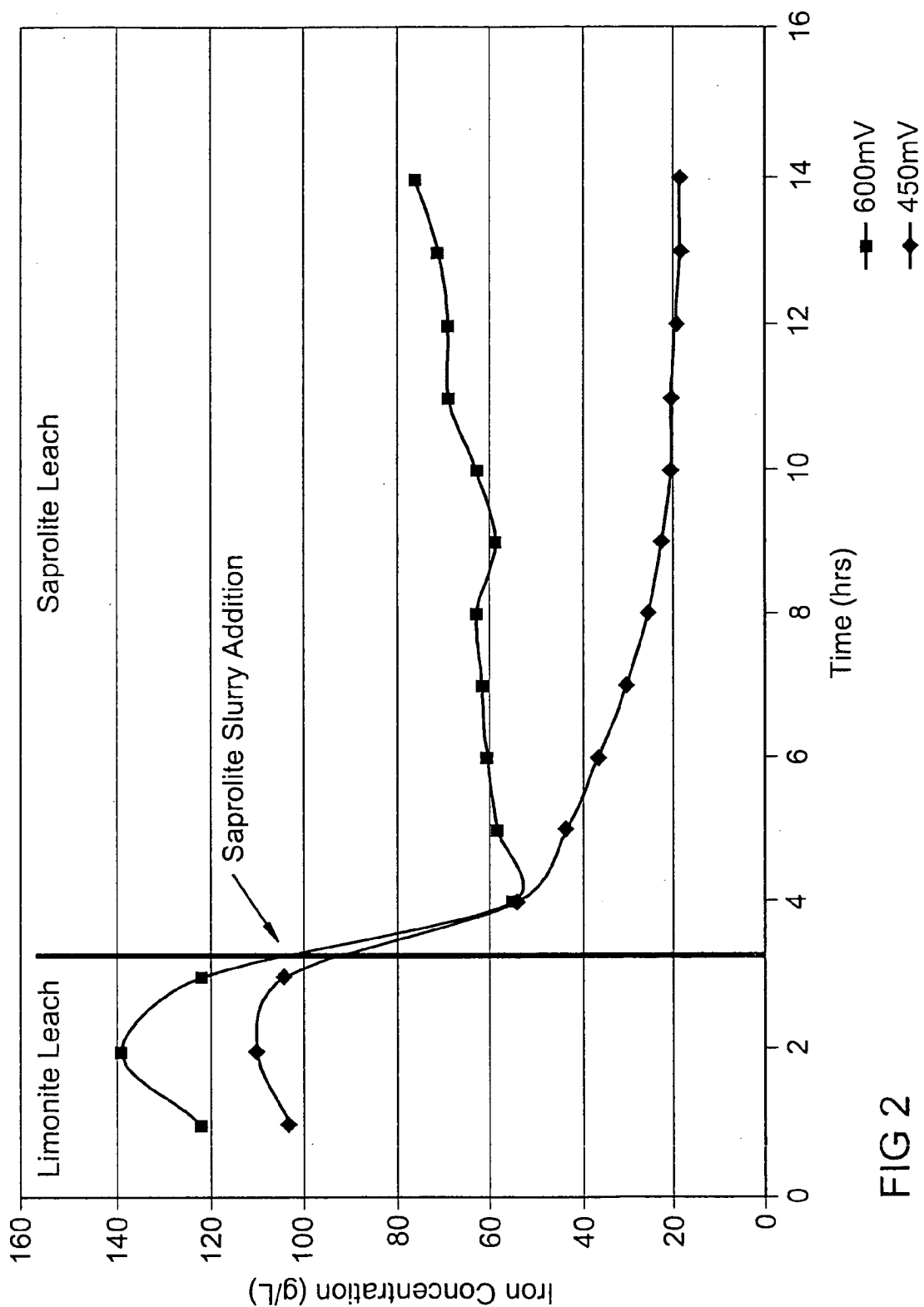


FIG 2

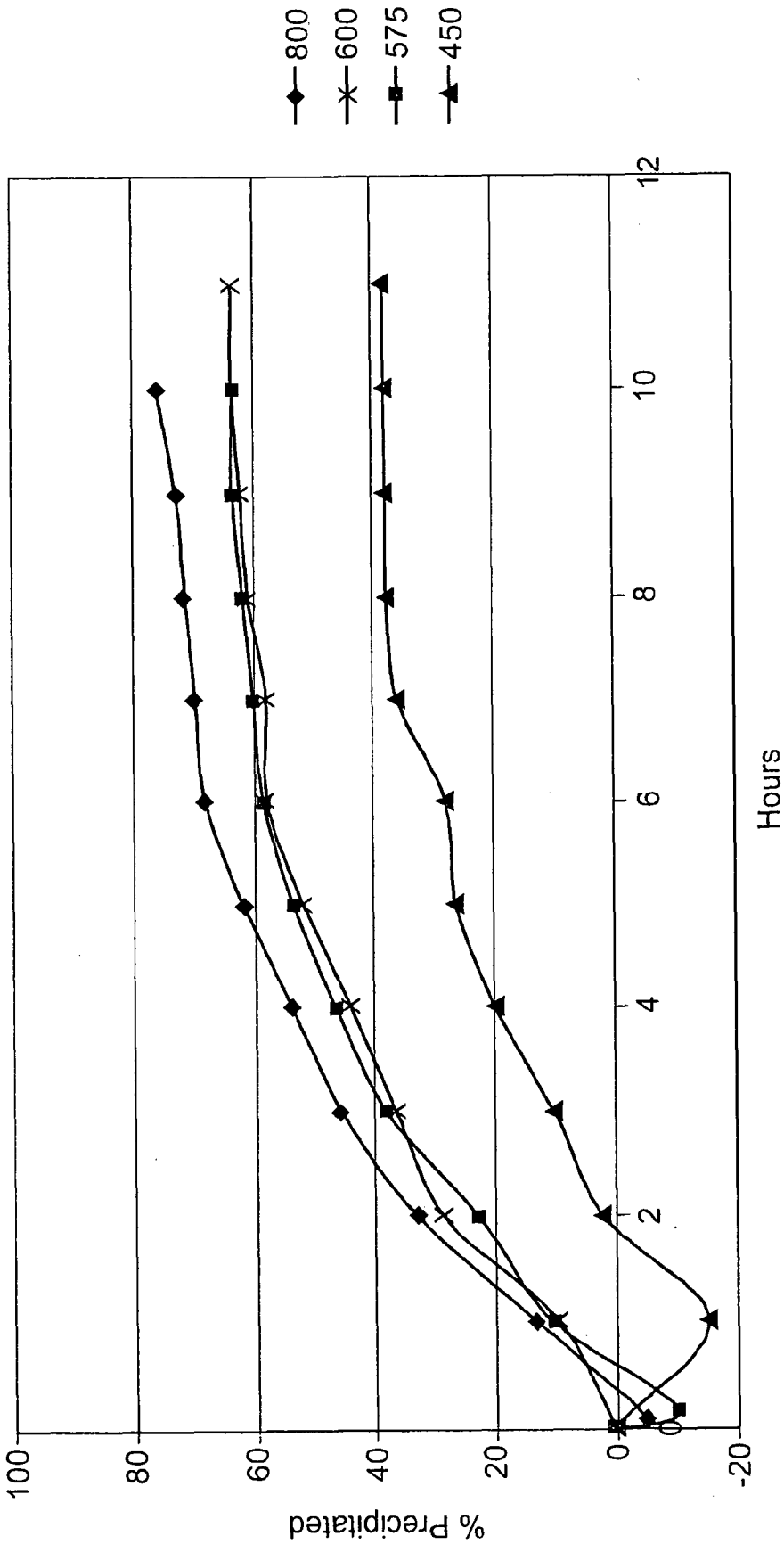


FIG 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2008/000645

A. CLASSIFICATION OF SUBJECT MATTER		
Int. Cl.	C22B 3/04 (2006.01) C22B 3/08 (2006.01) C22B 23/00 (2006.01) C22B 3/06 (2006.01) C22B 3/20 (2006.01)	
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DWPI - C22B 3/04, 3/06, 3/08, 3/20, 3/-, 23/00 & Keywords (laterite, limonite, saprolite, nickel, Ni, cobalt, Co, ferrous, ferric, iron, redox, oxidation, reduction, Eh, sulphur, sulfur and like terms)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CA 1086075 A (INCO LTD. CANADA) 23 September 1980 See: page 3, lines 19-30; page 6, line 1 – page 7, line 8	1, 2, 4, 7, 10, 12-17 19, 20- 23
Y	US 2006/0024224 A1 (NEUDORF, et al.) 2 February 2006 See: figure 1, [0029]-[0035], [0042], [0053]	3, 8, 9, 11
Y	US 2006/0228279 A1 (CAMPBELL, et al.) 12 October 2006. See: paragraph [0014]	8, 9, 11
Y		3
☒ Further documents are listed in the continuation of Box C ☒ See patent family annex		
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Date of the actual completion of the international search 27 June 2008		Date of mailing of the international search report 11 JUL 2008
