

## Bert De Waele

### Principal Consultant



<b>Profession</b>	Geologist
<b>Education</b>	PhD (Geology), Curtin University of Technology, Perth, 2005 MSc (Geology), University of Ghent, Belgium, 1992 BSc (Geology), University of Ghent, Belgium, 1989
<b>Registrations/ Affiliations</b>	RPGeo (AIG), Regional Geology, Mineral Exploration Adjunct Research Fellow, The University of Western Australia
<b>Awards</b>	PhD thesis: Best Thesis awarded by Earth Sciences Faculty, Curtin University PhD thesis: Lucien Cahen Prize of the Royal Academy of Sciences, Belgium

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**Specialisation** Structural mapping (regional and prospect); mineral exploration; geophysics and remote sensing interpretation; paperless mapping; project review; research in geochronology, global tectonics and palaeogeographic reconstruction

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**Expertise** Bert De Waele has over 23 years of structural mapping experience, mostly in African Precambrian terranes. In addition, he has consulted on base metal and gold prospects, setting up and running exploration programmes or interpreting regional geochemical data. With SRK, Bert has also conducted Independent Technical Assessments on various mineral assets including gold, porphyry copper, iron ore, manganese, diamond, mineral sands, phosphate, evaporite and uranium. He also developed both expert and data-driven exploration targeting systems for gold and iron exploration projects. Bert's regional mapping experience includes mapping 1:100,000 and 1:250,000 products in Zambia, Mauritania, Madagascar and Papua New Guinea, and prospect or tenement-scale mapping in Australia, Gabon, Ghana, Guinea, Indonesia, Ivory Coast, Lao PDR, Liberia, Mauritania, Morocco, Philippines, Republic of Congo, Sierra Leone, Western Sahara. His research interests focus on regional geology and tectonics, by integrating field and laboratory work, including U-Pb microprobe geochronology, isotope ( $^{147}\text{Sm}$ - $^{144}\text{Nd}$  and  $^{87}\text{Rb}$ - $^{86}\text{Sr}$ ) and whole-rock geochemistry and Geographic Information Systems. Bert has a strong commitment to transfer of knowledge, holding an Adjunct Research posting at The University of Western Australia. Bert has taught structural geology, computing in geoscience (GIS - Remote Sensing and DPA (Geosoft)) and supervised field classes, mapping projects and theses (BSc, MSc and PhD) both in French-speaking and English-speaking environments. Much of his work has included on-the-job training of sampling teams and mapping geologists using cutting-edge paperless mapping technologies.

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### Employment

<b>2008 – Present</b>	SRK Consulting (Australasia), Principal Consultant (Geology), Perth
<b>2006 – 2008</b>	The British Geological Survey, Senior Geologist, UK
<b>2004 – 2006</b>	The University of Western Australia, Research Scientist, Perth
<b>2000 – 2004</b>	Curtin University of Technology, PhD researcher, Perth
<b>2000</b>	The University of Ghent, Research Fellow (Digital Mapping and GIS), Belgium
<b>1995 – 2000</b>	The University of Zambia / Ghent, Project Manager, Lecturer, Researcher, Zambia
<b>1995</b>	Caledonia Mining, Chief Exploration Geologist, Zambia
<b>1992 – 1995</b>	Geological Survey of Zambia, Mapping Geologist, Zambia

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**Languages** Dutch, English and French

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### Publications

Total number of Peer-Reviewed full articles	: 54
Total number of published (extended) abstract	: 95
Total number of 1:100,000 map sheets	: 12
Total number of citations	: 2,599
Number of publications with at least ten citations	: 38
h-index for the publications	: 25

