

## **CURRICULUM VITAE-DR KHIN ZAW (AOGS)**

### **ACADEMIC AND PROFESSIONAL QUALIFICATIONS**

- 1964–1968: BSc in Geology**  
Arts and Science University, Yangon, Myanmar
- 1968–1969: FGA (London)**  
Overseas Diploma in Fellowship of Gemological Association of Great Britain
- 1973–1976: MSc in Economic Geology**  
Queen's University, Kingston, Ontario, Canada
- 1986–1990: PhD in Economic Geology**  
University of Tasmania, Hobart, Australia

### **CAREER RÉSUMÉ**

#### **PROFESSIONAL APPOINTMENTS**

- 2008–:** Associate Professor (Level D), CODES ARC Centre of Excellence in Ore Deposits, University of Tasmania, Australia
- 2003–2007:** Senior Research Fellow (Level C), CODES ARC Centre of Excellence in Ore Deposits, University of Tasmania, Australia
- 1994–2002:** Research Fellow (Level B), Centre for Ore Deposit Research, University of Tasmania, Australia
- 1991–1993:** Research Fellow (Level A), Centre for Ore Deposit Research, University of Tasmania, Australia
- 1986–1990:** Ph.D. student, University of Tasmania, Australia
- 1983–1986:** Lecturer and Head of Department, Geology Department, Maggwe University, Maggwe, central Myanmar
- 1976–1983:** Lecturer, Postgraduate Training in Mineral Exploration, Yangon University, Yangon, Myanmar
- 1973–1976:** M.Sc. student at Queen's University, Kingston, Ontario, Canada
- 1971–1972:** Geologist's assistant, Diamond Exploration Party, Northern Myanmar, joint venture of Dept. of Geology, Yangon University and Directorate of Geological Survey and Exploration, Myanmar
- 1969–1971:** Demonstrator, Yangon University, Yangon, Myanmar

#### **MEMBERSHIP OF LEARNED SOCIETIES**

1. Fellow of the Gemological Association of Great Britain
2. Fellow of the Australasian Institute of Mining and Metallurgy
3. Fellow of the Society of Economic Geologists (SEG)
4. Member of the International Association on the Genesis of Ore Deposits (IAGOD)
5. Formerly Member of the Institute of Mining and Metallurgy, London
6. Member of Mineral Industry Consultants Association (MICA)
7. Member and councilor of the Association of Geoscientists for International Development

## RESEARCH ACTIVITIES AND OUTCOMES

### MAJOR RESEARCH EXPERTISE AND RESEARCH PROJECTS

I have undertaken the following research programs for which the results have been already published or will be published in recognised Earth Science Journals:

1. Detailed mineralogical, petrological and geochemical studies including fluid inclusion analysis to investigate the origin and environment of skarn and ore deposition at CanTung Mine, one of the richest skarn-type tungsten deposits in the world, Northwest Territories, Canada (*Outcome: Constraints on P-T condition of ore formation and recognition of prograde-retrograde zonation in skarn assemblages. Two AI papers*).
2. Geology and genesis of a Mississippi-Valley type deposit at Theingon Mine, Bawsaing, and W-Sn vein deposits, Myanmar. Fluid inclusion study of W-Sn veins at Hermyingyi Mine and Mawchi Mine, Myanmar (*Outcome: First recognition of VMT deposits and thermal aspects of W-Sn ore formation. Three AI papers*).
3. Petrology and geochemistry of mineralised and barren granitoid intrusions with special reference to the emplacement of tin-tungsten mineralisation: Metallogeny of Burmese Sn-W deposits; application of bedrock geochemistry to the selection of target areas for the prospecting of Sn-W deposits in Myanmar (*Outcome: One of the landmark papers on the origin and petrogenetic significance of granitoids in SE Asia. Two AI papers which have been widely cited*).
4. Origin of the volcanic-hosted Pb-Zn-Cu-Ag-Ba deposit at Bawdwin Mine and related sedimentary-hosted Pb-Zn deposits, Northern Shan State, Myanmar (*Outcome: Textural, isotopic and fluid inclusion evidence for formation of the deposit under submarine environment against a long-held theory of epigenetic origin. Several FI conference papers*).
5. Fluid inclusions as a guide to origin and exploration at Tennant Creek goldfield, Northern Territory, Australia (*Outcome: Phase separation of ore fluids as a gold depositional mechanism and distinguishing features for mineralised ironstones for exploration. Two AI papers*).
6. Geochemical, stable isotope (C, O, S, H) and fluid inclusion study on F(J) lens, south-end orebodies at Rosebery Mine, a volcanic-hosted Au-rich massive sulphide deposit, Tasmania (*Outcome: Defined and documented the affects of Devonian granitoid-related metasomatism on remobilisation of Cambrian VHMS ore assemblages and gold enrichment. Five AI papers*).
7. Mineralogical, isotopic, and fluid inclusion study on precious metal mineralisation at J(K)-P lens of Hercules Mine and South Hercules deposit, Tasmania (*Outcome: Textural and isotopic evidence for formation of deposits by sub-seafloor replacement process. Three AI papers*).
8. Mineralogy and geochemistry of epithermal systems, Thames goldfield, North Island, New Zealand (*Outcome: Oxygen and carbon isotopic evidence of boiling and mixing of ore fluids for high-grade gold deposition and definition of criteria for exploration*).
9. Fluid inclusion composition studies (PIXE, LRS, FTIR, SEM/EM and mass spectrometric analyses) on VHMS deposits at Hellyer, Tasmania and Mt Chalmers, Queensland, Australia (*Outcome: Fluid inclusion compositional evidence for magmatic contribution of ore-forming fluids and metals and recognition of saline fluids which has a significant impact on currently debated brine pool vs exhalative model of ore formation. Five AI papers*).
10. Ore fluid characteristics of modern hydrothermal systems in Okinawa Trough, Japan and Middle Valley, northern Juan de Fuca Ridge (*Outcome: Fluid inclusion evidence of*

