REFERNCES

Allman, M., and Lawence, D.F. 1972. Geological Laboratory Techniques. Blandford Press, London, 335p.

Augustithis, S.S. 1973. Atlas of the Textural Patterns of Granites, Gneisses and Associated Rock Types. Elsevier Scientific Publishing Company, Netherlands, 378 p.

Barton, M., and Sidle, W. 1994. Petrological and geochemical evidence of granitoid formation: The Waldoboro pluton complex, Maine. Journal of Petrology 35: 1241-1274.

Batchelor, R.A. and Bowden, P. 1985. Petrogenetic interpretation of granitoid rock series using multicationic parameters. Chemistry Geology 48: 43-55.

Baum, F., et al. 1970. On the geology of northern Thailand. Beih. Geology Jahrb.Heft. 102: 1-24.

Brown, G.F.,et al. 1951. Geological reconnaissance of the mineral deposits of Thailand. U.S. Geol. Surv. Bull. 984.

Best, M.G. 1982. Igneous and Metamorphic Petrology. W.H. Freeman and Company, New York, 623 p.

Bunopas, S. 1981. Palaeogeographic History of Western Thailand and Adjacent Part of S.E. Asia: A Plate Tectonics Interpretation. Ph.D.Thesis, Victoria University of Wellington, New Zealand, 810 p.

_____. 1994. Regional stratigraphy, paleogeographic and tectonic events of Thailand and continental southeast Asia. Proceedings of the International Symposium on: Stratigrapic Correlation of Southeast Asia (Nov. 15-20): 2-24.

Burton, C.K. 1974. The Satun Group (Nai Tak Formation and Thung Song Limestone) of peninsular Thailand. Sains Malaysiana 3: 15-34.

Campbell, K.V. 1973. Basement complexes of Thailand. Proceedings of the Conference on the Geology of Thailand 1: 3-13.

Chaimanee, N. 1992. Geological Map of Khanom Quadrangle scale 1: 50,000. Geological Survey division, Department of Mineral Resource (with some explanation).

Chappel, B.W., and White, A.J.R. 1974. Two contrasting granite-types. Pacific Geology 8: 173-174.

Charusiri, P. 1989. Lithophile Metallogenic Epochs of Thailand : A Geological and Geochronological Investigation. Ph.D. Thesis, Queen's University, Canada, 819 p.

Chatterjee, A.K., and Muecke, G.K. 1982. Geochemistry and the distribution of uranium and thorium in the granitic rocks of the south mountain batholith, Nova Scotia : Some genetic and exploration implication. Geological Survey of Canada, paper 81-23, 173 p.

Cobbing, E.J., Pitfield, P.E.J., Darbyshire, D.P.F., and Mallicke, D.I.J. 1992. The granites of the south-east Asian tin belt. Overseas Mem. 10: 118-180.

Collerson, K.D., and Fryer, B.J. 1987. The role of fluids in the formation and subsequent development of early continental crust. Contribution Mineral Petrology 67: 151-167.

_____, and Bridgwater, D. 1979. Metamorphic development of early Archean tonalitic and trondhjemitic gneisses: Saglek area, Labrador. Trondhjemites, Dacites, and Related Rocks. Elsevier, Amsterdam: 205-273.

Conrad, W.K. 1987. A FORTRAN program for simulating major- and trace-element variations during rayleigh fractionation with melt replenishment or assimilation. Computers & Geosciences 13: 1-12.

Corey, M.C. 1987. A re-interpretation of U-Th rations in the New Ross area : Evidence for a zoned pluton. Nova Scotia, Department of Mines and Energy 87-5: 105-109.

Cullers, R.L., and Graf, J.L. 1984. Rare-earth elements in igneous rocks of the continental crust: Intermediate and silicic rocks-ore petrogenesis. Rare-Earth Element Geochemistry: 275-316.

_____, and Koch, R.J. 1981. Chemical evolution of magmas in the Proterozoic terrane of the St. Francisco mountains, southeastern Missouri, 2 trace element data. Journal Geophysic Resources 86: 10388-10401.

Dheeradilok, P., and Lumjuan, A. 1983. On the metamorphic and Precambrian rocks of Thailand. Conference on Geology and Mineral Resources of Thailand (Nov.18-19): 7 p.

Diederichs, M.S., and Hoek, E. 1989. Data Interpretation Package using Stereographic Projection (DIPS) Version 3.0. Rock Engineering Group Department of Civil Engineering, University of Toronto.

Ford, K.L., and O' Reilly, G.A. 1985. Airborne gamma-ray spectrometric-surveys as an indicator of granophile element specialization and associated mineral deposits in the granitic rocks of the Meguma zone of Nova Scotia,Canada. High heat production (HHP) granites, hydrothermal circulation and ore genesis : 113-133.

Galbraith, J.H.,and Saunders, D.F. 1983. Rock classification by characteristics of aerial gamma-ray measurments. Journal of Geochemistry Exploration 18: 49-73.

Garcia, D., Fonteilles, M., and Moutte, J. 1994. Sedimentary fractions between Al, Ti, and Zr and the genesis of strongly peraluminous granites. Jounal of Geology 104: 411-422.

Garson, M.S., Young, B., Mitchell, A.H.G., and Tait, B.A.R. 1975. The Geology of the Tin Belt in Peninsular Thailand around Phuket, Phang-nga and Takua Pa. Overseas Mem. Institute Geological Science 1: 112 p.

Gregg, W.J. 1993. Structural Geology of Parautochthonous and Allochthonous terrances of the Penokean orogeny in Upper Michigan- comparisions with northern Appalachian tectonics. U.S. Geological Survey Bulletin 1904.

Hansen, B.T., Ahrendt, H., Lujuan, A., Mickein, A., and Wemmer, K. 1994. Do the high grade metamorphic rocks in Thailand represent the basement for the Paleozoic strata?. Proceedings of the International Symposium on: Stratigrapic Correlation of Southeast Asia (Nov. 15-20).

