

Appendix

Radiometric age data for Sumatra

A summary of K–Ar, Rb–Sr and Ar–Ar age data for which methods and locations are documented. The summary is updated from the compilations by McCourt *et al.* (1996; Supplementary

Publication), and the SEAgEs Database (2004) <http://www.gl.rhul.ac.uk/seasia>. Additional information kindly provided by Professors Robert Hall and Hervé Bellon.

Table A1. Radiometric age dates of volcanics and for the intrusion and cooling of plutons related to the Palaeozoic volcanism and plutonism in Sumatra

Lithology	Dating method	Age (Ma)	Reference
Granite clast, Cucut No. 1 well (source rock not identified)	K–Ar, ?	348 ± 10	Koning & Darmono (1984)
East Sumatra Plutonic Arc			
Kiri Well, Granite	Rb–Sr, ?	427 ± 42	Eubank & Makki (1981)
Kiri Well, Granite	Rb–Sr, ?	335 ± 43	Eubank & Makki (1981)
Setiti 4 well, Granite*	Rb–Sr, feldspar	298 ± 39	Katili (1973)
Idris No. 1 well	Rb–Sr, ?	295 ± 3	Koning & Darmono (1984)
Setiti 5 well Granite*	Rb–Sr, feldspar	276 ± 20	Katili (1973)
West Sumatra Volcanic and Plutonic Belt			
<i>VOLCANICS</i>			
Silungkang area, andesite	K–Ar, ?	248 ± 10	Nishimura <i>et al.</i> (1978)
<i>PLUTONS</i>			
Singkarak (Ombilin) Granite*	K–Ar, muscovite	287 ± 3.5	Hahn & Weber (1981b)
Singkarak (Ombilin) Granite	K–Ar, ?	277 ± 13	Suwarna <i>et al.</i> (2000)
Sibolga Granite	Rb–Sr, isochron	264 ± 6	Aspden <i>et al.</i> (1982b)
Sibolga Granite	Rb–Sr, ? whole rock	257 ± 24	Fontaine & Gafoer (1989)
Singkarak (Ombilin) Granite	Rb–Sr, muscovite	256 ± 6	Silitonga & Kastowo (1975)
Singkarak (Ombilin) Granite	K–Ar, ?	246 ± 7	Koning & Aulia (1985)
Sijunjung Granite	K–Ar, biotite	246 ± 12	Sato (1991)

*Suspected presence of deformation

Locations in Figs 5.1 & 6.1

Table A2. Radiometric age dates of volcanics and for the intrusion and cooling plutons related to the Triassic–Early Jurassic Plutonic Episode in Sumatra

Lithology	Dating method	Age (Ma)	Reference
<i>West Sumatra Plutonic Arc</i> (Eastern Province-type granites)			
Sibolga Granite	K–Ar, hornblende	219 ± 4	Hehuwat (1976)
Sibolga Granite	K–Ar, biotite	211 ± 5	Aspden <i>et al.</i> (1982b)
Sibolga Granite [†]	K–Ar, biotite	211 ± 3	Hehuwat (1976)
Sibolga Granite	K–Ar, biotite	206 ± 3	Fontaine & Gafoer (1989)
Sibolga Granite [†]	K–Ar, biotite	206 ± 2	Fontaine & Gafoer (1989)
Sibolga satellite Granite	K–Ar, biotite	217 ± 4	Fontaine & Gafoer (1989)
Sibolga satellite Granite	K–Ar, biotite	212 ± 3	Fontaine & Gafoer (1989)
Sumpur Granite [†]	Rb–Sr, feldspar	216	Hehuwat (1976)
Sumpur Granite [†]	Rb–Sr, biotite	215	Hehuwat (1976)
Sumpur Granite [†]	K–Ar, biotite	215 ± 3	Hahn & Weber (1981b)
Tantan-Dusunbaru Granite	K–Ar, feldspar	209 ± 3	Fontaine & Gafoer (1989)
Tantan-Dusunbaru Granite	K–Ar, amphibole	201 ± 5	Fontaine & Gafoer (1989)
Tantan-Dusunbaru Granite	K–Ar whole rock	199 ± 4	Fontaine & Gafoer (1989)
Singkarak Granite	K–Ar, biotite	206 ± 3	Fontaine & Gafoer (1989)
SE Padangsimpuan [†]	K–Ar, biotite	202 ± 2	Wikarno <i>et al.</i> (1993)
Sulit Air Diorite	K–Ar, biotite	203 ± 6	McCourt & Cobbing (1993)
Sulit Air (98/8) no plateau	⁴⁰ Ar/ ³⁹ Ar, hornblende	193 ± 4	Imtihanah (2000)
Sulit Air (98/7) steps 1050–1175°C	⁴⁰ Ar/ ³⁹ Ar, hornblende	192 ± 0.4	Imtihanah (2000)
Sulit Air Diorite	K–Ar, hornblende	183 ± 13	McCourt & Cobbing (1993)
Sulit Air Diorite	K–Ar, hornblende/biotite	149 ± 5	McCourt & Cobbing (1993)
Padang Ganting Granite (Sulit Air)	K–Ar, ?	149 ± 3	Koning & Aulia (1985)