### Full Peer-Reviewed Publications

- De Waele, B, Lacorde, M, Vergara, F and Chan, G, 2014. New insights on Proterozoic tectonics and sedimentation along the peri-Gondwanan West African margin based on zircon U-Pb SHRIMP geochronology, *Precambrian Research* 259: 156-175.
- Pisarevsky, S A, De Waele, B, Jones, S, Söderlund, U and Ernst, R E, 2014. Paleomagnetism and U-Pb age of the 2.4 Ga Erayinia mafic dykes in the south-western Yilgarn, Western Australia: Paleogeographic and geodynamic implications, *Precambrian Research* DOI: 10.1016/j.precamres.2014.05.023. 259: 222-231.
- Gladkochub, D P, Kostrovitskii, S I, Donskaya, T V, De Waele, B and Mazukabzov, A M, 2013. Age of Zircons from Diamond-Bearing Lamproites of the East Sayan as an Indicator of Known and Unknown Endogenous Events in the South Siberian Craton, *Doklady Earth Sciences* 450, 597-601.
- Sundaralingam, K, De Waele, B, Thirukumaran, V, Thakur, S S, Mahadani, T and Biswal, T K, 2012. Deformation, metamorphism and geochronology of the Palaeoproterozoic Salem-Namakkal fold thrust belt and implications for the Gondwanaland continental assembly. *International Journal of Geology, Earth and Environmental Sciences* ISSN: 2277-2081, 2012, 2, pp. 266-283
- Morelli, C, Marocchi, M, Moretti, A, Bargossi, G M, Gasparotto, G, De Waele, B, Klötzli, U and Mair, V, 2012. Volcanic stratigraphy and radiometric age constraints in the northern margin of a mega-caldera system: Athesian Volcanic Group (Southern Alps, Italy), *GeoActa* 11: 51-67.
- Donskaya, T.V., Gladkochub, D.P., Mazukabzov, A.M., De Waele, B and Presnyakov, S.L., 2012. The Late Triassic Kataev volcanoplutonic association in western Transbaikalia, a fragment of the active continental margin of the Mongol-Okhotsk Ocean, *Russian Geology and Geophysics*, 53, 22-36.
- Pisarevsky, S.A., Biswal, T.K., Wang, X-C, De Waele, B, Ernst, R, Söderlund, U, Tait, J.A., Ratre, K, Singh, Y.K. and Cleve, M, 2012. Palaeomagnetic, geochronological and geochemical study of Mesoproterozoic Lakhna Dykes in the Bastar Craton, India: implications for the Mesoproterozoic supercontinent, *Lithos* 174: 125-143.
- Fernandez-Alonso, M, Cutten, H, De Waele, B, Tack, L, Tahon, A, Baudet, D and Barritt, S D, 2012. The Mesoproterozoic Karagwe-Ankole Belt (formerly the NE Kibara Belt): The result of prolonged extensional intracratonic basin development punctuated by two short-lived far-field compressional events, *Precambrian Research*, 216-219: 63-86.
- Key, R M, Pitfield, P E J, Thomas, R J, Goodenough, K M, De Waele, B, Schofield, D I, Bauer, W, Horstwood, M S A, Styles, M T, Conrad, J, Encarnacion, J, Lidke, D J, O'Connor, E A, Potter, C, Smith, R A, Walsh, G J, Ralison, A V, Randrianamananjara, T, Rafahatelo, J-M, Rabarimanana, M, 2011. Polyphase Neoproterozoic orogenesis within the East Africa-Antarctica Orogenic Belt in central and northern Madagascar, in D J J Van Hinsbergen, S J H Buitert, T H Torsvik, C Gaina and S J Webb (eds), *The Formation and Evolution of Africa: A Synopsis of 3.8 Ga of Earth History*, *Geological Society of London, Special Publications*, 357, 49-68.
- Vander Auwera, J, Bolle, O, Bingen, B, Liegeois, J-P, Bogaerts, M, Duchesne, J C, De Waele, B and Longhi, J, 2011. Sveconorwegian massif-type anorthosites and related granitoids result from post-collisional melting of a continental arc root, *Earth-Science Reviews*, 107: 375-397.
- Bauer, W, Walsh, G, De Waele, B, Thomas, R J, Horstwood, M S A, Bracciali, L, Schofield, D I, Wollenberg, U, Lidke, D, Rasaona, I T and Rabarimanana, M H, in press. Cover Sequences at the Northern Margin of the Antongil Craton, NE Madagascar, *Precambrian Research* 189: 292-312.
- De Waele, B, Thomas, R J, Macey, P H, Horstwood, M S A, Tucker, R D, Pitfield, P E J, Schofield, D I, Goodenough, K M, Bauer, W, Key, R M, Potter, C J, Armstrong, R A, Miller, J A, Randrianamananjara, T, Ralison, V, Rafahatelo, J-M, Rabarimanana, M and Bejoma, M, 2011. Provenance and tectonic significance of the Palaeoproterozoic metasedimentary successions of central and northern Madagascar, *Precambrian Research*, 189: 18-42.