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. +61 2 6283 7999		Authorized officer RHYS MUNZEL AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : (02) 6222 3650

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4410498 A (HATCH, et al.) 18 October 1983 See: column 2, line 67 – column 3, line 35; table 2	1, 4, 15
A	WO 2006/029443 A1 (BHP BILLITON SSM TECHNOLOGY PTY. LTD.) 23 March 2006 See: Fig. 8; page 5, lines 15-28	10
Note: for the Y indications, CA 1086075 can be combined with US 2006/0024224 for claims 8, 9 and 11 whilst CA 1086075 can also be combined with US 2006/0228279 for claim 3.		

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2008/000645

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
WO	2006029443	AU	2005284665	CA	2580542	CN	101068940
		EP	1794331	KR	2007006012	US	2008016986
US	4410498	AU	76688/81	BR	8107095	CA	1171287
		FR	2493341	GB	2086872	GR	78366
		NO	813732	NZ	198818	OA	6937
		PH	18315	ZW	25781		
US	2006228279	CA	2534035	US	7387767		
US	2006024224	AU	2005284620	BR	PI0513652	CA	2572420
		CN	101001964	EP	1778883	KR	2007004177
		WO	2006029499				
CA	1086075	FR	2390505	PH	14267		
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.							
END OF ANNEX							