(continued)

Table A4. Continued

Lithology	Dating method	Age (Ma)	Reference
Atar (Sulit Air) Granodiorite	K–Ar, biotite	147 ± 2	Hahn & Weber (1981b)
Sulit Air Diorite	K–Ar, hornblende/biotite	141 ± 5	McCourt & Cobbing (1993)
Sulit Air Diorite	K–Ar, hornblende	138 ± 3	McCourt & Cobbing (1993)
(Main Range Province type granites)			
Sijunjung Granite	K–Ar, hornblende, biotite	206 ± 3	Silitonga & Kastowo (1975)
Muarasipongi Granite	K–Ar, biotite	197 ± 2	Rock <i>et al.</i> (1983)
<i>Medial Sumatra Tectonic Zone</i> (Main Range Province granites)			
Kayumambang Granite	K–Ar, biotite	198 ± 2	Schwartz <i>et al.</i> (1987)
Sungai Isahan Granite-greisen	K–Ar, muscovite	197 ± 2	Schwartz <i>et al.</i> (1987)
Sungai Isahan Granite-greisen	K–Ar, muscovite	193 ± 2	Schwartz <i>et al.</i> (1987)
Rokan Granite*	K–Ar, biotite	189 ± 2	Rock <i>et al.</i> (1983)
Rokan Granite*	K–Ar, biotite	186 ± 2	Rock <i>et al.</i> (1983)
<i>East Sumatra, Indosinian Foreland</i> (Main Range Province granites)			
Idris No. 1 well, Granite	K–Ar, muscovite	208 ± 7	Koning & Darmono (1984)
Idris No. 1 well, Granite	K–Ar, albite	206 ± 8	Koning & Darmono (1984)
Idris No. 1 well	K–Ar, albite	206 ± 8	Koning & Darmono (1984)
Beruk NE No. 4 well	K–Ar, ?	203 ± 4	Koning & Darmono (1984)
Garnet-muscovite-tourmaline microgranite			
<i>Indosinian Collision Zone in Riau Archipelago, Bangka and Billiton</i> (Main Range & Eastern Province granites)			
Penangas-Belinyu Granite, Bangka	Rb–Sr, isochron	252 ± 8	Cobbing <i>et al.</i> (1992)
Belinyu Granite, Bangka	Rb–Sr, isochron	251 ± 10	Cobbing <i>et al.</i> (1992)
East Bintang Granite, Bintan	Rb–Sr, isochron	229 ± 7	Cobbing <i>et al.</i> (1992)
Lagoi Granite, Bintan	Rb–Sr, isochron	226 ± 8	Cobbing <i>et al.</i> (1992)
Toboali Granite, Bangka	Rb–Sr, isochron	225 ± 9	Cobbing <i>et al.</i> (1992)
Pading Granite, Bangka	Rb–Sr, isochron	223 ± 16	Cobbing <i>et al.</i> (1992)
Menumbing Granite, Bangka	Rb–Sr, biotite	217 ± 5	Priem & Bon (1982)
Menumbing Granite, Bangka	Rb–Sr, whole rock	217 ± 5	Priem & Bon (1982)
Tanjong Pandang Granite, Belitung	Rb–Sr, isochron	216 ± 3	Cobbing <i>et al.</i> (1992)
Parangbuloh Granite 2sp, Belitung	K–Ar, biotite	216 ± 6	Priem & Bon (1982)
Parangbuloh Granite, Belitung	Rb–Sr, biotite	216 ± 6	Priem & Bon (1982)
Parangbuloh Granite, Belitung	Rb–Sr whole rock	216 ± 6	Priem & Bon (1982)
Kelapa Granite, Bangka	K–Ar, biotite	216 ± 6	Priem & Bon (1982)
Kelapa Granite, Bangka	Rb–Sr, biotite	215 ± 5	Priem & Bon (1982)
Kelapa Granite, Bangka	Rb–Sr whole rock	215 ± 5	Priem & Bon (1982)
Menumbing Granite, Bangka	K–Ar, biotite	214 ± 6	Priem & Bon (1982)
Menumbing Granite, Bangka	Rb–Sr isochron	200 ± 4	Cobbing <i>et al.</i> (1992)
Permisan Granite, Bangka	Rb–Sr isochron	213 ± 4	Cobbing <i>et al.</i> (1992)
Pemali Megacrystic Granite, Bangka	Rb–Sr errorchron	211 ± 3	Schwartz & Surjono (1991)
Pemali Granite, Bangka	K–Ar, biotites	159 – 95	Schwartz <i>et al.</i> (1995)
Parangbuloh Granite, Belitung	Rb–Sr, biotite	206 ± 6	Priem & Bon (1982)
Tikus Granite greisen Belitung	K–Ar, muscovite	200 ± 6	Jones <i>et al.</i> (1977)
B. Pancur Granite greisen Belitung	K–Ar, muscovite	195 ± 6	Jones <i>et al.</i> (1977)
Dabo Granite, Singkep	Rb–Sr, 'errorchron'	193 ± 12	Cobbing <i>et al.</i> (1992)