Henderson, P., and Pankhurst, R.J. 1984. Analytical chemistry. Rare-Earth Element Geochemistry. Elsevier, New York: 467-500.

Hong, Y.K. 1985. Petrogeneses of the Proterozoic granitic rocks in the Buncheon-Seogpo area, NE Korea. Journal Geological Society of Korea 21: 196-209.

_____. 1992. Petrogeneses and evolution of early proterozoic granitic rocks in the northeastern Ryeongnam massif, Korea. Journal Geological Society of Korea 28: 571-589.

Irvine, T.N., and Baragar, W.R.A. 1971. A guide to the chemical classification of the common volcanic rocks. Canadian Journal Earth Science 8: 523-548.

Ishihara, S., Sawata, H., Arpornsuwan, S., Busaracome, P., and Bungbrakearti, 1978. Granitic rocks in southern Thailand. Proceedings of 3rd Regional Conference on Geology and Mineral Resources of Southeast Asia (Nov. 14-18): 265-267.

Javanaphet, J. 1969. Geological Map of Thailand, Scale 1:1,000,000. Dep. of Min. Res., Bankok.

Kamioka, H., Sudo, S., Kamitani, M., Kanazawa, Y.,and Hirano, H. 1994. Rare earth elements abundance patterns of weatering crust in Thailand. Report of International Research and Development Cooperation ITIT Projects 90-1-2: 85-106.

Kamitani, M., Kanazawa, H., Hamioka, H., and Krakhang, C., 1994. Rare earth elements in granitiods and their weathering crusts of southern Thailand. Report of International Research and Development Cooperation ITIT Projects 90-1-2: 55-84.

Kerrick, D.M. 1972. Experimental determination of muscovite + quartz stability with $P_{H2O} P_{total}$. American Journal Science 272: 946-958.

Killeen, P.G. 1979. Gamma-ray spectrometric methods in uranium exploration : application and interpretation. Geophysics and Geochemistry in Seach for Metallic Ores 31: 63-200.

Kosinowski, M.H.F. 1982. MSONRM, a FORTRAN program for for the improved version of mesonorm calculation. Computers & Geosciences 8: 11-20.

Lagarde, J.L., and Omar, S.A. 1990. Structual characteristics of granitic plutons emplaced during weak regional deformation: examples from Late Carboniferous plutons, Morocco. Journal of Structure Geology 12: 805-821.

Le Maitre, R.W. 1989. A Classification of Igneous Rocks and Glossary of Terms. Blackwell, Oxford, 193 p.

Lister, G.S. 1989. The origin of metamorphic core complexes and detachment faults formed during Tertiary continental extension in the northern. Journal of Structure Geology 11: 65-94.

Lumjuan, A. 1993. Pemo-Carboniferous of northern Nakhon Si Thammarat. Proceedings of International Symposium on Biostratigraphy of Mainland Southeast Asia: Facies and Paleontology 1: 219-224.

Luth, W.C., Jahns, R.H., and Tuttle, O.F. 1964. The granite system at pressure of 4 to 10 kilobars. Journal Geophysic Reseach 69: 759-773.

Maniar, P., and Piccoli, P. 1989. Tectonic discrimination of granitoids. GSA Bulletin 101; 635-643.

Mehnert, K.R. 1971. Migmatites and the Origin of Granitic Rocks. Elsevier, New York, 405 p.

Mickein, A., Ahrendt, H., Hansen, B., Lumjuan, A., and Wemmer, K. 1995. New age information on the history of the basement rocks of Thailand. Proceeding of International Conference of Geology, Geotechnology and Mineral Resources of Indochina (Nov. 22-25), Khon Kaen, Thailand (Abstract).

Miyashiro, A. 1973. Metamorphism and Metamorphic Belts. George Alien & Unwin, UK., 492 p.

Nakapadungrat, S. 1982. Geochornology and Geochemistry of the Thong Lang Granite Complex, Central Thailand. Ph.D. Thesis, Univ. London, U.K., 336 p.

_____, Beckinsale, R.D., and Suensilpong, S. 1984. Geochronlogy and geology of Thai granites: Proceedings of the Conference on Application of Geology and the National Development. Chulalongkorn University, Bangkok (Nov.): 75-93.

_____, Chaisen, S. and Techavichitpaisarn, S. 1987. Geology of Changwat Nakhon Si Thammarat (4925 I) and Amphoe Chawong (4925IV) Quadrangles Scale

1:50,000. Geological Survey Division Report of Investigation No.T-06-2-0083-87/GEOL.,58p.

_____, and Putthapiban, P. 1992. Granites and associated mineralization in Thailand. Proceedings of a National Conference on Geological Resources of Thailand: Potential for Future Development (Nov. 17-24): 153-171.

Nakinbodee, V. , Wongwanich , T. , Lumjuan , A. 1985. Geological Map of Changwat Surat Thani scale 1: 250,000. Geological Survey Division, Department of Mineral Resources, Bangkok.

O'connor, J.T. 1965. A classification for quartz-rich igneous rocks based on feldspar ratios. U.S. Geological Survey Profesional Paper. 525-B :79.

Pavlis, T.L., and Sisson, V.B. 1995. Structural history of the Chugach metamorphic complex in the Tana River region, eastern Alaska: A record of Eocence ridge subduction. GSA Bulletin 107: 1333-1355.

Piwinskii, A.J., 1968. Experimental studies of igneous rock series, central Sierra Nevada Batholith, California. Journal Geology 76: 548-570.

Piyasin, S. 1975. Stratigraphy and sedimentology of the Kaeng Krachan Group (Carboniferous), Proceedings of Conference Geology 2: 25-36.

Polachan, S., and Sattayarak, N. 1989. Strike-slip tectonics and the development of Tertiary basins in Thailand. Proceedings of the International Symposium on Intermontane Basins : Geology & Resources (Feb.2-Jan.30) : 243-253.