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13. Pisarevsky, S A, De Waele, B, Söderlund, U and Ernst, E, 2010. 2401+/-3 Ma age of dyke subswarm in the southeastern Yilgarn craton: new member of the Widgiemooltha swarm, *Confidential Report*.
14. Bogdanova, S V, De Waele, B, Belousova, E A, Bibikova, E V, Postnikov, A V, Fedotova, A A and Popova, L P, 2010. Volgo-Uralia: the first U-Pb, Lu-Hf and Sm-Nd isotopic evidence of preserved Paleoarchean crust, *American Journal of Science*, 310, 1345-1383.
15. Wingate, M T D, Pisarevsky, S A and De Waele, B, 2010. Paleomagnetism of the 765 Ma Luakela volcanics in northwest Zambia and implications for Neoproterozoic positions of the Congo Craton, *American Journal of Science* 310: 1333-1344.
16. Singh, Y K, De Waele, B, Karmakar, S, Sarkar, S and Biswal, T K, 2010. Tectonic setting of the Balaram-Kui-Surpagla-Kengora granulites of the South Delhi Terrane of the Aravalli Mobile Belt, NW India and its implication on correlation with the East African Orogen in the Gondwana assembly, *Precambrian Research*, 183: 669-688.
17. Key, R M, Pitfield, P E J, Thomas, R J, Tucker, R T, De Waele, B, Horstwood, M S A and Styles, M T, 2011. Polyphase Neoproterozoic orogenesis within the East Africa-Antarctica Orogenic Belt in Madagascar. In van Hinsbergen, D.J.J.; Buiter, S.J.H.; Torsvik, T.H.; Gaina, C. and Webb, S.J. (Eds.) *The Formation and Evolution of Africa: A Synopsis of 3.8 Ga of Earth History. Geological Society of London, Special Publications SP357: 49-68.*
18. Schofield, D I, Thomas, R J, Goodenough, K M, De Waele, B, Pitfield, P E J, Key, R M, Bauer, W, Walsh, G, Lidke, D, Ralison, A V, Rabarimanana, M, Rafahatelo, J-M and Randriamananjara, T, 2010. Geological evolution of the Antongil Craton, NE Madagascar. *Precambrian Research* 182: 187-203.
19. Fezaa, N; Liégeois, J-P; Abdallah, N, Cherfouh, E H, De Waele, B; Bruguier, O and Ouabadi, A, 2010. Late Ediacaran geological evolution (575–555 Ma) of the Djanet Terrane, Eastern Hoggar, Algeria, evidence for a Murzukiam intracontinental episode, *Precambrian Research* 180: 299-327.
20. Ratre, K; De Waele, B; Biswal, T K and Sinha, S, 2010. SHRIMP geochronology for the 1450 Ma Lakhna dyke swarm: its implication for the presence of Eoarchean crust in the Bastar Craton and 1450-517 Ma depositional age for Purana basin (Khariar), Eastern Indian Peninsula, *Journal of Asian Earth Sciences* 39, 565-577.
21. Tack, L; Wingate, M T D; De Waele, B, Meert, J; Belousova, E, Griffin, B, Tahon, A and Fernandez-Alonso, M, in press. The 1375 Ma "Kibaran Event" in Central Africa: prominent emplacement of bimodal magmatism under extensional regime, *Precambrian Research*.180: 63-84.
22. Goodenough, K M, Thomas, R J, De Waele, B, Key, R M, Schofield, D I, Bauer, W, Tucker, R M, Rafahatelo, J-M, Rabarimanana, M, Ralison, A V and Randriamananjara, T, 2010. Post-collisional magmatism in the central East African Orogen: the Maevarano Suite of north Madagascar, *Lithos* 116, 18-34.
23. Li, Z X, Bogdanova, S, Collins, A S, Davidson, A, De Waele, B, Ernst, R E, Evans, D A D, Fitzsimons, I C W, Fuck, R A, Gladkochub, D P, Jacobs, J, Karlstrom, K E, Lu, S, Natapov, L M, Pease, V L, Pisarevsky, S A, Thrane, K and Vernikovsky, V, 2009. How not to assemble a Precambrian supercontinent - Reply to comment by J.D.A. Piper on "Assembly, configuration, and break-up history of Rodinia: A synthesis". *Precambrian Research*, 174, 208-214.
24. Thomas, R J, De Waele, B, Schofield, D I, Goodenough, K M, Horstwood, M, Tucker, R D, Bauer, W, Annel, R A, Howard, K, Walsh, G, Rabarimanana, M, Rafahatelo, J M, Ralison, A V and Randriamananjara, T, 2009. Geological Evolution of the Neoproterozoic Bemarivo Belt, northern Madagascar, *Precambrian Research*, 172: 279-300.
25. Danderfer, A, De Waele, B, Pedreira, A J and Nalini, H A Jnr, 2009. New geochronological constraints on the geological evolution of Espinhaço Basin within the São Francisco Craton. *Precambrian Research*, 170: 116-128.
26. De Waele, B, Fitzsimons, I C W, Wingate, M T D, Tembo, F, Mapani, B S E, 2009. The geochronological framework of the Irumide Belt of Zambia: A prolonged crustal history along the margin of the Bangweulu Craton, *American Journal of Science*, 309: 132-187 (TSRC#365).
27. Gladkochub D P , Mazukabzov A M, Donskaya, T V, De Waele, B, Stanevich A M, Pisarevsky, S A, 2008. Structural position, age and composition of the volcanics considered to be a lower part of the Riphean passive continental margin of the Siberian craton, *Russian Geology and Geophysics*, 49: 749-758.
28. Donskaya T V, Bibikova, E V, Gladkochub, D P, Mazukabzov, A M, Bayanova, T B, De Waele, B, Didenko, A N, Bukharov, A A, Kirnozova, T I, 2008. Petrogenesis and age of felsic volcanics of the North-Baikal volcanic-plutonic belt, *Petrology*, 16: 422-447.