11. GIS, geological and metallogenic relation studies of mineral deposits in SE Asia/South China: their potential and prospectivity (*Outcome: Synthesis and analysis of key ore deposit types and districts. Several AI papers and special volume on South China Mineral Deposits*).
12. Fluid/melt characteristics, geochronology and chemistry of gem sapphires in SE Asia, Tasmania and eastern Australia (*Outcome: A major advance in the understanding of gemstone deposits bearing on their genesis and exploration, e.g., LA ICP-MS dating of zircon inclusions in gem sapphires from NE Tasmania defined older basalt (40 Ma) as a source of gems rather than younger (16 Ma) basalt flows. Several AI papers and a special volume on Genesis of Gemstone Deposits*).
13. Tectonic and metallogenic significance of granitoids from Main Range Province, Malaysia (UniTas IRGS project) (*Outcome: Age of emplacement of granitoids together with Prof Azman Ghandi of Univ of Malaya. AI paper in preparation*)
14. PIXE/LA ICP-MS analysis of trace element composition in hydrothermal magnetites and implications for ore formation (AINSE Project). (*Outcome: Constraints on genesis of magnetite-bearing skarn, IOCG and VHMS systems. Two F1 papers and one AI paper in preparation*)
15. Geochronology (LA ICP-MS U-Pb zircon, K-Ar, Ar-Ar and Re-Os dating), geochemistry and tectonic and metallogenic evolution of mineralised fold belts in SE Asia (*Outcome: A new synthesis of SE Asian plate tectonic and metallogenic history*).
16. Deposit characterisation and origin of a variety of Cu-Au and Pb-Zn-Ag ore deposit styles in SE Asia (porphyry, epithermal, skarn and sedimentary-rock hosted ore deposits) (*Outcome: A well constrained metallogenic framework and geochemical and isotopic criteria for exploration*).

#### **RESEARCH MANAGEMENT AND SUPERVISORY (LEADERSHIP) RECORD**

- 2008– :** Leader of ‘Ore Deposits in SE Asia’
- 2004–2006:** Leader of ARC Linkage project ‘Geochronology and Metallogenesis of Loei Fold Belt in Thailand and Laos’
- 1999–2003:** Leader of AMIRA P603 project: Metallogenic relations of South China
- 1993–1999:** Leader of AMIRA P390A project: Metallogenic relations of mainland SE Asia

I have supervised to completion of three postdoctoral fellows, and three visiting research fellows, four Master students, three PhD student and several honours students and am currently supervising/co-supervising seven PhD students and some of their topics are as below.

Teera Kamvong, PhD

#### **Geology and genesis of porphyry-skarn Cu-Au deposits at the northern Loei Fold Belt, Northeast Thailand and Laos**

The Loei Fold Belt exhibits one of the greatest endowments of economic metal deposits (e.g., epithermal Chatree gold deposit, Thailand, porphyry-skarn Puthep copper-gold deposit, Thailand and porphyry-skarn Phu Kham copper-gold deposit, Laos) in mainland South East Asia. The aim of this research is to undertake an integrated study of geology, mineralogy, fluid inclusions and isotope geochemistry in the northernmost part of the Loei Fold Belt, focusing on the area of the Puthep 1 copper deposit in the northeastern region of Thailand and the Phu Kham copper-gold deposit in Laos. The Puthep 1 (PUT 1) deposit contains 44

million tonnes at 0.5 % Cu, and the Phu Kham deposit has a geological resource of 64 million tonnes at 0.9 % Cu and 0.4 g/t Au. The research will determine the spatial, temporal, and genetic relationships between porphyry-skarn environments and their associated intrusions on the regional and deposit scale, and to constrain the metallogenesis and to develop the ore genetic model of the northernmost portion of the Loei Fold Belt so critical to mineral exploration activities in the region. This research project is funded by UniTas IPRS scholarships, SEG student Foundation, ARC Loei Linkage project and Pan Australian Resources N.L. Company.

Asalam Abhisit, PhD

### **Geological, paragenesis and geochronological relations of the Chatree area, Phetchabun Province, central Thailand**

The Chatree epithermal deposit contains 22.7 million tons at 2.34 g/t Au and 16 g/t Ag and is located in the Loei Fold Belt which extends from the coast in the southern gulf of Thailand through central Thailand up north into Laos. The regional geological setting of the Loei Fold Belt is characterised by Middle Palaeozoic to Cenozoic volcanic and sedimentary rocks. This research project is to develop a geological, geochronological, mineral paragenesis, and geochemical framework in relation to mineralisation in the Chatree area. The main goal of the research is to develop a detailed genetic model applied to exploration. The role of volcanic host rocks and intrusions in controlling source of ores, ore-forming fluid mechanisms, and the spatial distribution of different mineralisation styles on the district scale will also be investigated to understand the metallogenic evolution of the region. This research project is funded by UniTas IPRS Scholarships, ARC Loei Linkage project and Akara/Kingsgate Consolidated Company.

