

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
25 May 2001 (25.05.2001)

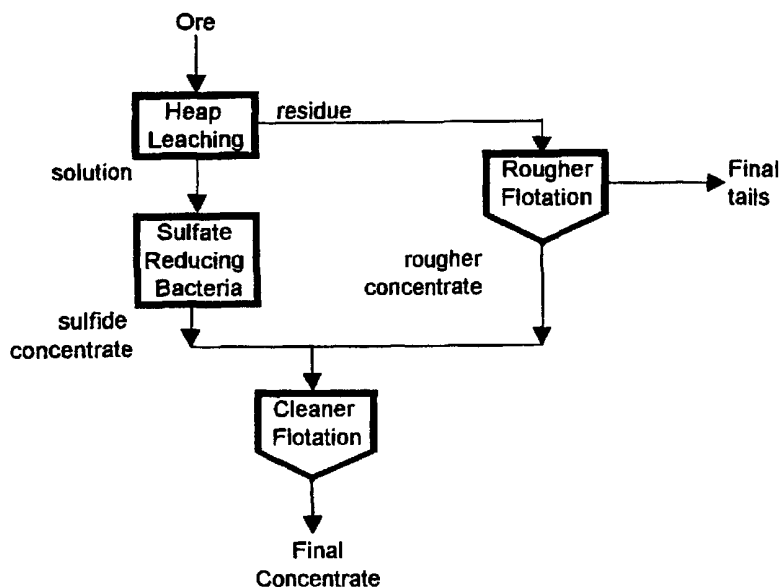
PCT

(10) International Publication Number  
**WO 01/36693 A3**

- (51) International Patent Classification<sup>7</sup>: **C22B 3/18**, 23/00, 19/20, 19/34, 11/00
- (74) Agent: **NICHOLS, G., Peter**; Brinks Hofer Gilson [entity:amp] Lione, P.O. Box 10087, Chicago, IL 60610 (US).
- (21) International Application Number: PCT/US00/41705
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.
- (22) International Filing Date: 31 October 2000 (31.10.2000)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
09/441,488 17 November 1999 (17.11.1999) US
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- (71) Applicant: **BHP MINERALS INTERNATIONAL, INC.** [US/US]; 1360 Post Oak Boulevard, Suite 150, Houston, TX 77056-3020 (US).
- (72) Inventors: **DUYVESTYEN, Willem, P., C.**; 2200 Del Monte Lane, Reno, NV 89511 (US). **BUDDEN, Julia, R.**; 7611 Jimson Drive, Reno, NV 89511 (US). **LASTRA, Manuel, R.**; 2919 Aspen Meadows Court, Reno, NV 89509 (US).
- Published:  
— with international search report
- (88) Date of publication of the international search report:  
15 November 2001

[Continued on next page]

(54) Title: RECOVERY OF METALS FROM ORE BY BIOLEACHING WITH SULFUR ADDITION



(57) Abstract: A bio-leaching method is provided for recovering metal from a metal containing ore. The ore is subjected to contact with a microorganism selective to the oxidation of sulfur. A sulfur containing compound is mixed with the microorganism before, during or after contact with the ore to systemically form sulfuric acid to leach the metal from the ore. The ore is in the form of a slurry, a heap, a charge in a vat and is bioleached for a time sufficient to dissolve the metal in the ore and form a metal-rich leachate and an ore residue. The metal can then be extracted from the metal-rich leachate. The metal containing ore may contain base metals, precious metals, or platinum group metals. Upon formation of the metal-rich leachate, the ore residue may be further processed to recover any precious metals or platinum group metals that may be present.



*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

PCT/L 00/41705

IPC 7 C22B3/18 C22B23/00 C22B19/20 C22B19/34 C22B11/00

IPC 7 C22B

WPI Data, EPO-Internal, PAJ, COMPENDEX

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|------------------------------------------------------------------------------------|-----------------------|
| X          | DE 25 57 008 A (SAARBERG INTERPLAN GMBH)                                           | 1,2,4-6,              |
| Y          | 28 July 1977 (1977-07-28)                                                          | 14,31                 |
|            | page 2 -page 4; claims 1-4                                                         | 3,7-10,               |
|            |                                                                                    | 15-30,                |
|            |                                                                                    | 32,33                 |
|            | ---                                                                                |                       |
| Y          | FR 2 725 457 A (GENCOR LTD)                                                        | 9,10,29,              |
|            | 12 April 1996 (1996-04-12)                                                         | 30                    |
|            | page 10; claims 1,11-13; figure 1                                                  |                       |
|            | ---                                                                                |                       |
| X          | US 4 740 243 A (KREBS-YUILL BARBARA A ET                                           | 1,4,5,31              |
| Y          | AL) 26 April 1988 (1988-04-26)                                                     |                       |
|            | column 2, line 45 - line 51; claims 1,7-10                                         | 2,3,6,7,              |
|            |                                                                                    | 29,30                 |
|            | column 8, line 20 - line 27                                                        |                       |
| X          | column 9, line 33 - line 59                                                        | 22-26,                |
|            |                                                                                    | 28,29                 |
|            | ---                                                                                |                       |
|            | -/--                                                                               |                       |

☒ Patent family members are listed in annex.