*Deformation suspected.

[†]Location of sample point uncertain.

Locations in Figs 5.1, 5.2 & in references.

Table A3. Radiometric age dates of volcanics and for the intrusion and cooling of plutons related to the Mesozoic Volcanic and Plutonic Episodes and Phases in Sumatra

Lithology	Dating method	Age (Ma)	Reference
Mid Jurassic–Lower Cretaceous Volcanic and Plutonic Episode (180–129 Ma)			
<i>VOLCANICS</i>			
Tanjung Siantu, metabasalt, Belitung	K–Ar, whole rock*	181 ± 5	Priem <i>et al.</i> (1975)
Palangki, andesite	K–Ar, ?	143 ± 4	Koning & Aulia (1985)
Silungkang area, andesite	K–Ar, ?	140 ± 10	Suwarna <i>et al.</i> (2000)
Gumai Mts, basic volcanic	K–Ar, ?	122 ± 4	Gafoer <i>et al.</i> (1992c)
Lembak A1 well, andesite	K–Ar, ?	121 ± 2	Pulunggono & Cameron (1984)
<i>PLUTONS</i>			
Kayumambang Granite	K–Ar, whole rock	180 ± 7	Simandjuntak <i>et al.</i> (1991)
Kayumambang Granite	K–Ar, biotite	124 ± 5	Andi Mangga <i>et al.</i> (2000)

(continued)