Paul Cromie, PhD

### **Geological setting, geochemistry and genesis of the Sepon Mineral District, Lao**

The Sepon Mineral District (SMD) occurs within the NW-trending Truongson Fold Belt in Savannakhet Province, south-eastern Laos. Geology of the SMD is dominated by Devonian to Carboniferous aged continental fluvial and shallow to deep marine sedimentary rocks that were deposited in a half graben basin and intruded by Early Permian Rhyodacite Porphyry (RDP). Gold in the SMD is predominantly micro-disseminated and show similarities with Carlin-type deposits in Nevada, USA. The SMD contains 4.1 million ounces of gold and adjacent copper skarn-gold mineralisation covers a variety of primary and secondary styles such as the Khanong copper deposit (40Mt @ 2.9% Cu). The aims of the PhD project are to document the: (1) geological characteristics, (2) ore-mineral paragenesis and nature of gold occurrence, and; (3) investigate the geochemistry associated with gold and copper mineralisation to: (a) aid in the development of a model to explain the genesis of the deposits, and (b) establish exploration criteria and vectors towards finding gold at Sepon. This research project is funded by APA Scholarships, CSIRO Scholarships, SEG student Foundation and Oxiana Limited Company.

Singoyi Blackwell, PhD

### **Textures and trace element geochemistry of magnetites from hydrothermal deposits**

Magnetite is a common iron oxide mineral in many giant ore deposits such as Olympic Dam in South Australia and Cadia in NSW. However, chemical analyses of individual mineral grains were hampered by high detection limits in electron probe micro-analysis and use of techniques such as XRF or solution chemistry on mineral separates was associated with problems of contamination by foreign mineral inclusions. Application of the LA ICP-MS technique allows us to select very small spots (5 to >120µm) on mineral grains that are largely free of inclusions for analysis at low (<1ppm) detection limits and provide more

information on trace elements in individual magnetite, thus leading to better understanding how ore deposits form. This research will generate magnetite compositional data and other data largely from deposits with well-constrained geology. The main objectives of this PhD project are to: (1) determine the range of trace elements in magnetite (and hematite) by LA ICP-MS from a variety of hydrothermal deposits, (2) investigate magnetite trace element compositional variations in time and space, (3) establish the physical-chemical conditions associated with the formation of the hydrothermal magnetite mineral assemblages in the selected deposits, and (4) assess the application of magnetite trace element compositional variation as a tool in mineral exploration and targeting ore-rich zones as well as a criterion for discriminating deposits. This project is funded by UniTas IPRS scholarships, CODES Scholarships, SEG student Foundation and Newcrest Company.

## **RESEARCH ACTIVITIES AND OUTCOMES (CONTINUED)**

I have won several competitive research grants since 1992, including ARC Large, ARC Linkage, ARC Small, AMIRA, ARC REIF, ANISE, IRGS, CODES SRC grants, and Centre of Excellence grants. I am also one of the CIs on the CODES ARC Centre of Excellence granted in 2005. My research experience in the last 35 years also spans regionally from Canada, Australia, New Zealand, China and SE Asia and I have worked on a variety of ore deposit styles from skarn, VHMS, vein-type W-Sn, to porphyry-related skarn/epithermal deposits. I have produced more than 70 refereed A1 papers.

### ***Papers in refereed journals:***

1. **Khin Zaw** and Clark, A.H. (1978). Fluoride-Hydroxyl ratios of skarn silicates, CanTung E-zone scheelite orebody, Tungsten, N.W.T: CANADIAN MINERALOGIST, v. 16, p. 207-221.
2. Archibald, D.A., Clark, A.H., Farrar, E. and **Khin Zaw** (1978). Potassium-argon ages of intrusion and scheelite mineralisation, CanTung, Tungsten, Northwest Territories: Canadian Jour. Earth Sci., v. 15, p. 1205-1207.
3. **Khin Zaw** et al (1982). Rock geochemical exploration at Thabyebintaung Pb-Zn Prospect, Bawsaing, Southern Shan State, Myanmar: Bull. Geol. Soc. Malaya, v. 15, p. 83-95.
4. **Khin Zaw** and Khin Myo Thet (1983). A note on fluid inclusion study of W-Sn mineralisation at Mawchi Mine, Kayah State, Myanmar: ECONOMIC GEOLOGY, v. 78, p. 530-534.
5. **Khin Zaw** (1983). Book review on "Geology of Myanmar": Episode, Newsmagazine of International Union of Geological Sciences, v. 1983, No. 3, p. 49.
6. **Khin Zaw** (1984). Geology and geothermometry of vein-type W-Sn deposits at Peinnaichaung and Yetkantzintung Prospects, Tavoy township, Tennasserim Division, southern Myanmar: Mineral. Deposita, v. 19, p. 138-144.
7. **Khin Zaw** et al (1984). Lead-zinc mineralisation at Theingon Mine, Bawsaing, southern Shan State, Myanmar: A Mississippi-Valley type deposit?: Bull. Geol. Soc. Malaya, v. 17, p. 283-306.
8. Khin Zaw (1987). Tectonic settings for the emplacement of granitoid rocks in Myanmar *in* The Geological Structure, Mineralisation and Economic of the Pacific Rim, Proceeding of Pacific Rim Congress, AUSIMM, Gold Coast, Australia, 1987, p. 937-940.