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29. De Waele, B and Pisarevsky, S A, 2008. Geochronology, palaeomagnetism and magnetic fabric of metamorphic rocks in the NE Fraser Belt, Western Australia, *Australian Journal of Earth Sciences*, 55 (5): 605-621.
30. Pedreira, A J and De Waele, B, 2008. Contemporaneous evolution of the Palaeo / Mesoproterozoic sedimentary basins of the São Francisco - Congo Craton, in Gondwana XII: Western Gondwana – The Ties that Bind, *Geological Society of London, Special Publication*, 294: 33-48 (TSRC#380).
31. De Waele, B; Johnson, S P; Pisarevsky, S A, 2008. Palaeoproterozoic to Neoproterozoic growth and evolution of the eastern Congo Craton: its role in the Rodinia puzzle, *Precambrian Research*, 160: 127-141 (TSRC#363).
32. Li, Z X; Bogdanova, S V; Collins, A S; Davidson, A; De Waele, B; Ernst, R E; Fitzsimons, I C W; Fuck, R A; Gladkochub, D P; Jacobs, J; Karlstrom, K E; Lu, S; Natapov, L M; Pease, V, Pisarevsky, S A, Thrane, K, Vernikovskiy, V, 2008. Assembly, configuration and break-up history of Rodinia: A synthesis, *Precambrian Research*, 160: 179-210 (TSRC#387).
33. Johnson, S P, De Waele, B, Tembo, F, Katongo, C, Tani, K, Chang, Q, Iizuka, T and Dunkley, D, 2007. Geochemistry, geochronology and isotopic evolution of the Chewore-Rufunsa terrane, Southern Irumide Belt: A Mesoproterozoic, continental-margin-arc, *Journal of Petrology*, 48: 1411-1441 (TSRC#405).
34. Abdallah, N, Liégeois, J P, De Waele, B, Fezaa, N and Ouabadi, A, 2007. The Temaguessine Fe-cordierite orbicular granite (Central Hoggar, Algeria): U-Pb SHRIMP age, origin and geodynamical consequences for the late Pan-African magmatism of the Tuareg shield, *Journal of African Earth Sciences*, 49: 153-178 (TSRC#419).
35. De Waele, B and Fitzsimons, I C W, 2007. The nature and timing of Palaeoproterozoic sedimentation at the southeastern margin of the Congo Craton, *Precambrian Research*, 159: 95-116 (TSRC#422).
36. Biswal, T K, De Waele, B and Ahuja, H, 2007. Timing and dynamics of the juxtaposition of the Eastern Ghats Mobile Belt against the Bhandara Craton, India: A structural and zircon U-Pb SHRIMP study of the fold-thrust belt and associated nepheline syenite, *Tectonics*, 26, TC4006, doi: 10.1029/2006TC002005 (TSRC#402).
37. Johnson, S P, De Waele, B, Tembo, F, Evans, D, Iizuka, T and Tani, K, 2007. Geochronology of the Zambezi Supracrustal sequence, southern Zambia: A record of Neoproterozoic divergent processes along the southern margin of the Congo Craton, *Journal of Geology*, 115: 355-374 (TSRC#360).
38. Johnson, S P, De Waele, B and Liyungu, A K, 2006. U-Pb SHRIMP geochronology of granitoid rocks in eastern Zambia: Terrane subdivision of the Mesoproterozoic Southern Irumide Belt, *Tectonics*, 25, TC6004, doi: 10.1029/2006TC001977 (TSRC#373).
39. Pisarevsky, S A, Gladkochub, D P, Donskaya, T A and De Waele, B, 2006. Palaeomagnetism and geochronology of mafic dykes in the south-west Baikal Lake, south Siberia, Russia: The first precisely dated Early Permian palaeomagnetic pole from the Siberian Craton, *Geophysical Journal International*, doi: 10.1111/j.1365-246X.2006.03160.x (TSRC# 383).
40. Cutten, H, Johnson, S P and De Waele, B, 2006. Protolith ages and timing of metasomatism related to the formation of whiteschist at Mautia Hill, Tanzania: Implications for the timing of assembly of Gondwana, *Journal of Geology*, 114 (6): 683-698 (TSRC#346).
41. De Waele, B; Liégeois, J-P, Nemchin, A A and Tembo, F, 2006. Isotopic and geochemical evidence of Proterozoic episodic crustal reworking within the Irumide Belt of south-central Africa: The southern metacratonic boundary of an Archaean Bangweulu Craton, *Precambrian Research*, 148: 225-256 (TSRC#362).
42. De Waele, B, Kampunzu, A B, Mapani, B, Tembo, F, 2006. The Irumide belt of Zambia, *Journal of African Earth Sciences*, 46: 36-70 (TSRC#257).
43. Johnson, S P, Rivers, T and De Waele, B, 2005. A Review of the Mesoproterozoic to early Palaeozoic magmatic and tectonothermal history of south-central Africa: Implications for Rodinia and Gondwana, *Journal of the Geological Society of London*, 162: 433-450 (TSRC#305).
44. Katongo, C, Köller, F, Klötzli, U, Koeberl, C, Tembo, F and De Waele, B, 2004. Petrography, geochemistry and geochronology of key granitoid rocks in the Neoproterozoic-Paleozoic Lufilian - Zambezi belt, Zambia: Implications for the tectonic setting and regional correlation, *Journal of African Earth Sciences*, 40: 219-244 (TSRC#299).
45. Key, R M, De Waele, B, Liyungi, A K, 2004. A multi-element baseline geochemical database from the western extension of the central Africa Copperbelt in north-western Zambia, *Applied Earth Sciences (Transactions of the Institute of Mining and Metallurgy, B)* 113: B205-226 (TSRC#302).