Pongsapich, W., Vedchakanchana, S., and Pongprayoon, P. 1980. Petrology of the Pranburi-Hua Hin metamorphic complex and geochemistry of gneisses in it. Geological Society of Malaysia Bulletin 12 : 55-74.

_____, Pisutha-Arnond, V., and Charusiri, P. 1983. Reviews of felsic phitonic rocks in Thailand. Proceedings of the Workshop on Stratigraphic Correlation of Thailand and Malaysia (Sep.): 213-232.

Pressnall, D.C. 1979. Fractional crystallization and partial fusion. In : The Evolution of Igneous rocks. ed. Yoder, Princeton, N.Y. 59-75.

_____, and Bateman, P.C. 1973. Fusion relations in the system $NaAlSiO_3O_8$-$CaAl_2Si_2O_8$-SiO_2-H_2O and generation of granitic magmas in the Sierra Nevada batholith. Bulletin Geological Society of America: 3181-3202.

Putthapiban, P. 1984. Geochemistry, Geochronology and Tin Mineralization of Phuket Granites, Phuket, Thailand. Ph.D. Thesis, La Trobe University, Melbourne, Australia, 414 p.

_____, and Suensilpong, S. 1978. The igneous geology of the granitic rocks of the Hub Kapong-Hua Hin area. Journal of Geological Society of Thailand 3: 1-22.

Raksaskulwong, L., and Wongwanich, T. 1994. Stratigraphy of Kaeng Krachan Group in peninsular and western Thailand, Proceedings of Geological Survey Division Yearly Meeting (Sep.19-20): 106-115 (in Thai).

Rollinson, H.R. 1993. Using Geochemical Data: Evaluation, Presentation, Interpretation. Longman Group, UK.

Salyapongse, S. 1992. Foliated contact metamorphic rock of the eastern gulf, Thailand. Journal of Thai Geosciences 2: 35-43.

Schwartz, M.O., Rajab, S.S., Askury, A.K., Putthapiban, P., and Djaswadi, S. 1995. The southeast Asian tin belt. Earth Science Reviews 38 (2-4): 95-293.

Sims, P.K., Schulz, K.J., Dewitt, E., and Brasaemle, B. 1993. Petrography and geochemitry of Early Proterozic granitoid rocks in Wisconsin magmatic terranes of Penokean orogen, northern Wisconsin. U.S. Geological Survey Bulletin 1904-J: 1-29.

Slaney, V.R. 1985. Lansat MSS and airborne geophysical data combined for mapping granite in southwest Nova Scotia. 11th International Symposium on Machine Processing of Remotely Sensed Data, Purdue University, Indiana (Jun. 25-27).

Srisakulrat, N. 1995. Geological Study of the Thi Wang Area, Thung Song, Changwat Nakhpn Si Thammarat : An Unpulished Senior Project. Department of Geology, Chulalongkorn University, Bangkok.

Streckeisen, A. 1973. Plutonic rocks: classification and nomenclature recommended by the IUGS Subcomission on the systematics of igneous rocks. Geotimes 18: 26-30.

_____. 1974. Classification and nomenclature of plutonic rocks. Geologische Rundschau 63: 763-786.

Subandrio, A.S., and Soeria-Atmadja, R. 1995. Petrologic relations and uraminm distribution in the Sibolga granitoid complex, north Sumatra, Indonesia.

Proceedings of 8th Regional Conference on Geology, Mineral, and Energy Resources of Southeast Asia : 1-14.

Sun, S.S. 1982. Chemical composition and origin of the Earth's primitive mantle. Geochemistry Cosmochemistical Acta 46: 179-192.

Tantiwanit, W., Raksaskulwong, L., and Mantajit, N. 1983. The upper Paleozoic pebbly rocks in southern Thailand. Proceedings of a Workshop on Stratigraphic Correlation of Thailand and Malaysia 1: 96-104.

Taylor, S.R., and McLennan, S.M. 1985. The Continental Crust : Its Composition and Evolution. Blackwell, oxford, 312 pp.

Thomoson, A.B. 1974. Calculation of muscovite-paragonite-alkali feldspar phase relations. Contribute Mineral Petrology 44: 173-194.

_____, and Algor, J.R. 1977. Model systems for anatexis of pelitic rocks. Contribute Mineral Petrology 63: 247-269.

Tsuesue, A., Mizuta, T., Tamai, T., and Kim, S.W. 1987. Mesozoic granite rocks of south Korea : Trace element evidence regarding their differentiation; 2. REE patterns. Journal Japan Association Mineral Petrology Economic Geology 82: 23-35.

Tulyatid, J. 1991. $^{40}Ar/^{39}Ar$ Geochronological Study of Deformed Meta-granitoid Rocks Adjacent to the Hua Hin-Pran Buri Fault System, M.Sc. Thesis, Queen's University, Kingston, Ontario, Canana, 351 p.

_____. 1992. Airborne radometric data interpretation as an aid to granitic terrain mapping : A case study for Hua Hin - Pran Buri area, south central Thailand. Proceedings of the National Conference on Geologic Resources of Thailand : Potential for Future Development (Nov. 7-14) : 70-85.

Turner, F.J. 1968. Metamorphic Petrology Mineralogical and Field Aspects. McGraw Hill, N.Y., 403 p.

Tuttle, O.F., and Bowen, N.L. 1958. Origin of granite in the light of experimental studies in the system $NaAlSi_3O_8$- $KAlSi_3O_8$-SiO_2-H_2O. Geological Society of America Mem. 74.

White, A.J.R., and Chappell, B.W. 1983. Granitoid types and their distribution in the Lachlan Fold Belt, southeastern Australia. Geological Society of America Mem. 159: 21-31.

Whitten, E.H.T. 1966. Structural Geology of Folded Rocks. Rand Mcnally & Company, USA, 678 p.

Wilson, M. 1989. Igneous Petrogenesis. Unwin Hyman, UK, 466 p.