9. **Khin Zaw** (1989). Comments on Transcurrent movements in the Myanmar-Andaman sea region: Geology, v. 17, p. 93-95.
10. **Khin Zaw** and Goossens, P.J. (1989) A brief account of lead mineralisation at Phaungdaw Prospect, Pyawbwe Township, Mandalay Division, Myanmar: Bull. Geol. Soc. Malaya, v. 23, p. 121-132.
11. Lees, T., **Khin Zaw**, Large, R.R., Huston, D.L. (1990). Economic Geology of Rosebery-Hercules area, western Tasmania *in* Geology of the Mineral Deposits of Australia and Papua New Guinea, ed., F. E. Hughes. p. 1241-1247, Aust. I. M. M: Melbourne.
12. **Khin Zaw** (1990). Geological, petrological and geochemical characteristics of granitoid rocks in Myanmar: with special reference to W-Sn mineralisation and their tectonic setting: SE Asian Jour. Earth Sci., v. 4, p. 293-335.
13. Huston, D.L., Bottrill, R.S., Creelman, R.A., **Khin Zaw**, Ramsden, T.R., Rand, S., Gemmell, B., Jablonski, W., Sie, S., and Large, R.R. (1992). Geological and geochemical controls on the mineralogy and grain size of gold bearing phases, eastern Australian volcanogenic massive sulphide deposits: ECONOMIC GEOLOGY, Special Issue on Australian VHMS deposits, v. 87, p. 542-663.
14. **Khin Zaw** and Large, R.R. (1992). The precious metal-rich South Hercules mineralisation, western Tasmania: A possible subsea-floor replacement volcanic-hosted massive sulphide deposit: ECONOMIC GEOLOGY, Special Issue on Australian VHMS deposits, v. 87, p. 931-952.
15. **Khin Zaw** and Henderson, S. (1993) Geochemical and isotopic constraints for high grade gold mineralisation at Waitangi deposit, Thames district, Coromandel Peninsula, North Island, New Zealand: *in* Proceedings of 27th Annual Conference, New Zealand Branch, Aust. I. M. M., Wellington, New Zealand, 1993, p. 133-141.
16. **Khin Zaw**, Huston, D.L., Large, R.R., Mernagh, T.P. and Ryan, C.G. (1994). Geothermometry and compositional variation of fluid inclusions from the Tennant Creek gold-copper deposits, Northern Territory: Implication for exploration of auriferous ironstones: *in* Proceedings of AusIMM Annual Conference, Darwin, September 1994, p. 185-188.
17. **Khin Zaw**, Huston, D.L., Large, R.R., Mernagh, T.P., and Hoffman, C. (1994). Microthermometry and geochemistry of fluid inclusions from the Tennant Creek gold-copper deposits: Implication for ore genesis and exploration: Special volume on Australian Proterozoic copper-gold deposits, Mineral. Deposita., v. 29, p. 288-300.
18. **Khin Zaw**, Gemmell, J.B., Hunns, S.R., Large, R.R., Ryan, C.G., and Mernagh, T.P., (1995), Compositions of fluid inclusions from Hellyer and Mt. Chalmers deposits: Implications for source of VHMS ore-forming fluids: Proceedings of Pacrim Conference 95, Auckland, New Zealand, p. 663-668.
19. **Khin Zaw** and Large, R.R. (1996). Petrology and geochemistry of sphalerite from the Cambrian VHMS deposits in the Rosebery-Hercules District, Western Tasmania: Implications for gold mineralisation and Devonian metamorphism: MINERALOGY AND PETROLOGY, v. 57, p. 97-118.
20. Ryan, C.G., Heinrich, C.A., van Achterbergh, E., Mernagh, T.P., Ballhaus, C., and **Khin Zaw** (1996) The non-destructive analysis of fluid inclusions in minerals using the proton

microprobe: Nuclear Inst. and methods: Proceedings of the 9th Australian Conf. on Nuclear Techniques of Analysis, Newcastle, p. 47-148.

21. **Khin Zaw**, Gemmell, J.B., Large, R.R., Mernagh, T.P. and Ryan, C.G. (1996). Evolution and source of ore fluids in the footwall stringer zone, Hellyer VHMS deposit, western Tasmania: evidence from fluid inclusion microthermometry and geochemistry: ORE GEOLOGY REVIEW, v. 10, p. 251-278.

22. **Khin Zaw**, Large, R.R. and Huston, D.L. (1997). Petrological and geochemical significance of a Devonian replacement zone in the Cambrian Rosebery VHMS deposit, western Tasmania. CANADIAN MINERALOGIST, v. 35, p. 1-25.

23. Solomon, M. and **Khin Zaw** (1997). The formation on the seafloor of Hellyer and other Rosebery-type volcanic-hosted massive sulphide deposits: ECONOMIC GEOLOGY, v. 92, p. 686-695.

24. **Khin Zaw** (1998). Geology and evolution of granitic pegmatites in Myanmar (Burma): Constraints from regional setting, lithology and fluid-inclusion studies: International Geology Review, v. 40, p. 647-662.