Table A4. Continued

Lithology	Dating method	Age (Ma)	Reference
Kayumabang Granite	K–Ar, biotite	123 ± 1	Andi Mangga <i>et al.</i> (2000)
Beruk NE No. 2 muscovite-tourmaline granite	K–Ar, ?	179 ± 5	Koning & Darmono (1984)
Lubuk Terap Granite	K–Ar, ?	175 ± 5	Koning & Aulia (1985)
Bungo Batholith Granite	K–Ar, biotite	169 ± 5	McCourt & Cobbing (1993)
Bungo Batholith Granodiorite	K–Ar, hornblende	156 ± 6	McCourt & Cobbing (1993)
Bungo Batholith Granodiorite	K–Ar, hornblende	154 ± 7	McCourt & Cobbing (1993)
Bungo Batholith Granite	K–Ar, biotite	153 ± 4	McCourt & Cobbing (1993)
Bungo Batholith Quartz diorite	K–Ar, biotite	148 ± 4	McCourt & Cobbing (1993)
Bungo Batholith Quartz diorite	K–Ar, hornblende	131 ± 7	McCourt & Cobbing (1993)
Bungo Batholith Granite	K–Ar, biotite	129 ± 4	McCourt & Cobbing (1993)
Berhala Island, gabbro	K–Ar, ?	167	Katili (1973)
S. Salai Porphyritic Granite [†]	K–Ar, whole rock	166 ± 3	Suwarna <i>et al.</i> (1991)
Tebingtinggi 1 well, Granite	K–Ar, ? whole rock	160 ± 3	Anon (1983)
Duabelas Mts. Granite	K–Ar, ?biotite	159 ± 6	Simandjuntak <i>et al.</i> (1991)
Muarasipongi Granite	Rb–Sr, isochron	158 ± 23	Beddoe-Stephens <i>et al.</i> (1987)
Kluang Utara-49 well Granite	K–Ar, ?	153 ± 5	Pulunggono <i>et al.</i> (1992)
Way Sulan Gabbro	K–Ar, hornblende	151 ± 4	McCourt & Cobbing (1993; map)
Bungsu-1 well Granite, Beruk	K–Ar, muscovite	150 ± 2	Koning & Darmono (1984)
Tanjung Laban-1 well Granite	K–Ar, ?	149 ± 4	Pulunggono <i>et al.</i> (1992)
Sibolga satellite Granite	K–Ar, biotite	147 ± 2	Aspden <i>et al.</i> (1982b)
Tanjung Gadang Granite	Rb–Sr, ?	145 ± 4	Pulunggono & Cameron (1984)
Sibolga satellite Granite	K–Ar, hornblende	144 ± 2	Aspden <i>et al.</i> (1982b)
S. Mentaus, Porphyritic Granite [†]	K–Ar, whole rock	144 ± 3	Suwarna <i>et al.</i> (1991)
S. Muara, Porphyritic Granite Tigapuluh Mts.	K–Ar, whole rock	135 ± 3	Suwarna <i>et al.</i> (1991)
Kiri Granite*	K–Ar, ?	134 ± 1	Eubank & Makki (1981)
S. Manggajahan Biotite Granite	K–Ar, whole rock	128 ± 3	JICA (1990)
Pakning No. 1 well, Granite	K–Ar, muscovite	122 ± 2	Eubank & Makki (1981)
Panyabungan Batholith	K–Ar, biotite	121 ± 1	Rock <i>et al.</i> (1983)
Late Cretaceous Volcanic and Plutonic Episode (120–75 Ma)			