_____. 1993. Magmatic differentiation. Journal of the Geological Society 150: 611-624.

Winkler, H.G.F. 1979. Petrogenesis of Metamorphic rocks. 4th ed. Springer verlag. N.Y., 334 p.

Wongwanich, T., Burrett, C., Tansathein, W., and Chaodumrong, P. 1988. Lower to Mid Palaeozoic stratigraphy of mainland Satun province, southern Thailand. Journal of Southeast Asian Earth Sciences 4: 1-9.

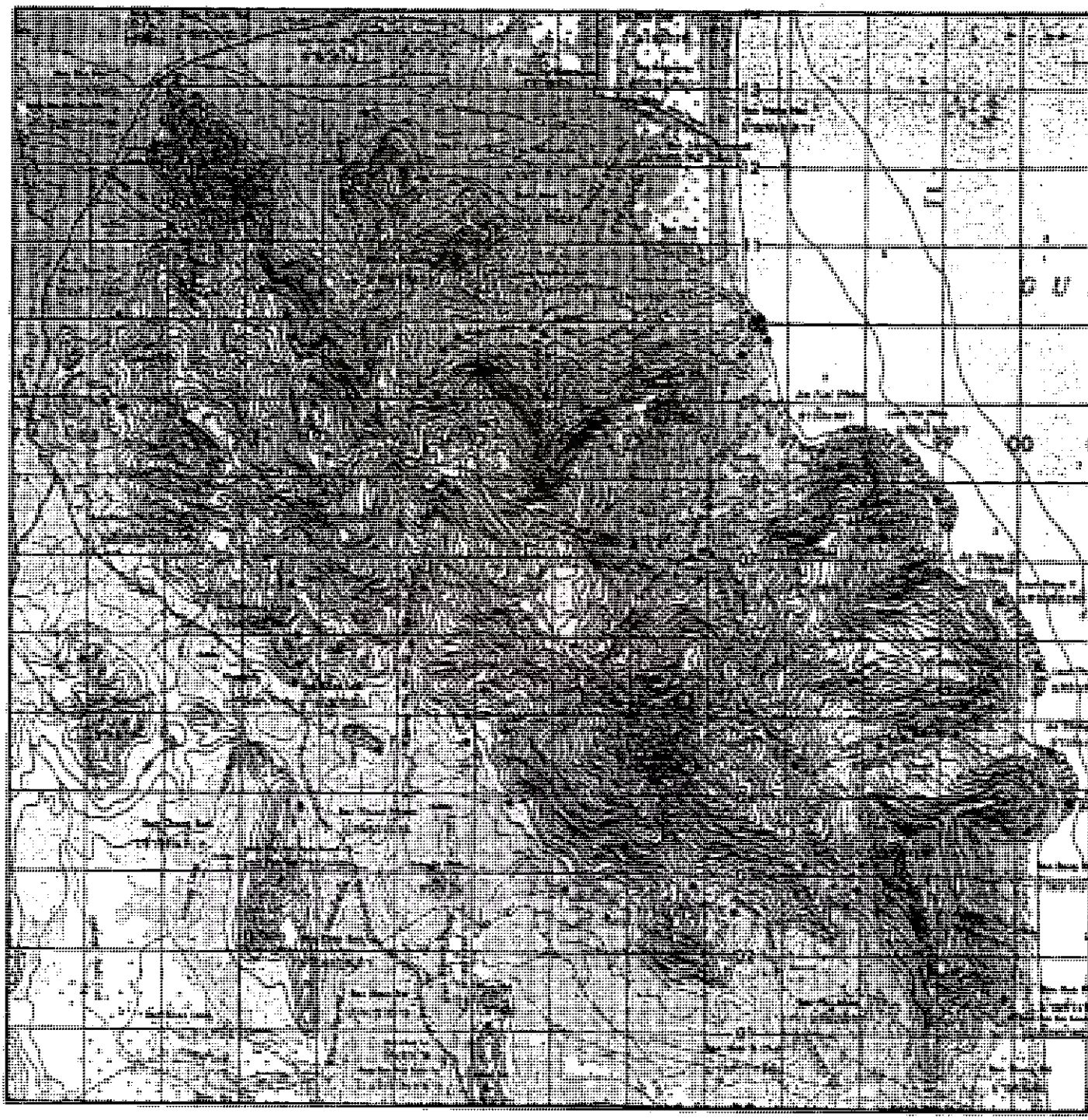
_____. 1990. Lithostratigraphy, Sedimentology, and Diagenesis of the Ordovician Carbonates, Southern Thailand. Thesis Ph.D., University of Tasmania, 215 p.

Wunapeera, A. 1992. The Geology of the Cape North and Money Point Groups, Northern Cape Breton Highlands, Nova Scotia. M.Sc. Thesis, Acadia University, Canana, 293 p.

Udomratn, C., Muenlek, S., and Wongwanich, T. 1981. Prelimary Report on the Stratigraphy of Southern Thailand. Geological Survey Division, Department of Mineral Resources, Bangkok Thailand, 59 p.

APPENDIXES

Appendix A. Map showing investigated locations in the study area.



Appendix B. Staining rock slabs techique and results of modal analysis.

1. Immerse the smooth face of gry slab in HF acid for 30 second.

2. Rinse the entire slab sufficiently tap-water to remove the excess HF and then dry it in an oven at 90° C for 15 minutes or longer to eleminate all HF.