25. Gemmell, J.B., Large, R.R., and **Khin Zaw** (1998). Palaeozoic volcanic-hosted massive sulphide deposits: AGSO Jubilee Journal, p. 129-138.

26. **Khin Zaw**, Huston, D.L. and Large, R.R. (1999). A chemical model for remobilisation of ore constituents during Devonian replacement process within Cambrian VHMS Rosebery deposit, western Tasmania: ECONOMIC GEOLOGY, v. 94, p. 529-546.

27. **Khin Zaw**, Cooke, D. R. and Ryan, C. G. (1999) Stable isotopes and ore fluid chemistry of gold mineralisation at Waitangi deposit, Thames district, Coromandel peninsula, north Island, New Zealand: Proceeding of Pacrim Conference 99, November 19-22, 1999, Bali, Indonesia, p. 633-668.

28. Singoyi, B., and **Khin Zaw** (2000). A petrological and fluid inclusion study of magnetite-scheelite skarn mineralisation at Kara, Northwestern Tasmania: Implications for ore genesis: PACROFI VII (Pan-American Current Research on Fluid Inclusions) Special Issue, CHEMICAL GEOLOGY, v. 64, p. 345-369.

29. **Khin Zaw** and Singoyi, B. (2000). Formation of magnetite-scheelite skarn mineralisation at Kara, northwestern Tasmania: evidence from mineral chemistry and stable isotopes: ECONOMIC GEOLOGY, v. 95, p. 1215-1230.

30. **Khin Zaw**, Huston, D.L., Gemmell, J.B., Hunns, S.R., Large, R.R., Ryan, C.G. and Mernagh, T.P. (2001). Microthermometry and geochemistry of ore fluids bearing on the genesis of volcanic-hosted massive sulphide deposits: water depth and source of metals: *XVI ECROFI (European Current Research on Fluid Inclusions)*, Porto, Portugal, Abstracts (Eds. F. Noronha, A. Doria and A. Guedes), Faculdade de Ciencias do Poto, Departamento de Geologia, Memoria, no 7, p. 463-466.

31. Limtrakun, P., **Khin Zaw**, Ryan, C.G., Mernagh, T.P., (2001). Formation of the Denchai gem sapphires, northern Thailand: evidence from mineral chemistry and fluid/melt inclusion characteristics: Mineralogical Magazine, v. 65 (6), p. 725-735.

32. Hou Zengqian, **Khin Zaw**, Qu Xiaoming, Ye Qingtong, Yu Jinjie, Xu Mingji, Fu Deming, and Yin Xianke (2001). Origin of the Gacun volcanic-hosted massive sulphide

deposit in Sichuan, China: Fluid inclusion and stable isotope evidence. ECONOMIC GEOLOGY, v. 94, p. 529-546.

33. **Khin Zaw**, Limtrakun, P., Tzen-Fu Yui, Ryan, C.G., Mernagh, T.P. (2002). Mineral chemistry, oxygen isotopes and fluid/melt inclusion studies of the Denchai sapphires, Northern Thailand: Proceedings of GeoThai 2002, 26-31 August, 2002, Bangkok, Thailand, p. 309-314.

34. Ulrich, T., Golding, S.D., Kamber, B.S., **Khin Zaw**, Taube, A. (2002). Different mineralization styles in a volcanic-hosted ore deposit; the fluid and isotopic signatures of the Mt Morgan Au-Cu deposit, Australia: ORE GEOLOGY REVIEWS, v. 22, p. 61-90.

35. Jingwen Mao, Yinqing Li, Goldfarb, R., Ying Hi, **Khin Zaw** (2003). Fluid inclusion and noble gas studies of the Dongping gold deposit, Heibei Province, China: A mantle connection for mineralisation ? : ECONOMIC GEOLOGY, v. 98, p. 517-534.

36. Hou Zengqian, Ma Hongwen, **Khin Zaw**, Zhang Yuquan, Wang Mingjie, Wang Zeng, Pan Guitang (2003). The Yulong (Himalayan) Porphyry Copper Belt: Product of large-scale strike-slip faulting in Eastern Tibet: ECONOMIC GEOLOGY, v. 98, p. 125-145.

37. Tzen-Fu Yui, **Khin Zaw**, Limtrakun, P. (2003). Oxygen isotope compositions of the Denchai sapphires, Thailand: A clue to its enigmatic origin: LITHOS, v. 67, p. 153-161.

38. Hou, Z., Wang, L., **Khin Zaw**, Mo Xuanxue, Wang Mingjie, Li Dingmou, Pan Guitang (2003). Post-collisional crustal extension setting and VHMS mineralization in the Jinshajiang Orogenic Belt, southwestern China: ORE GEOLOGY REVIEWS, v. 22, p. 177-199.

39. **Khin Zaw**, Hunns, S.R., Large, R.R., Gemmell, B.J., Ryan, C.G., and Mernagh, T.P. (2003). Microthermometry and chemical composition of fluid inclusions from the Mt Chalmers volcanic-hosted massive sulphide deposits, central Queensland, Australia: Implications for ore genesis: CHEMICAL GEOLOGY, v. v. 194, p. 225-244.