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46. Sikazwe, O N and De Waele, B, 2004. Assessment of the quality and reserves of bat guano at Chipongwe and Kapongo caves near Lusaka as fertiliser material, *UNZA Journal of Science and Technology*, Special Edition, June 2004, pp 32-42.
47. Cox, R, Coleman, D S, Chokel, C B, DeOreo, S B, Wooden, J L, Collins, A S, De Waele, B and Kröner, A, 2004. Proterozoic tectonostratigraphy and paleogeography of central Madagascar derived from detrital zircon U-Pb age populations, *Journal of Geology*, 114: 379-399 (TSRC#243).
48. De Waele, B, Wingate, M T D, Mapani, B, Fitzsimons, I C W, 2003. Untying the Kibaran knot: A reassessment of Mesoproterozoic correlations in southern Africa based on SHRIMP U-Pb data from the Irumide belt, *Geology*, 31: 509-512 (TSRC#218).
49. Johnson, S P, Cutten, H N C, Muhongo, S and De Waele, B, 2003. Neoproterozoic magmatism and metamorphism of the western granulites in the central domain of the Mozambique belt, Tanzania: U-Pb SHRIMP geochronology and PT estimates, *Tectonophysics*, 375: 125-145 (TSRC#214).
50. De Waele, B and Mapani, B, 2002. Geology and correlation of the central Irumide belt, *Journal of African Earth Sciences*, 35: 385-397 (TSRC#222).
51. De Waele, B and Simasiku, S, 2002. An overview of the refractory mineral potential of Zambia, *International Geology Reviews*, 44 (3): 254-263 (TSRC#221).
52. Tembo, F, De Waele, B and Nkemba, S, 2002. Syn- to post-orogenic granitoid magmatism in the Irumide belt of Zambia: Geochemical evidence, *Africa Geoscience Review*, 9: 1-17 (TSRC#220).
53. De Waele, B, Tembo, F and Key, R M, 2000. Towards a better understanding of the Mesoproterozoic Irumide belt of Zambia: Report on a geotraverse across the belt, *Episodes*, 23: 126-130.
54. De Waele, B, 1997. Geology and stratigraphy of the Mupamadzi river area and correlation with the adjoining areas within the Irumide belt, *Zambian Journal of Applied Earth Sciences*, 11: 34-48.

### Published maps and explanatory notes

1. 1:100,000 scale geological map, Jimi Sheet (Central Highlands, Papua New Guinea), mapped under a European Development Fund Project.
2. Participating author on the final report for the World Bank Mapping Project of the BGS-USGS team in central and northern Madagascar. 984 pages + appendices.
3. Eight (first author) and seven (co-author) 1:100,000 scale geological maps in central and northern Madagascar mapped as part of a World Bank project.
4. Feybesse, J-L, Sidibé, Y T, Konaté, C M, Lacomme, A, Zammit, C, Guerrot, C, Liégeois, J-P and De Waele, B, 2006. BRGM, CPG, DNGM. Notice explicative de la Carte géologique de la République du Mali à 1/200 000, Feuille n° NC-29-XVII, Tienko. - Bamako (Mali) : Ministère des Mines, de l'Énergie et de l'Eau.
5. Feybesse, J-L, Sidibé, Y T, Konaté, C M, Lacomme, A, Zammit, C, Guerrot, C, Liégeois, P and De Waele, B, 2006. BRGM, CPG, DNGM. Notice explicative de la Carte géologique de la République du Mali à 1/200 000, Feuille n° ND-29-XVIII, Tingréla. - Bamako (Mali) : Ministère des Mines, de l'Énergie et de l'Eau.
6. Van de Velde, P and De Waele, B, 1998. The geology of the Mupamadzi river area; explanation of degree sheet 1231, SW quarter, Report and geological maps, Geological Survey Department of Zambia, Lusaka, rep. 105.