3. Immerse the etched face of the slab in sodium cobaltinitrite solution (60 %) for 1 minute.

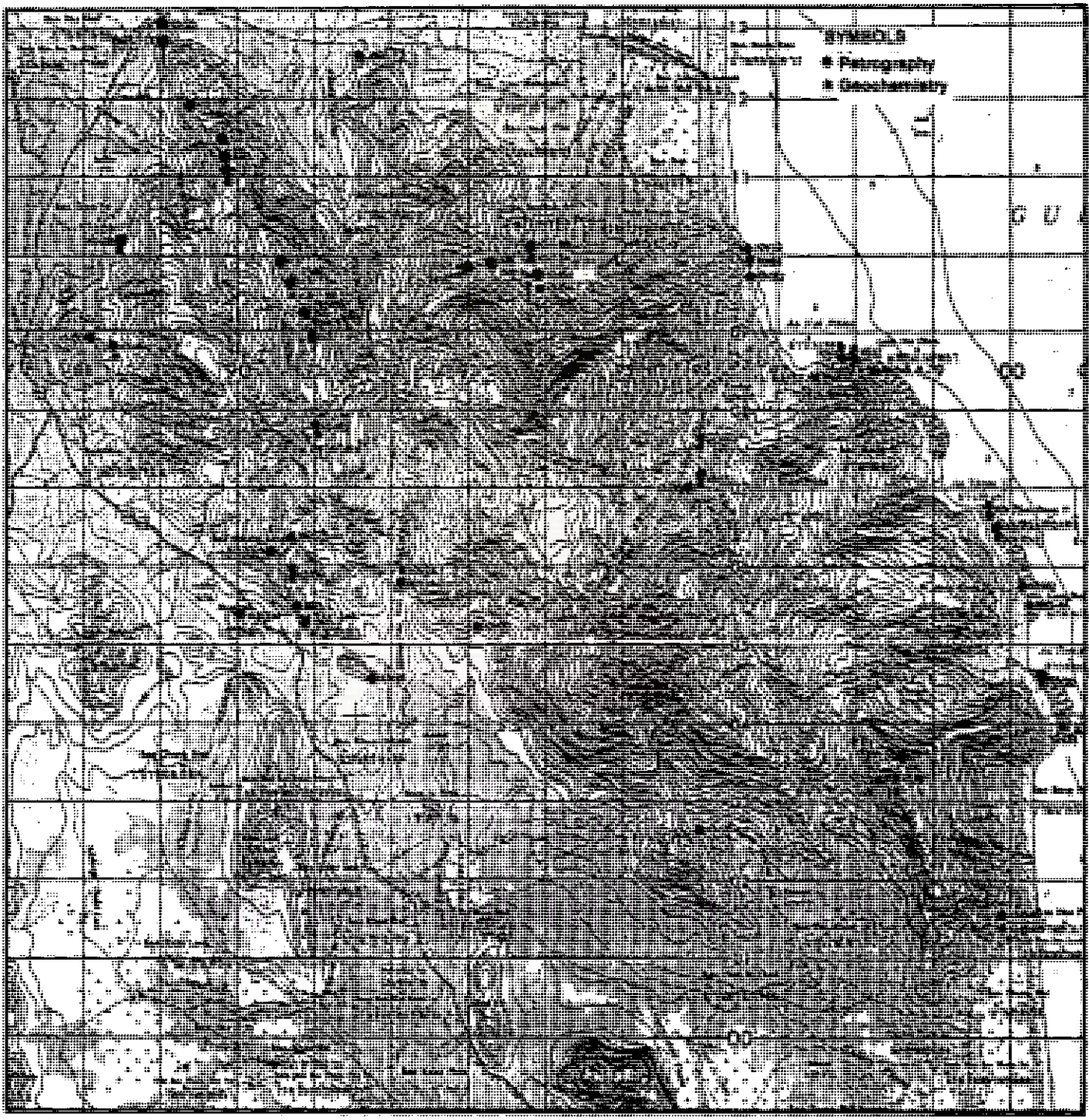
4. Rinse the slab thoroughly in running tap-water to remove excess sodium cobaltinitrite and allowed it to dry.

At this point the K-feldspar is stained with bright yellow, while the plagioclase is become chalky white to yellowish white colour, but quartz is unaffected.

Results of modal analysis of the Khanom granitic rocks.

Sample No.	Grid reference	Quartz (%)	K- feldspar (%)	Plagioclase (%)
KN2-1	980087	51.48	18.86	30.13
KN2-3	980087	23.56	46.92	29.21
KN13	933099	34.77	29.90	32.66
KN19-3	965100	26.62	51.66	23.76
KN22	960071	39.74	38.38	22.99
KN24-2	921058	43.24	26.60	29.26
KN30	004046	23.50	31.92	43.26
KN43-2	893102	51.00	25.84	24.14
KN54-2	939097	29.96	35.60	33.60

Appendix C. Map showing rock sample locations for petrography and geochemistry.



Appendix D. Conclusion of petrographic identification of rock samples.

Sample no.	Grid reference	Name	Texture	Grain size	%qz	%kfs	%pfs	%bio	%mus	%others
KN1	977086	Sillimanite-biotite Gneiss	Gneissic Cataclastic Fibroblastic	0.5 - 1.5	40	30 or	3 olc	10	1 - 2	10 slm gar, ap
KN13	933099	Biotite Gneiss	Gneissic Granophyric Myrmekitic	0.5 - 2.5	30	50 or	10 olc	10	-	3 Fe
KN14	930099	Muscovite-biotite Gneiss	Gneissic Granophyric Myrmekitic Cataclastic	0.5 - 3.5	25	35 or	10 olc	15	10	5 chl
KN19	965100	Muscovite-biotite Gneiss	Gneissic Granophyric Myrmekitic	0.2 - 0.7	30	45 or	5 olc	15	5	5 chl
KN31	005039	Muscovite-biotite Gneiss	Gneissic Granophyric Myrmekitic	0.1 - 2.0	40	40 or	5 olc	10	5	
S93-4A	002055	Muscovite-biotite Gneiss	Gneissic	0.3 - 1.0	40	25 or 5 mcn	10 olc	10	5	Fe
S93-6	982085	Muscovite-biotite Gneiss	Gneissic	0.1 - 1.0	15	40 or	15 olc	15	10	
S93-7	982085	Sillimanite-biotite Gneiss	Gneissic Granophyric Myrmekitic	0.1 - 1.5	20	35 or	10 olc	15	5	slm
S93-8	982085	Sillimanite-biotite Gneiss	Porphyroblastic Granophyric cataclastic Poikiloblastic	0.1 - 5.0	10	60 or	10 olc	10	5	slm
S93-10	915126	Muscovite-biotite Gneiss	Gneissic Granophyric	0.3 - 1.2	10	60 or	10 olc	5	3	5 chl Fe
KN36	957070	Garnet-biotite Gneiss	Gneissic	0.1 - 0.5	20	35 or	5 olc	15	10	10 gar