40. **Khin Zaw** (2003). Geology and sulphur isotope implications of Bawdwin deposit, Northern Shan State, Myanmar: An Ag-rich, volcanic-hosted, polymetallic massive sulphide deposit: Proceedings of the 7<sup>th</sup> Biennial SGA meeting, Athens, Greece, 24-28 August, 2003, p. 217-220.

41. Hou Zengqian, **Khin Zaw**, Pan Guitang, Xu Qiang, Li Xingzhen, Mo Xuanxue, and Hu Yunzhong (2003). Tectonic setting, metallogenesis and deposit types in Sanjiang Tethyan domain, S.W. China: Proceedings of the 7<sup>th</sup> Biennial SGA meeting, Athens, Greece, 24-28 August, 2003, p. 1165-1168.

42. Barley, M.E., Pickard, A.L., **Khin Zaw**, Rak, P., and Doyle, M.G. (2003). Jurassic to Miocene magmatism and metamorphism in the Mogok Metamorphic Belt and the India-Eurasia collision in Myanmar: TECTONICS, v. 22, No. 3, p. 4(1)-4(11).

43. Chromie, P., and **Khin Zaw** (2003). Geological setting, nature of ore fluids and sulfur isotope geochemistry of the Fu Ning Carlin-type gold deposits, Yunnan Province, China: GEOFLUIDS, v. 3, p. 1-11.

44. Solomon, M, Gemmell, J.B., and **Khin Zaw** (2004). The nature and origin of the fluids responsible for forming the Heyller volcanic-hosted massive sulphide deposit, as indicated by fluid inclusions, and stable and radiogenic isotopes of sulphides, sulphates, silicates and carbonates: ORE GEOLOGY REVIEWS, v. 25, p. 89-124.

45. Solomon, M., Tornos, F., Large, R.R., Badham, J.N.P., Both, R.A., **Khin Zaw** (2004). Zn-Pb-Cu volcanic-hosted massive sulphide deposits: Criteria for distinguishing brine pool-type from black smoker-type sulphide deposition: ORE GEOLOGY REVIEWS, v. 25, p. 259-283.
46. Hou Zengqian, **Khin Zaw**, Li Yanhe, Zhang Qiling, Zeng Zhigang, Urabe, T., (2005). Contribution of magmatic fluid to the active hydrothermal system in the JADE field, Okinawa Trough: Evidence from fluid inclusions, oxygen and helium isotopes: International Geology Review, v. 47, p. 420-437.
47. Hou Zengqian, Zhong Dalai, Deng Wanming, **Khin Zaw** (2005). A tectonic model for porphyry copper-molybdenum-gold deposits in the eastern Indo-Asian collision zone. In Super Porphyry Copper & Gold Deposits: A Global Perspective, ed., Porter, A.M., PGC Publishing, Adelaide, v. 2, p. p. 423-440.
48. Panjasawatwong, Y., **Khin Zaw**, Chantaramee, S., Limtrakun, P., Pirarai, K., (2006). Geochemistry and Tectonic Setting of the Central Loei volcanic rocks, Pak Chom area, Loei, northeastern Thailand: Journal of Asian Earth Sciences, v. 26, p. 77-90.
49. Hein, K.A., **Khin Zaw**, Mernagh, T.P., (2006). Linking mineral and fluid inclusion paragenetic studies: The Batman deposit, Mt Todd (Yimuyn Manjerr) goldfield, Australia: ORE GEOLOGY REVIEWS, v. 28.
50. **Khin Zaw**, F.L. Sutherland, F. Dellapasqua, C.G. Ryan, Tzen-Fu Yui, T.P. Mernagh, D. Duncan (2006). Contrasts in gem corundum characteristics, eastern Australian basaltic fields, based on trace elements, fluid/melt inclusions and oxygen isotopes: Mineralogical Magazine, v. 70, p. 617-635.
51. Gu Lianxing, Zheng Yuanchuan, Tang Xiaoqian, **Khin Zaw**, Fernando Della-Pasque, Wu Changzhi, Tian Zeman, Lu Jianjun, Ni Pei, Li Xin, Yang Futian, Wang Xiangwen (2007). Copper, gold and silver enrichment in ore mylonites within massive sulphide orebodies at Hongtoushan VHMS deposit, N.E. China: ORE GEOLOGY REVIEWS, v. 30, p. 1-29.
52. Hou Zengqian, Xie Yuling, Xu Wenyi, Li Yinqing, **Khin Zaw**, Beaudoin, G., Rui Zongyao, Huang Wei, Luobu Ciren (2007). Yulong deposit , East Tibet: A high- sulfidation Cu-Au porphyry deposit in the eastern Indo-Asian collision zone: International Geology Reviews, v. 49, p. 235-258.
53. Wu, C.Z., Zhang, Z.Z., **Khin Zaw**, Della-Pasque, F., Tang, J.H., Zheng, Y.C., Wang, C.S. and San, J.Z. 2006. Geochronology, geochemistry and tectonic significances of the Hongyuntan granitoids in the Qoltag area, Eastern Tianshan. Acta Petrologica Sinica, v. 22, 1121-1134.
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In addition, I have successfully presented my research results at international conferences, totaling more than 100 conference abstracts over the years. I have undertaken a series of consultancies for various mining and exploration companies and produced 43 high quality consultancy and research reports to industry. I was also periodically invited to give Keynote addresses.