\*& document member of the same patent family

04/07/2001

Bombeke, M

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/41705

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                        | Relevant to claim No.               |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Y          | EP 0 522 978 A (NEWMONT MINING CORP<br>;NEWMONT GOLD CO (US))<br>13 January 1993 (1993-01-13)<br><br>page 5, line 19 -page 6, line 35; claims<br>1-5,22; figures 5,7<br>---                                               | 2,3,<br>6-10,14,<br>19-30,<br>32,33 |
| Y          | DATABASE WPI<br>Section Ch, Week 199528<br>Derwent Publications Ltd., London, GB;<br>Class E32, AN 1995-212750<br>XP002170247<br>& JP 07 126013 A (KANEKO M),<br>16 May 1995 (1995-05-16)<br>abstract<br>---              | 14,15,<br>19-21                     |
| Y          | US 5 441 712 A (DUYVESTEYN WILLEM P C ET<br>AL) 15 August 1995 (1995-08-15)<br>claim 2; figure 1<br>---                                                                                                                   | 2,14-18                             |
| X          | US 5 573 575 A (KOHHR WILLIAM JACK)<br>12 November 1996 (1996-11-12)<br>column 6, line 13 - line 54; figure 1;<br>examples 1,2<br>---                                                                                     | 1-5,22,<br>23,31                    |
| Y          | DATABASE WPI<br>Section Ch, Week 199954<br>Derwent Publications Ltd., London, GB;<br>Class D16, AN 1999-620925<br>XP002170261<br>& AU 18524 99 A (PLACER DOME INC),<br>16 September 1999 (1999-09-16)<br>abstract<br>---  | 33                                  |
| X          | DATABASE WPI<br>Section Ch, Week 197822<br>Derwent Publications Ltd., London, GB;<br>Class M25, AN 1978-38947A<br>XP002170263<br>& JP 53 042117 A (ISE KAGAKU KOGYO KK),<br>17 April 1978 (1978-04-17)<br>abstract<br>--- | 1,2,4-6,<br>31                      |
| X          | GB 1 382 357 A (MINERALES MINISTERE DES<br>RICHES) 29 January 1975 (1975-01-29)<br>Y, sentence 35 - sentence 63; claim 1;<br>figure 6<br>-----                                                                            | 1,2,4,6<br><br>32,33                |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/41705

| Patent document<br>cited in search report |   | Publication<br>date | Patent family<br>member(s)                                                                                                                                                                                                                                                   | Publication<br>date                                                                                                                                                                                                                        |
|-------------------------------------------|---|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DE 2557008                                | A | 28-07-1977          | OA 5512 A                                                                                                                                                                                                                                                                    | 30-04-1981                                                                                                                                                                                                                                 |
| FR 2725457                                | A | 12-04-1996          | AU 701811 B<br>AU 3305995 A<br>ZA 9508374 A                                                                                                                                                                                                                                  | 04-02-1999<br>18-04-1996<br>24-04-1996                                                                                                                                                                                                     |
| US 4740243                                | A | 26-04-1988          | AU 583151 B<br>AU 6293686 A                                                                                                                                                                                                                                                  | 20-04-1989<br>05-11-1987                                                                                                                                                                                                                   |
| EP 0522978                                | A | 13-01-1993          | US 5332559 A<br>AU 658423 B<br>AU 1868792 A<br>BR 9202534 A<br>CA 2073589 A<br>MX 9203974 A<br>TR 26634 A<br>US 5834294 A<br>US 5246486 A<br>ZA 9204825 A<br>ZW 10692 A<br>RU 2065503 C                                                                                      | 26-07-1994<br>13-04-1995<br>21-01-1993<br>16-03-1993<br>11-01-1993<br>01-04-1993<br>15-03-1995<br>10-11-1998<br>21-09-1993<br>31-03-1993<br>07-10-1992<br>20-08-1996                                                                       |
| JP 7126013                                | A | 16-05-1995          | NONE                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                            |
| US 5441712                                | A | 15-08-1995          | NONE                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                            |
| US 5573575                                | A | 12-11-1996          | US 5431717 A<br>AU 681225 B<br>AU 1298195 A<br>BR 9408248 A<br>CA 2176147 A<br>FR 2713242 A<br>GB 2298643 A,B<br>NZ 277674 A<br>RU 2113522 C<br>WO 9515403 A<br>US 5676733 A<br>US 6083730 A<br>US 6107065 A<br>US 6146444 A<br>US 5611839 A<br>US 5800593 A<br>ZA 9409538 A | 11-07-1995<br>21-08-1997<br>19-06-1995<br>27-05-1997<br>08-06-1995<br>09-06-1995<br>11-09-1996<br>25-03-1998<br>20-06-1998<br>08-06-1995<br>14-10-1997<br>04-07-2000<br>22-08-2000<br>14-11-2000<br>18-03-1997<br>01-09-1998<br>22-05-1995 |
| AU 1852499                                | A | 16-09-1999          | US 6207443 B                                                                                                                                                                                                                                                                 | 27-03-2001                                                                                                                                                                                                                                 |
| JP 53042117                               | A | 17-04-1978          | JP 1063553 C<br>JP 56004131 B                                                                                                                                                                                                                                                | 22-09-1981<br>28-01-1981                                                                                                                                                                                                                   |
| GB 1382357                                | A | 29-01-1975          | CA 960463 A<br>AU 474361 B<br>AU 5097073 A<br>BE 794526 A<br>DE 2303388 A<br>FR 2169263 A<br>JP 48086724 A<br>ZA 7208280 A                                                                                                                                                   | 07-01-1975<br>22-07-1976<br>11-07-1974<br>25-07-1973<br>02-08-1973<br>07-09-1973<br>15-11-1973<br>25-07-1973                                                                                                                               |