Sample no.	Grid reference	Name	Texture	Grain size	%qz	%kfs	%pfs	%bio	%mus	%others
KN42	002057	Muscovite-biotite Gneiss	Gneissic Granophyric Myrmekitic	0.3 - 2.0	35	30 or	10 olc	10	5	Fe
KN28	964025	Augen Gneiss	Porphyroblastic Augen Poikiloblastic Perthitic Myrmekitic	1.0 - 3.0	25	50 or	10 olc	10	5	Fe
KN30	004046	Augen Gneiss	Porphyroblastic Augen Myrmekitic	0.5 - 4.0	25	30 or 10 mcn	10 an	15	10	Fe
KS84-B	999015	Porphyroblastic Gneiss	Porphyroblastic	0.2 - 3.5	20	25 mcn 20 or	10 olc	15	10	
S93-4B	002055	Porphyroblastic Gneiss	Porphyroblastic Lepidoblastic	0.5 - 4.0	20	60 or 10 mcn	10 olc	10	5	
S93-5	982085	Porphyroblastic Gneiss	Porphyroblastic Cataclastic	0.1 - 2.0	40	35 or	5 olc	15	2	2 slm
KS116-A	907096	Foliated Granite	Porphyritic Poikilitic Perthitic Lepidoblastic	0.1 - 3.5	30	40 or	10 olc	15	5	chl, ser
KS117	905099	Foliated Granite	Phaneritic Perthitic Myrmekitic Lepidoblastic	0.1 - 3.5	20	40 or 5 mcn	15 olc	10	7	chl, ser
S93-12	909093	Foliated Granite	Phaneritic Lepidoblastic	0.1 - 1.5	50	35 or	10 an	10	5	tou, Fe

Sample no.	Grid reference	Name	Texture	Grain size	%qz	%kfs	%pfs	%bio	%mus	%others
KS154	894116	Foliated Granite	Porphyroblastic	0.1 - 3.0	10	50 or	-	15	20	5 tou gar, sp, ap
KN59	907059	Foliated Granite	Porphyritic Cataclastic Lepidoblastic	2.0 - 7.0	20	50 or 5 mcn	10 ab	10	5	
KS153	899111	Foliated Granite	Phaneritic Lepidoblastic	1.0 - 5.0	20	50 or 5 mcn	10 ab	10	5	2 gar
KN22	956069	Biotite Granite	Phaneritic Myrmekitic	0.3 - 3.0	15	50 or 5 mcn	15 ab	10	-	ser, sp
S93-9	959070	Muscovite-biotite Granite	Phaneritic	0.2 - 4.0	20	45 or 5 mcn	20 ab	10	5	
KN49	884087	Muscovite-biotite Granite	Phaneritic Granophyric Myrmekitic	1.0 - 5.0	35	30 or 20 mcn	5 ab	10	5	ap, Fe, ch
KN54-1	939096	Biotite-muscovite Granite	Phaneritic	2.0 - 6.0	35	35 or 10 mcn	10 ab	5	10	ser, chl Fe
KN58	885102	Muscovite-biotite Granite	Phaneritic Perthitic Myrmekitic	3.0 - 7.0	35	25 or 20 mcn	10 ab	5	2	
KN23	891130	Epidote-diopside Hornfels	Granoblastic	0.2 - 0.5	40	-	10 ab	-	-	45 di, 3 chl act, tm, cc, ep
KN25	917046	Muscovite-quartz Schist	Schistose	0.2 - 0.4	85	-	-	-	10	3 Fe
KN20	967098	Diopside Calc-silicate	Granoblastic	0.1 - 0.5	35	-	10 ab 5 lb	-		50 di, cc sp, act, tm

Sample no.	Grid reference	Name	Texture	Grain size	%qz	%kfs	%pfs	%bio	%mus	%others
KN62	942028	Biotite Hornfels	Granoblastic	0.1 - 1.0	60	15	-	25	-	3 chl
KS112	891130	Muscovite-quartz Schist	Schistose Mylonitic	0.2 - 0.5	80	-	-	-	20	
KS114	999088	Muscovite-quartz Schist	Schistose	0.1 - 0.3	80	-	-	-	15	Fe
KS202-A	904062	Mica schist	Schistose	0.1 - 1.0	80	-	-	5	15	-
KS204	900055	Marble	Granoblastic Crystalloblastic	1.0 - 2.0	-	-	-	-	-	90 cc 10 ph
S93-1	907054	Muscovite-quartz Schist	Schistose	0.1 - 0.2	75	-	-	-	20	Fe
S93-2	909053	Muscovite-quartz Schist	Porphyroblastic	0.1 - 2.0	40	25	-	-	30	5 Fe
KN52	867096	Limestone	Micritic	0.1	-	-	-	-	-	95 cc
S93-11A	890128	Mica Quartzite	Granoblastic	0.1 - 1.0	80	10	-	-	10	
S93-11B	890128	Quartz-muscovite Schist	Schistose	1.0 - 3.0	20	-	-	-	75	5 Fe
KS155	894118	Muscovite-quartz Schist	Schistose	0.1 - 1.5	35	30	-	2	30	gar, Fe

Remarks

ab = Albite
act = Actinolite
an = Andesine
ap = Apatite
bio = Biotite
cc = Calcite
chl = Chlorite
di = Diopside
ep = Epidote
Fe = Iron oxide
gar = Garnet
kfs = K-feldspar
lb = Labradorite
mcn = Microcline
mus = Muscovite
olc = Oligoclase
or = Orthoclase
pfs = Plagioclase
ph = Phlogopite
qz = Quartz
ser = Sericite
sim = Sillimanite
sp = Sphene
tou = Tourmaline
tm = Tremolite

Appendix E. Data on structural analysis.