***Invited Keynote address:***

1. **Khin Zaw** (2009). Metallogeny of mainland SE Asia: Invited Keynote address, Eleventh Regional Conference on Geology, Mineral and Energy Resources of Southeast Asia, GEOSEA 2009, Abstract volume, 8-10 June, 2009, Kuala Lumpur, Malaysia, 19.

2. **Khin Zaw** (2008). Tectonic and metallogenic relations of South China and SE Asian Terranes: Invited Keynote address, International Conference on Tectonics of northwestern Indochina, Abstract volume, 6-8 February, 2008, Chiang Mai, Thailand, 17.

3. **Khin Zaw** (2008). Exploration significance and diversity of mineral deposit types in South China and mainland SE Asia: Invited Seminar, Conference Proceedings of Mineral Exploration Technology Summit (METS), Asian Mining 2008, 8-9 April 2008, Singapore.

4. **Khin Zaw** (2008). Effectively using geospatial information for exploration in SE Asia and South China. Invited paper, Conference on GIS in Mining and Exploration, 24-25 September 2008, Brisbane, Queensland, Australia.

5. Mernagh, T., **Khin Zaw**, Evgeniy Bastrakov, E., (2006). A comparison of fluid inclusion data and mineralisation processes for Australian Orogenic-Gold and Intrusion-Related Gold Systems: Keynote address, Asian Current Research on Fluid Inclusions (ACROFI), 26-28 May, 2006, Nanjiang, CD-ROM.

6. Sutherland, F.L., Graham, I., **Khin Zaw** (2006-on line). Basaltic gemfields and their lithospheric sources, West Pacific margins: Invited address, 3<sup>rd</sup> AOGS meeting, <http://www.asiaoceania-conference.org/Abstract2006/AbstractFile/SE/SE26/59-SEA0796.rtf>.

7. Sutherland, F.L., Webb, G.B, Garland, M.L., Giuliani, G., Fallick, A.E., **Khin Zaw** (2006). Metamorphic ruby-bearing gem suites from Australian and SE Asian basalt fields: spinel- and garnet-facies ruby types. Invited Keynote address, 1<sup>st</sup> International Gem and Jewelry Conference, 6-9 Dcember 2006, Bangkok, Thailand.

8. **Khin Zaw**, Huston, D.L., Gemmell, J.B., Hunns, S.R., Large, R.R., Ryan, C.G., and Mernagh, T.P. (2001). Microthermometry and geochemistry of ore fluids bearing on the genesis of volcanic-hosted massive sulphide deposits: water depth and source of metals: Invited keynote address, XVI ECROFI (European Current Research on Fluid Inclusions), 2-4 May, 2001, Porto, Protugal.

9. **Khin Zaw**, Hunns, S.R., Large, R.R., Gemmell, J.B., Ryan, C.G., and Mernagh, T.P. (2000). Geochemistry of fluid inclusions from the Mt. Chalmers VHMS deposit, Australia: Implications for ore genesis: Invited keynote address for 31th International Geological Congress, 6-17 August, 2000, Rio De Janiero, Brazil.

10. **Khin Zaw**, Gemmell, B.J., Large, R.R., Aung Myo Thaik, Yeap, E.B., and Khoo, T.T. (1998). The Importance of ore fluid chemistry in studies of ore genesis: Examples from Australian and Southeast Asian deposits: Invited keynote address, 9<sup>th</sup> Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia (GEOSEA'98), Kuala Lumpur, Malaysia, 17-19 August, 1998 and Chair an afternoon section for Mineral Resources Section.

### ***Convener and Councillor:***

Main Convener of Section with Prof. Chin Ching-Hua Lo, National Taiwan University, Taiwan on “SE19: “Linking Tectonics, Magmatism and Metallogeny in East and SE Asia (see below)” at 8<sup>th</sup> AOGS Conference, 8-12 August, 2011, Taipei, Taiwan.

In the last few years, the effects of tectonic processes on the emplacement of magma and generation of ore deposits from ocean floor spreading to subduction and collision-related environments are increasingly discovered and documented. Seafloor related deposits such as VHMS deposits are formed during the rifting of oceanic ridges or back-arc basins and related to specific magmatic processes. Continental ore deposits such as porphyry copper deposits are formed in time and space as clusters, coinciding with particular tectonic processes related to episodes of flat slab subduction or collision of intra-oceanic island arcs and continental margin. The East and SE Asia region is characterised by an assembly of crustal plates or microcontinents that were rifted off from northern margin of Gondwana during Phanerozoic. These microplates or terranes were drifted on the Tethyan Ocean northward and accreted or collided with the Eurasian margin. During these rift, drift and assembly, various subduction and collision/post collisional processes are responsible for a diverse and abundant formation of minerals from gems to future metals such as REE and Li, and other ore deposits in East and SE Asia. However, the knowledge of various tectonic events and related magmatic processes and metallogeny in the region are poorly documented. The aim of this session is to improve the understanding of the tectonic evolution and metallogeny of East and SE Asian region. The main topics that will be covered in this session are: (1) Subduction- and Collision-related tectonics and assembly of Gondwana, (3) Intra-plate deformation in Asia, (4) Tectonics and deformation along Eastern Asian continental margin, (5) Metallogensis and mineral potentials, (6) Geochemistry and genesis of ore deposits in East and SE Asia and (7) Recent geochemical, isotopic and geochronological studies of mineralized Fold Belts in the region. This particular session will invite various group of petrologists, sedimentologists, structural geologists, geochemists, geochronologists and economic geologists working in Asia to offer their results and knowledge to make a better understanding of tectonic processes linking magmatism and metallogeny of the region.