<i>VOLCANICS</i>			
Lubuk Paruku, tuff	K–Ar, ?	105 ± 3	Koning & Aulia (1985)
Tambak Baru Volcanic Unit	K–Ar, whole rock	78.4 ± 2.5	Wajzer <i>et al.</i> (1991)
Gumai area, andesite	K–Ar, ?	78 ± 3	Suwarna <i>et al.</i> (2000)
Palepat area, andesite	K–Ar, ?	75 ± 1	Suwarna <i>et al.</i> (2000)
<i>PLUTONS</i>			
Gunung Mang Diorite, Belitung	K–Ar, whole rock	120 ± 4	Priem <i>et al.</i> (1975)
Tanjung Gadang	K–Ar, ?	118 ± 4	Koning & Aulia (1985)
Garba Pluton Monzodiorite	K–Ar, biotite	117 ± 3	McCourt & Cobbing (1993)
Garba Pluton Monzodiorite	K–Ar, biotite	115 ± 4	McCourt & Cobbing (1993)
Garba Pluton Monzogabbro*	K–Ar, hornblende	104 ± 3	McCourt & Cobbing (1993)
Garba Pluton Monzogabbro*	K–Ar, biotite ?	100 ± 3	McCourt & Cobbing (1993)
Garba Pluton	? K–Ar, biotite	89 ± 2	Pulunggono <i>et al.</i> (1992)
Garba Pluton Granite	K–Ar, biotite	86 ± 3	McCourt & Cobbing (1993)
Garba Pluton Monzogranite	K–Ar, biotite	82 ± 3	McCourt & Cobbing (1993)
Garba Pluton Granite	K–Ar, biotite	80 ± 1	Pulunggono <i>et al.</i> (1992)
Gumai Mts Diorite	K–Ar, ?	116 ± 3	Gafoer <i>et al.</i> (1992c)
Sulan Pluton Tonalite	K–Ar, biotite	113 ± 3	McCourt & Cobbing (1993)
Sulan Pluton Granodiorite	K–Ar, biotite	111 ± 3	McCourt & Cobbing (1993)
Lassi Granite	Rb–Sr, biotite ?	112 ± 24	Katili (1962)
Guntung No. 1 well Granite	K–Ar, muscovite	112 ± 2	Eubank & Makki (1981)
Sibolga satellite granite	K–Ar, biotite	105 ± 1	Hehuwat (1976)
Idris No. 1 Granite	K–Ar, microcline	101 ± 4	Koning & Darmono (1984)
Palepat Granite [†]	K–Ar, ?	100 ± 1	Suwarna <i>et al.</i> (2000)
Seumayam Complex granodiorite	K–Ar, biotite	99 ± 4	Kallagher (1990)
Susoh intrusion	K–Ar, ?	98 ± 2	McCourt & Cobbing (1993, map)
Sikuleh Granite	K–Ar, mean of 2 biotite & 1 hornblende determination	98 ± 1	Bennett <i>et al.</i> (1981b)
Well 100 km NW Pekanbaru, Granite	Rb–Sr, ?	95 ± 3	Eubank & Makki (1981)
Ulai (Sontang) Granite	K–Ar, biotite	89.6	Rock <i>et al.</i> (1983)
Aroguru foliated diorite	K–Ar, biotite	89 ± 3	McCourt & Cobbing (1993)
Lampung Granite	Rb–Sr, 4 determinations on biotite & muscovite	88	Katili (1973)
Manunggal Granite	K–Ar, K-feldspar	87.0	Kanao <i>et al.</i> (1971)
Branti Granodiorite	K–Ar, biotite	86 ± 3	McCourt & Cobbing (1993)