Hasd Nai Phlao Gneiss

Axial Plane Foliations (S1)

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
50	65	55	65	45	60	75	80	70	75
75	80	65	70	85	75	75	250	60	62
65	70	75	70	60	75	75	70	85	75
75	260	85	245	90	260	21	263	40	265
75	265	70	260	75	265	60	265	70	275
80	285	80	270	80	120	65	110	70	52
55	75	45	65	40	310	40	280	80	270
55	95	80	280	80	90	80	80	70	95
60	90	50	85	40	90	40	85	30	85
60	90	70	275	85	110	85	285	85	280
85	280	10	35	20	65	25	90	30	45
40	200	55	75						

Late Schistosity (S2)

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
80	80	80	255	65	250	80	80	80	50
80	250								

Beding Plane (S0)

DIP	DIP DIRECTION
65	85

Joints

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
90	350	80	120	75	120	75	35	65	170
50	340	70	202	80	130	50	355	80	310
85	335	80	305	85	190	40	125	80	360
85	310	80	355	90	310	80	295	80	125
70	305	90	310	85	125	50	320	85	120
55	325	78	15	80	300	60	160	75	10
80	190	72	198	80	210	75	200	65	15
85	15	60	170	60	160	70	145	70	90
75	195	75	195	40	40	65	185	80	120
80	105	65	250	60	170	85	260	70	215
70	120	70	270	80	350	85	190	65	30
75	355	70	80	50	20	70	280	55	25
80	105	80	90	60	40	60	30	80	10
50	280	90	200	80	260	80	185	80	200
50	300	40	100	80	295	85	205	85	210
60	185	85	20	80	210	85	105	80	360
80	110	70	135	90	135	85	25	90	300
55	25	85	25	90	300	55	25	80	150
85	355	50	140	80	320				

Faults

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
80	30	70	360	70	20	80	130	58	205
60	190	80	305	85	305	40	60	50	220

Quartz veins

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
80	270	65	80	75	265	85	70	80	160
60	145								

Pegmatites

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
85	280	80	270	65	265	85	95	80	280
70	90	80	270	80	270	80	100	80	160
80	270	60	140	85	340				

Khao Yai Schist

Axial Plane Schistosity (S1)

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
40	70	20	80	20	90	20	80	10	70
20	70	20	75	15	75	20	75	15	75
20	85	20	65	10	85	10	80	10	85
15	85	10	100	10	95	10	80	10	85
15	75	10	70	10	95	10	70	10	90
30	60	20	70	15	70	10	85	10	95
5	70	5	85	15	45	13	360	15	60
15	75	15	60	15	80	10	75	20	50
20	60	25	45	20	50	30	65	20	55
15	85	30	20	25	30	25	10	30	15
20	10	20	25	15	25	30	75	40	50
80	70	45	65	65	70	50	60	30	85
20	70	40	65	20	35	20	20	20	10
20	35	25	45	10	40	20	30	40	35
40	55	45	65	20	50	20	55	20	305
45	310	10	290	30	280	20	305	20	50
75	140	30	65	60	270				

Joints

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
80	150	80	120	80	160	75	350	80	160
83	35	70	360	80	150	85	330	80	325
75	360	70	170	75	140	85	310	80	140
50	200	85	355	80	345	80	350	20	280
80	350	30	310	10	330	75	155	85	355
80	145	75	145	75	140	85	170	80	325
80	160	65	160	80	335	80	350	70	350
85	345	20	245	30	320	85	350	80	350
80	355	40	240	70	155	80	150	75	140
45	255	80	150	75	60	85	330	40	330
75	360	75	350	85	340	80	345	80	95
90	340	83	45	20	320	80	145	70	145
70	140	75	300	65	5	80	160	75	325
80	335	80	145	60	280	80	70	83	40
35	290	85	345	80	160	75	160	70	140
80	340	70	145	60	10	80	345	85	145
80	350	30	30	80	345	60	130	85	335
80	140	80	340	40	270	80	350	80	145
80	320	60	65	70	105	20	315	80	250
83	30	80	335	20	345	30	330	85	340
70	70	85	340	10	75	60	80	80	150
85	330	85	185	70	170	75	20	80	335
85	145	80	5	85	345	80	340	85	175
70	340	80	350	80	345	40	75	80	75
80	150								

Faults

DIP	DIP DIRECTION	DIP	DIP DIRECTION
85	140	60	240

Quartz veins

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
30	55	30	40	30	150

Pegmatites

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
30	220	60	200	10	280	85	260	20	50
40	50	40	125	30	50	20	90	55	280

Laem Thong Yang Gneiss

Axial Plane Foliations (S1)

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
80	75	70	65	75	70	70	80	80	65
75	75	70	50	70	55	75	90	85	90
85	85	80	85	75	45	70	65	65	190
75	75	70	55	75	60	70	70	70	85
85	85	80	80	55	90	50	60	80	70
50	85	80	70	85	70	70	65	70	70
60	70	70	75	75	70	70	65	65	75
70	70	30	60	45	60	50	90	75	90
45	105	75	60	75	70	70	70	50	75
70	65	70	60	80	70	75	75	85	70
80	60	55	45	15	110	60	55	65	60
75	70	80	70	70	65	55	85	80	75
70	75	75	60	70	100	80	90	40	90
75	95	70	95	80	80	80	95	85	100
70	95	65	90	80	90	80	75	75	90
85	80	80	70	80	75	75	85	80	80
50	175	70	182	70	100	80	280	85	110

Late Schistosity (S2)