Main Convener of Section on “Tectonic evolution of SE Asia”, 13<sup>th</sup> Quadrennial IAGOD Symposium, 6-9 April, 2010, Adelaide, Australia.

Main Convener of Section on “SE5: Orogenesis, magma genesis and mineral genesis: gemstones to sulphide ores” at 7<sup>th</sup> AOGS Conference, 5-9 July, 2010, Hyderabad, India.

Mineral deposits form where new minerals are precipitated from magmas or fluids in response to changes in tectonic processes and of mineral-forming conditions in pressure, temperature, and chemical environment. Mineral deposits occur in a variety of geological environments in the Earth's crust. Mineral deposits of an individual element need not to be restricted to a single geological and tectonic setting. Elemental associations may, however, be indicative of a specific orogenic and paleotectonic setting because of differing geochemical processes leading to mineral enrichment. The formation of certain mineral deposit types can be ascribed to processes that are mainly magmatic, that is, to processes related to the cooling and solidification of magmas and the chemical composition of the magma from which they formed. Fractional crystallization is usually important in plutonic rocks, whereas post-magmatic hydrothermal circulation is significant in all geological environments from plutonic, volcanic and sedimentary to metamorphic conditions. Crystallization of oxides during early magma genesis can generate chromium-, iron-, vanadium-, or titanium-rich layers of economic importance and may relate to formation of gemstones. Post-magmatic hydrothermal processes can generate base and precious metal-rich deposits of porphyry, skarn, mesothermal to epithermal types. Volcanic-hosted massive sulphide (VHMS) deposits and sedimentary exhalative (SEDEX) deposits are composed predominantly of iron sulphides (pyrite, pyrrhotite), and economic amounts of copper, zinc, and lead sulphides. Economically important contents of gold and silver are also present in most orebodies. These sulphide ores are related to hydrothermal fluid circulation in submarine environments. The Asia and Pacific region, in particular, has many diverse metallogenic provinces of different mineralization styles and mineral commodities, such as zinc, lead, copper, gold, silver, tin, tungsten, molybdenum, bismuth, antimony, uranium, and rare earth elements and gem deposits. The gem deposits are also highly significant in terms of monetary value, with annual worldwide production exceeding several billion dollars. However, accurate production figures are extremely difficult to come by, as many of these deposits are worked by individuals or small groups of miners. The understanding their genesis is also limited, although they are of especial economic significance in a number of developing economies in Asia and Africa where they account for a significant proportion of the gross domestic product, both in terms of mined rough and manufactured products. This session will focus upon the orogenesis, magma genesis and mineral genesis with special emphasis on gemstones and sulphide ores and welcome any contribution relating to review of previous studies as well as new data and new interpretation on this subject.

Main Convener of Section on “SE52: Geological Terranes and Metallogensis in Asia” at 6<sup>th</sup> AOGS Conference, 11-15 August, 2009, Suntec City, Singapore.

Co-Convener of Mineral Resource Section of 11<sup>th</sup> Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia (GEOSEA'09), 8-10 August, 2009, Kuala Lumpur, Malaysia.

Co-Convener of Section on “SE61: Magma, Fluids and Mineral Deposits of Asia and Oceania” at 5<sup>th</sup> AOGS Conference, 16-20 June, 2008, Busan, Korea.

Main Convener of Section on “SE04: Tectonics and Metallogeny in Asia and Oceania” at 4<sup>th</sup> AOGS Conference, 31 July-4 August, 2007, in Bangkok, Thailand.

Chairman of Mineral Resource Section, International Conference on Geology, Geotechnology and Mineral Resources of Indochina (GEOINDO 2005), 28-30 November 2005, Khon Kaen, Thailand.

Primary Convener of Asian Ore Deposits Section, Australian Geological Convention, 14-16 February, 2004, Hobart, Australia.

Co-convening, reviewing and editing papers for the Skarn Section of the joint SGA-IAGOD International Conference, 22-25 August, 1999, London.

Primary Convener of Mineral Resource Section of 9<sup>th</sup> Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia (GEOSEA'98), 17-19 August, 1998, Kuala Lumpur, Malaysia.

Co-convening International Conference on Stratigraphy and Tectonic Evolution of Southeast Asia and the South Pacific, August 19-24, 1997, Bangkok, Thailand.

Councillor (1999- ) for Association of Geoscientists for International Development representing Australia

Vice-President (2007- ) for Asian & Pacific International Fluid Inclusion Society (APIFIS)

***Editorial duty:***

Associate Editor and editorial board member of “ORE GEOLOGY REVIEWS” journal: the Journal for Comprehensive Studies of Ore Genesis and Ore Exploration, aims to familiarise all earth scientists with recent advances in a number of interconnected disciplines related to the study of, and search for, ore deposits.

I also review papers for ECONOMIC GEOLOGY, Mineralium Deposita, Ore Geology Reviews, Mineralogy and Petrology, Chemical Geology, Lithos, Applied Geochemistry and Southeast Asian Jour. Earth Sciences, and ARC also assigns me as an assessor for the ARC Large Grant applications.