(continued)

Table A4. Continued

Lithology	Dating method	Age (Ma)	Reference
Batu Madingding Diorite	K–Ar, whole rock	85 ± 4	Wajzer <i>et al.</i> (1991)
Padean Granite	K–Ar, muscovite	84.7 ± 3.6	McCourt & Cobbing (1993)
Padean Pluton Microdiorite	K–Ar, muscovite (2 dets.)	82 ± 2	McCourt & Cobbing (1993)
Padean Monzogranite	K–Ar, biotite	82 ± 3	McCourt & Cobbing (1993)
Padean Monzogranite	K–Ar, biotite	82 ± 2	McCourt & Cobbing (1993)
Padean Monzogranite	K–Ar, biotite	81 ± 2	McCourt & Cobbing (1993)
Padean Granite	K–Ar, muscovite	79 ± 2	McCourt & Cobbing (1993)
Senawar Quartz Diorite	K–Ar, whole rock	83.6 ± 4.2	JICA (1988)
Hatapang Granite	Rb–Sr, isochron	80 ± 1	Clarke & Beddoe-Stephens (1987)
Sibolga satellite granite	K–Ar, biotite	75 ± 1	Hehuwat (1976)

*Deformed sample.

†Location of sampling point uncertain.

Locations on Fig 5.1 & in references.