### Published abstracts and extended abstracts

1. De Waele, B., Lacorde, M. and Rivers, J. 2015. Banded Iron Formations and Associated Detrital Iron Deposits of the Western Congo Craton. SEG 2015, World-Class Ore Deposits: Discovery to Recovery, Sept 27-30, 2015, Hobart.
2. Gilbertson, J.; Fonseca, A.; De Waele, B. and Lacorde, M. Application of Ground Control Samples in Advancing Epithermal and Porphyry Exploration. Perumin 32, Convencion Minera, Lima, Pery.
3. Fonseca, A., Vos, I., Kramer, J., De Waele, B. and Lacorde, M. 2014. Unravelling Structural History through Alteration Mapping. Saskatchewan Open House, December 2014.
4. De Waele, B., Lacorde, M., Vergara, F. and Chan, G. 2013. New Insights on West African Tectonics and Iron Mineralisation Based on Zircon U-Pb SHRIMP Geochronology and Structural Mapping. SEG Conference abstract Whistler 2013: Geoscience for Discover, pp42-43

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5. De Waele, B. 2013. Tectono-magmatic evolution of the southern margin of the Congo Craton: pre-conditioning of the basement to the Central African Copperbelt as a factor in metal endowment. Uranium through Geodynamic Cycle: From Source to Deposit, Université de Lorraine, 12-13<sup>th</sup> December 2013. pp 12-13.
6. De Waele, B. and Beltran, J. 2013. The Digital Mapping Revolution: How to Get the Best out of Data Capture in the Field. Advances in Exploration and Ore Deposit Geochemistry – Como, Western Australia 2013, pp4-5.
7. Bogdanova, S V; Belousova, E A; De Waele, B, 2013. Zircon from Mesoarchean enderbites of Volgo-Uralia: U-Pb age, REE, Hf- and O-isotope composition, Goldsmith 2013 abstracts, *Mineralogical Magazine*.
8. Cunningham, M, De Waele, B and Halpin, S, 2012. Geological Mapping of the Badondo and Belinga (North) iron mineralisation targets, Republic of Congo, paper presented to Structural Geology and Resources Symposium, Kalgoorlie, September 2012.
9. Lacorde, M, De Waele, B, Hanna, N and Monoury, S, 2012. The use of gravity and magnetic data to unravel structure: the Forécariah magnetite mineralisation, paper presented at Structural Geology and Resources Symposium, Kalgoorlie.
10. Pisarevsky, S; Biswal, T; De Waele, B; Tait, J; Ratre, K; Singh, Y K, 2010. New paleomagnetic study of the 1450 Ma Lakhna Dyke Swarm in the Bastar Craton, India: implications for the Mesoproterozoic supercontinent, Australian Earth Sciences Convention 2010, Canberra, pp 109-110.
11. Monoury, S, De Waele, B and Meyer, C, 2010. Mapping and target generation in poorly exposed subtropical terrains: the application of heliborne VTEM and magnetic survey data in base metal exploration in the Central African Copperbelt, Australian Society of Exploration Geophysicists, Sydney, Australia, pp. 3p.
12. Bogdanova, S V, De Waele, B, Bibikova, E A, Belousova, E A, Postnikov, A V and Popova, L P, 2010. Aleoarchean to Neoarchean Granitoids and Migmatites Making Up the Crustal Structure of Volgo-Uralia, paper presented at 5<sup>th</sup> International Archean Symposium, Perth, Western Australia.
13. Taylor, C D, Tucker, R D and De Waele, B, 2010. The Metallogeny and Mineral Deposits of Madagascar, in Proceedings 13<sup>th</sup> Quadrennial IAGOD Symposium 2010 'Giant Ore Deposits Down-Under', Adelaide, Australia, pp. 260-261.
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### Key experience: Geological and Structural Mapping

Bert's main experience is in structural geological mapping at regional and prospect scales, coupled with organisation and running of regional geochemical sampling programmes and the accompanying delineation of potential targets for detailed follow-up work. Bert is an accomplished trainer, both in formal to practical courses or in on-the-job training. His training programmes have included GIS, data analysis and processing (geochemical and geophysical data sets), practical mapping and sampling methodologies.

Bert is also an accomplished research scientist, with broad interests ranging from regional / global tectonics to detailed geochronological field studies. Bert has been involved in mapping of a total of 12 quarter degree sheets (1:100,000 scale) in Zambia, Madagascar and Papua New Guinea.