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
68	65	75	50	75	60	85	60	80	50
70	45	60	50	60	45	30	45	40	30
40	40	60	50	75	105	70	70	65	50
65	25	70	30	60	55	60	50	65	50
40	40	60	40	60	40	50	40	40	30
75	55	45	55	65	55	65	50	75	45
65	40	60	30	40	40	50	40	80	40
70	35	60	40	70	70	65	35	80	20
75	30	70	40	60	40	60	35	80	35
80	40	60	60	70	60	60	60	60	65
75	70	70	60	65	70	55	60	60	60
65	75	60	60	60	65	60	55	60	65
60	65	70	50	60	65	70	60	70	60
60	45	60	40	60	60	65	30		

Joints

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
84	10	45	65	84	10	65	135	85	340
85	160	65	150	70	130	80	190	85	360
85	140	85	160	65	150	85	345	85	145
70	185	80	180	75	340	70	160	60	190
65	105	70	150	60	150	70	150	60	140
85	20	70	150	65	140	68	120	70	300
70	316	85	360	85	190	70	340	85	10
90	10	70	210	85	140	80	10	70	150
70	190	70	355	80	190	70	265	85	330
85	360	50	170	50	180	40	40	90	20
30	280	50	200	75	210	70	140	80	210
80	160	85	340	90	160	85	185	85	360
85	175	90	150	40	65	90	330	82	138
64	72	85	170	70	270	80	20	90	180
80	350	80	355						

Faults

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
50	125	80	295	80	95	85	120	85	100
45	110	66	5	85	160	80	220	75	225
80	240								

Quartz veins

DIP	DIP DIRECTION	DIP	DIP DIRECTION
40	70	65	50

Pegmatites

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
60	90	85	115	70	50	50	70	70	60
80	80	80	110	75	125	70	120	60	90
60	65	85	90	60	55	60	60	75	75
60	210	70	60	30	210	55	90	55	75
60	100	60	90	62	30	70	65	65	200
72	165								

Khao Dat Fa Granite

Axial Plane Foliations (S1)

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
85	260	85	255	85	90	45	85	80	95
40	70	50	80	40	70	50	65	35	65
80	280	85	82	60	270	55	90	65	85
20	100	50	80	50	75	35	80	50	285
80	85	75	85	60	280	55	85	55	90
45	85	40	100	30	85	40	65	20	70
80	80	40	120	35	80	60	80	50	85
40	75	60	110	40	85	45	70	50	75
80	80	25	105	80	250	55	90	50	85
30	90	30	80	35	75	40	65	55	100
75	75	70	85	70	80	50	80	60	90
50	85	35	70	35	70	80	85	30	280
85	80	70	90	50	85	45	90	40	80
60	70	30	65	40	70	90	280		

Joints

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
85	186	80	140	80	145	80	355	70	360
80	355	10	160	85	30	80	180	80	140
70	110	30	15	80	190	85	130	80	200
85	115	75	360	85	340	40	290	85	30
50	340	60	280	85	80	85	280	30	100
85	205	70	350	75	185	75	350	75	5
35	110	80	85	85	40	75	130	80	180
80	340	50	320	85	185	80	225	85	250
80	20	70	355	80	330	70	330	80	235
80	280	80	160	80	320	80	350	50	100
85	155	85	270	75	5	80	345	80	355
70	350	85	300	80	360	85	355	80	295
70	75	80	345	70	190	80	180	80	190
85	340	75	340	85	350	85	355	70	5
80	165	70	350	70	320	70	120	70	145
83	35	85	185	80	175	70	185	80	345
70	10	80	345	85	290	85	20	85	350
75	320	10	250	80	310	40	20	80	270
80	180	80	330	80	240	50	240	70	105
80	340	85	225	75	155	85	170	80	110
75	285	70	360	70	280	85	325	80	345
80	40	70	140	85	160	85	180	80	155
80	340	50	325	70	340	83	20	80	245
85	340	75	165	85	360	85	180	80	180
90	185	50	205	80	90	85	285	50	40
85	95	75	105	80	150	70	160	75	160
85	10	50	345	85	320	55	200	50	110
80	60	80	115	80	170	75	185	85	75
80	210	50	40	70	20	80	330	80	85
90	310	85	170	80	320	70	160	50	140
40	140	60	80	85	330	50	240	90	230
80	140	85	245	35	20	70	155	80	345
50	140	80	345	90	95	40	20	40	80

Faults

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
90	95	40	20	40	60	50	30	65	350
40	25	85	170	60	100	50	160	70	60
40	130								

Quartz veins

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
85	80	80	95	85	118	65	282	85	320
80	320	85	75	50	360	50	35	30	15
90	85	85	90	55	300	10	315	40	70
40	65	60	95	80	90	80	270	25	65
40	40	30	55	30	40	70	205		

Pegmatites

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
75	200	80	320	40	125	80	180	65	90
80	220	70	15	40	170	35	275	85	325
10	260	60	205	80	100	60	125	40	150
85	85	20	50	40	50				

Khao Pret Granite

Joints

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
85	350	65	95	80	355	85	25	80	340
80	180	80	170	80	10	85	220	85	270
75	30	85	180	80	240	75	175	80	10
80	170	70	180	70	180	80	95	80	180
90	95	85	360	60	120	80	30	85	90
90	190	90	20	80	280	70	10	80	190
60	100	60	75	80	185	80	110	80	10
65	170	60	10	85	330	80	10	80	105
85	130	50	175	90	270	82	45	90	175
60	170	80	280	80	150	60	115	87	225
85	30	65	170	85	345	80	60	80	160
80	180	85	185						

Faults

DIP	DIP DIRECTION	DIP	DIP DIRECTION
65	150	55	115

Pegmatites

DIP	DIP DIRECTION	DIP	DIP DIRECTION	DIP	DIP DIRECTION
85	85	85	180	85	200

BIOGRAPHY

Mr. Suwith Kosuwan was born in Khon Kaen province, northeastern part of Thailand on October 20, 1962. He studied at Siriwitayakorn school for the pre university education in Nakhon Ratchasima province. He graduated with a B.Sc. degree in Geology from Khon Kaen University in 1984. He has been working as a field geologist at Geological Survey Division, Department of Mineral Resources since 1987.