Table A4. Radiometric age dates of volcanics and for the intrusion and cooling of plutons related to the Tertiary Volcanic Episodes and Phases in Sumatra

Lithology	Dating method	Age (Ma)	Reference
PALAEOCENE VOLCANIC EPISODE (65–50 Ma)			
<i>VOLCANICS</i>			
Basalt tuff, Bentaro Volcanic Formation (LM 116A)	⁴⁰ K– ⁴⁰ Ar	51.3 ± 1.5	Bellon <i>et al.</i> (2004)
Basalt dyke in Lhoong Formation (LM 124)	⁴⁰ K– ⁴⁰ Ar	55.5 ± 1.5	Bellon <i>et al.</i> (2004)
Basalt flow, SW of Banda Aceh (LM 118)	⁴⁰ K– ⁴⁰ Ar	57.9 ± 1.4	Bellon <i>et al.</i> (2004)
Basalt dyke in Bentaro Volcanic Formation	⁴⁰ K– ⁴⁰ Ar	63.1 ± 1.5	Bellon <i>et al.</i> (2004),
Basalt dyke, Natal area (SU 49)	⁴⁰ K– ⁴⁰ Ar	52.1 ± 1.2	Bellon <i>et al.</i> (2004)
Andesite dyke in Woyla Group, Batang Natal (NL 41)	⁴⁰ K– ⁴⁰ Ar	59.6 ± 1.4	Bellon <i>et al.</i> (2004)
Basalt dyke, Tambak Baru Volcanics (NL 40)	⁴⁰ K– ⁴⁰ Ar	62.5 ± 1.4	Bellon <i>et al.</i> (2004)
Gabbro dyke in Silungkang Formation (RDC 11)	⁴⁰ K– ⁴⁰ Ar	62.9 ± 1.5	Bellon <i>et al.</i> (2004)
Basalt flow, Silungkang Formation (RDC 13A2)	⁴⁰ K– ⁴⁰ Ar	63.1 ± 1.5	Bellon <i>et al.</i> (2004)
Basalt flow, Silungkang Formation (RDC 13A1)	⁴⁰ K– ⁴⁰ Ar	63.7 ± 1.5	Bellon <i>et al.</i> (2004)
Andesite, Gunung Dempu	K–Ar, whole rock?	63.3 ± 1.9	Amin <i>et al.</i> (1994b)
Basalt, Garba Mountains	K–Ar, whole rock?	60.3	Gafoer <i>et al.</i> (1994)
Tuff, Tamiang 2-well	K–Ar, ?whole rock	55	De Coster (1974)
<i>PLUTONS</i>			
Padangpanjang	K–Ar, biotite, mean 2 dets.	63.6 ± 3.2	Sato (1991)
Jatibaru microgranite	K–Ar, biotite	62 ± 3	McCourt & Cobbing (1993)
Jatibaru microgranite	K–Ar, biotite	56 ± 3	McCourt & Cobbing (1993)
Well in N Sumatra Basin, Granite	Rb–Sr, ?	58	Wikarno <i>et al.</i> (1993)
Lassi Pluton gabbro	K–Ar, hornblende	57 ± 2	McCourt & Cobbing (1993)
Lassi Pluton biotite tonalite	K–Ar, biotite mean 2 dets	56.2 ± 2.8	Sato (1991)
Lassi Pluton (98/3) Steps 1100–1250°C	⁴⁰ Ar/ ³⁹ Ar, hornblende	56.06 ± 0.19	Imtihanah (2000)
Lassi Pluton quartz diorite	K–Ar, biotite	55 ± 2	McCourt & Cobbing (1993)
Lassi Pluton (98/2)	Rb–Sr, biotite	55.02 ± 0.7	Imtihanah (2000)
Lassi Pluton (98/2) Steps 1100–1300°C	⁴⁰ Ar/ ³⁹ Ar, biotite	54.78 ± 0.10	Imtihanah (2000)
Lassi Pluton diorite	K–Ar, hornblende	54 ± 2	McCourt & Cobbing (1993)
Lassi Pluton granite	K–Ar, biotite	53 ± 2	McCourt & Cobbing (1993)
Lassi Pluton quartz diorite	K–Ar, biotite	53 ± 2	McCourt & Cobbing (1993)
Lassi Pluton (98/4)	Rb/Sr, biotite	52.2 ± 0.7	Imtihanah (2000)
Lassi microdiorite	K–Ar, ?	52 ± 1.6	Koning & Aulia (1985)
Lassi Pluton (98/1) 750–900°C steps	⁴⁰ Ar/ ³⁹ Ar, K-feldspar	~48.5	Imtihanah (2000)
Meulaboh-Meuko granodiorite	K–Ar, biotite	56.2 ± 2.2	Kallagher (1990)
Meulaboh-Meuko granodiorite	K–Ar, biotite	53.2 ± 3.3	Kallagher (1990)
Granite in well in N Sumatra Basin	K–Ar, biotite	56 ± 1	Hehuwat (1976)
Bungo Batholith quartz diorite	K–Ar, hornblende	54 ± 2	McCourt & Cobbing (1993)
Bungo Batholith quartz diorite	K–Ar, biotite	54 ± 2	McCourt & Cobbing (1993)
Nagan granodiorite	K–Ar, biotite	54.4 ± 0.5	Kusnama <i>et al.</i> (1993b)
Nagan granodiorite	K–Ar, mafic	53.5 ± 0.9	Kusnama <i>et al.</i> (1993b)
Nagan granodiorite	K–Ar, biotite	51.5 ± 0.7	Kusnama <i>et al.</i> (1993b)
Bukit Raja Pluton	K–Ar, ?	54.1 ± 2.7	JICA (1988)
Bukit Raja Pluton	K–Ar, ?	51.9 ± 2.6	JICA (1988)
Ulai (Sopan) granite	K–Ar, biotite	52.2	Hahn & Weber (1991b)
Ulai (Panti) pegmatitic granodiorite	K–Ar, biotite	52.4 ± 0	Kanao <i>et al.</i> (1971)
Ulai granodiorite	K–Ar, biotite	47.7	Rock <i>et al.</i> (1983)
Samadua granite	K–Ar, biotite	52 ± 1	Cameron <i>et al.</i> (1982b)