Recent (project) mapping experience includes:

- Genmin Limited, Gabon, 2015: Reconnaissance mapping of multi-commodity projects (~100 km<sup>2</sup>)
- Genmin Limited, Gabon, 2015: Structural mapping of the Minvoul, Mafoungui, Bakoumba and Baniaka iron licenses (~300 km<sup>2</sup>)
- Phil Alstrom and Asia Alstrom Mining, Mindanao, Philippines 2015: Structural mapping of the Mountain Range Copper-Gold skarn and epithermal projects (~30 km<sup>2</sup>)
- Cape Lambert, Ivory Coast, 2014: Structural mapping of the Bouake, Katiola and Boundiali licenses (gold, ~200 km<sup>2</sup>)
- Belle Resources, Ghana and Liberia, 2014: Structural mapping and review of alluvial gold and mesothermal gold projects (~100 km<sup>2</sup>)
- SLJ Global, Sulawesi, Indonesia, 2014: Structural mapping of several REE licenses (135 km<sup>2</sup>)
- Minera Interpacific Ltd, Arequipa Province, Peru, 2013: Detailed structural mapping and chip and alteration sampling of eight tenements (52 km<sup>2</sup>)
- Sand Hill Minerals Company Limited, Sierra Leone, 2013: Detailed structural mapping and stream sediment sampling of the EL44/2012 Exploration License (210 km<sup>2</sup>)
- Asia Minerals Corp., Timor, 2013: Mapping of manganese mineralisation (60 km<sup>2</sup>)
- Belle Resources Ltd, Liberia, 2012: Detailed prospect mapping of the Bopolu and KPO Range Project; focus on gold, iron ore and other commodities (200 km<sup>2</sup>)
- Samling Strategic Corporation, Liberia, 2012: Structural mapping of the Bopolu and KPO Range area; gold (500 km<sup>2</sup>)
- Equatorial Resources Ltd, Republic of Congo, 2012: Prospect mapping of the Mayoko target; iron ore (BIF, 60 km<sup>2</sup>)
- Samling Strategic Corporation, Liberia, 2011: Mapping of the KPO Range/ Bopolu area; iron ore, gold (200 km<sup>2</sup>)

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### Principal Consultant

- Equatorial Resources Ltd, Congo, 2011: Detailed prospect mapping of the Badondo and Belinga North targets; iron ore (BIF), gold and diamond, 200 km<sup>2</sup>)
- Metal Exploration Limited, Sierra Leone, 2011: Mapping of the Rokel Iron Project, iron ore (2,500 km<sup>2</sup>)
- Pinnacle Group Assets Limited, Guinea, 2010: Detailed prospect mapping of the Sandenia and Sandenia East targets (100 km<sup>2</sup>)
- West African Iron Ore, Guinea, 2011: Mapping of the K rouan  Project (500 km<sup>2</sup>), iron ore, diamond and gold)
- Bumi Mauritania SAS, 2011: Detailed prospect mapping of the Otoy iron ore project, Mauritania (200 km<sup>2</sup>)
- Pinnacle Group Assets Limited, Guinea, 2010: Mapping of the Sandenia Project; iron ore (800 km<sup>2</sup>)
- Sky Alliance Resources Ltd, Guinea, 2010: Mapping of the Kalyadi area; iron ore (500 km<sup>2</sup>)
- Sunny Power Holdings Limited, West Timor, 2010: Mapping and exploration targeting ; manganese (400 km<sup>2</sup>)
- Marampa Iron Ore Limited, Sierra Leone, 2010: Structural mapping of the Kukuna area, iron ore (700 km<sup>2</sup>)
- SARI, Guinea, 2010: Independent Technical Assessment and geological mapping, For cariah, gold, iron ore, diamond and mineral sands (1,400 km<sup>2</sup>)
- St Barbara Mines Ltd, Leonora, Western Australia, 2010: Detailed structural analysis of drill core at the Tower Hill deposit; gold
- Ferromet Ltd, 2009: Detailed mapping for iron ore exploration over tenement in southern Lao People's Democratic Republic; iron ore (1,200 km<sup>2</sup>)
- Marampa Iron Ore Ltd, Lunsar, Sierra Leone, 2009: Detailed mapping of the Marampa tenement; iron ore(1,400 km<sup>2</sup>)
- Cape Lambert Iron Ore, Karratha, Western Australia, 2008: Detailed mapping of the Cape Lambert South tenement, iron ore (1,200 km<sup>2</sup>)
- The British Geological Survey, 2008: Mapping work in the Jimi Sheet, Western Highlands of Papua New Guinea
- The British Geological Survey, 2006-2008: Mapping work on the central and northern zones of Madagascar; (World Bank contract number 175/05 – MEM/SG/DG/UCP/PGRM) – 16 x 100K map sheets
- Curtin University, Perth, 2000-2004: PhD research included extensive mapping work in the Irumide Belt and Bangweulu Block of Zambia, and assistance with mapping classes in the Yilgarn Craton, Albany-Fraser Belt and the Carnarvon Basin in Western Australia
- Caledonia Mining Ltd, 1995: Exploration management in the Nama prospect area (Cu-Co) – mapping, sampling, trenching / pitting and drilling
- Geological Survey Department of Zambia, 1992-1995: Geologist in charge of regional mapping of Mupamadzi River area (QDS 1231 SW) and assistance with mapping 1124SW (West-Lunga area) and 1625SE (Sichifulo River area)
- Data processing and GIS work on geophysical data over the Kagem emerald mine, Ndola, Zambia. (Zambian Privatisation Agency ZPA): Geophysical interpretation and GIS integration of ground magnetic, radiometric, resistivity and seismic data for Kagem Emerald Mine
- Digital processing and digital data processing, Geological Survey Department - British Geological Survey ERIPTA Project: Analysis of geochemical data on Mwinilunga and Kalene Hill sheets, northwestern Zambia.

### Key Experience: Exploration Targeting

- Century Iron, 2014: Review of prospectivity for iron ore in Western Australia
- Aditya Birla Ltd, Nifty Project, Australia, 2013: Exploration targeting (base metals)
- Endeavour Mining Ltd, Nzema Gold Project, Ghana, 2013: Exploration targeting
- Project management, KPO Range/Bopolu Project, Liberia: Regional mapping, soil sampling, stream sediment sampling

## **Bert De Waele**

### **Principal Consultant**

- Belle Resources, Liberia, 2012: Drill planning at the Gayama gold prospect
- Equatorial Resources, Congo, 2012: Drill planning at the Badondo and Belinga targets
- Bumi Mauritania SAS, 2011: Drill planning for the Otoy and S'Fariat Projects, Mauritania
- West African Iron Ore, Guinea, 2010: Drill planning for the Kalyadi Project
- Golden Rim, Mali, 2009: Geophysical data interpretation and gold targeting
- Confidential client, Pilbara, Western Australia: Weights of Evidence targeting work; manganese
- Northcore Investments, 2009: Regional targeting study for base metals in the Central African Copperbelt, using a range of geophysical and geological datasets including VTEM and airborne magnetic/radiometric data (two projects)
- Harmony Gold, 2009: Regional targeting exercise for gold prospectivity in the greenstone belt of the Murchison Province, Western Australia
- International Mining Consultant, 2006: Sfarlates-Ouassat gold exploration programme, Mauritania; processing and interpretation of geochemical data, and training of personnel at the Office Mauritanien de Recherches Géologiques.

### **Key Experience: Project Review / Valuations**

- Guinea Government / DLA Piper, 2015: Technical Review of Simandou, Blocks A and B
- Genmin Group, Gabon, 2015: Independent Geological Assessment and Valuation of iron ore properties
- Nordgold, Lefa Gold Project, northern Guinea, 2014: Review of exploration data (regional and near-mine) and development of an exploration plan and staff requirements
- Phil Alstron Mining Ltd, Philippines, 2014: Site visit and review of a skarn copper-gold project
- Summit Equities; Kimberly Diamonds Limited, 2014: Review of geology and exploration targeting of an alluvial diamond property
- DTN Resources, Terengganu, Malaysia, 2013: Site visit and review of a magnetite iron project
- Standard Chartered Bank, Bukit Besi, Malaysia, 2013: Site visit and review of the iron deposit
- General Nice Group, South Africa, 2012: Site visit and review of the Buchansvale manganese project in the West-Wits field
- West African Iron ore, Guinea, 2012: Competent Person for NI 43-101 Report on the Kérouané Project
- Transcontinental Group, Mauritania, 2012: Site visit and assessment of the Bou Naga REE Project
- Mincor, West Africa, 2012: Review of iron and gold prospectivity in Nigeria, Ghana, Burkina Faso, Mali, Sierra Leone, Guinea and Senegal
- Aquia Resources, Brazil, 2011: Expert Valuation of potassium and phosphate projects
- Confidential client: Global review of REE projects
- West African Iron Ore, Guinea, 2010: Competent Person, NI 43-101 Report on the Forécariah Project
- Confidential client: Site visit to a base metal tenement in the Mount Isa Inlier, Queensland (NI 43-101 compliant Report)
- Confidential client: Compilation of prospectus on an iron ore project in south west India for inclusion in ASX listing document
- Confidential client: Review of three deposits in Morocco including a vein-hosted gold prospect, a sedimentary iron prospect and a carbonatite complex.

### **Key Experience: Training**

- Onsite mapping training to Nordgold geologists, Guinea
- Onsite mapping training of Belle Geologists, Ghana, Liberia
- Onsite mapping training at the Forécariah Project, Guinea
- Onsite mapping training, Bumi Mauritania SAS
- Onsite tutoring of company geologists in structural mapping (Eastern Goldfields)
- Training in GIS and Digital Mapping Technologies (internal and for various clients).