(continued)

Table A4. Continued

Lithology	Dating method	Age (Ma)	Reference
Samadua (Tapaktuan) granite	K–Ar, biotite	51 ± 1	Cameron <i>et al.</i> (1982b)
Batang Natal microdiorite dyke	K–Ar, whole rock	49.5 ± 2.5	Wajzer (1986)
Sibubung granite	K–Ar, ?	50.9 ± 1	Wikarno <i>et al.</i> (1993)
Well in N Sumatra Basin	K–Ar, biotite	50 ± 1.2	Hehuwat (1976)
Gle Seukeun Complex granodiorite	K–Ar, hornblende	50 ± 1	Van Leeuwen <i>et al.</i> (1987)
Gle Seukeun Complex granodiorite	K–Ar, biotite	47.2 ± 0.7	Van Leeuwen <i>et al.</i> (1987)
Gle Seukeun Complex hb diorite	K–Ar, hornblende	47.6 ± 1.0	Van Leeuwen <i>et al.</i> (1987)
Gle Seukeun Complex	K–Ar, mean of analyses of a hornblende and a biotite	42 ± 3	Bennett <i>et al.</i> (1981a)
Granite in well 100 km NW Pakanbaru	K–Ar, ?	45 ± 1	Eubank & Makki (1981)
LATE MID-EOCENE VOLCANIC EPISODE (c. 46–40 Ma)			
<i>VOLCANICS</i>			
Andesite dyke, Langsat Volcanic Formation (NL 36)	⁴⁰ K– ⁴⁰ Ar	41.1 ± 0.9	Bellon <i>et al.</i> (2004)
Basalt dyke, Indarung Calcareous Formation (RDC 20)	⁴⁰ K– ⁴⁰ Ar	45.8 ± 1.1	Bellon <i>et al.</i> (2004)
Shoshonite dyke, Tanjungkarang area (PCE 13)	⁴⁰ K– ⁴⁰ Ar	43.5 ± 1	Bellon <i>et al.</i> (2004)
<i>PLUTONS</i>			
*Gabbro in ophiolite, P. Simeulue	K–Ar, whole rock	40.1 ± 2.7	Kallagher (1990)
*Gabbro in ophiolite, P. Simeulue	K–Ar, whole rock	35.4 ± 3.6	Kallagher (1990)
S. Tuboh Quartz Monzonite	K–Ar, ?	40.1 ± 2.0	JICA (1988)
Andesite dyke in Sikumbu Fm	K–Ar, whole rock	40.1 ± 1.6	Wajzer (1986)
Andesite dyke in Sikumbu Fm	K–Ar, whole rock	37.6 ± 1.3	Wajzer (1986)
LATE EOCENE–LATE OLIGOCENE VOLCANIC EPISODE (c. 38–24 Ma)			
Late Eocene–Early Oligocene phase (c. 35–30 Ma)			
<i>VOLCANICS</i>			
Basaltic andesite dyke, Blang Pidie, Tapaktuan (TT 148)	⁴⁰ K– ⁴⁰ Ar	31.6 ± 0.85	Bellon <i>et al.</i> (2004)
Basalt dyke, Langsat village, Natal area (NL 37)	⁴⁰ K– ⁴⁰ Ar	37.4 ± 0.9	Bellon <i>et al.</i> (2004)
Basalt dyke in Silungkang Formation (RDC 13)	⁴⁰ K– ⁴⁰ Ar	37.3 ± 1	Bellon <i>et al.</i> (2004)
<i>PLUTONS</i>			
Air Bangis Granite	K–Ar, hornblende	29.7 ± 1.6	Wajzer (1986)
Air Bangis Granite	K–Ar, whole rock	28.2 ± 1.2	Wajzer (1986)
Late Oligocene–Early Miocene phase			
<i>VOLCANICS</i>			
Basalt dyke in Woyla Group north of Tapaktuan (TT 144)	⁴⁰ K– ⁴⁰ Ar	26.9 ± 0.72	Bellon <i>et al.</i> (2004)
Basalt flow, Painan Formation (PN 26)	⁴⁰ K– ⁴⁰ Ar	23.7 ± 0.55	Bellon <i>et al.</i> (2004)
Andesite dyke in Painan Formation (TP 34)	⁴⁰ K– ⁴⁰ Ar	24.3 ± 0.60	Bellon <i>et al.</i> (2004)
Dacite dyke in Painan Formation (TP 33)	⁴⁰ K– ⁴⁰ Ar	25.5 ± 0.59	Bellon <i>et al.</i> (2004)
<i>PLUTONS</i>			
Way Bambang Granite	K–Ar, biotite + hornblende	19.8 ± 0.8	McCourt & Cobbing (1993)
Way Bambang Granite	duplicate Ar	20.1 ± 0.7	McCourt & Cobbing (1993)
Way Bambang Granite	K–Ar, biotite + hornblende	18.7 ± 1.9	McCourt & Cobbing (1993)
Raya Diorite	K–Ar, hornblende, mean of 6 dets.	18.9 ± 1.2	Bennett <i>et al.</i> (1981a)
LATE EARLY MIOCENE–MID-MIOCENE VOLCANIC EPISODE (22–8 Ma)			
<i>VOLCANICS</i>			
Late Early Miocene volcanic phase (c. 22–14 Ma)			
Basalt block in Indrapuri melange, Banda Aceh (IP 113)	⁴⁰ K– ⁴⁰ Ar	18.8 ± 0.49	Bellon <i>et al.</i> (2004)
Basalt dyke in Lhoong Formation (LM 126)	⁴⁰ K– ⁴⁰ Ar	14.5 ± 1.17	Bellon <i>et al.</i> (2004)
Basalt flow, in Calang Volcanic Formation (CL 140)	⁴⁰ K– ⁴⁰ Ar	21.4 ± 0.59	Bellon <i>et al.</i> (2004)
Andesite dyke, Calang area (CL 135C)	⁴⁰ K– ⁴⁰ Ar	21.1 ± 0.60	Bellon <i>et al.</i> (2004)
Andesite dyke, Calang area (GB 15)	⁴⁰ Kr– ⁴⁰ Ar	18.7 ± 0.44	Bellon <i>et al.</i> (2004)
Basalt dyke in Tangla Formation (CL 135B)	⁴⁰ K– ⁴⁰ Ar	18.8 ± 0.59	Bellon <i>et al.</i> (2004)
Basalt flow in Calang Volcanic Formation (CL 141A)	⁴⁰ K– ⁴⁰ Ar	18.8 ± 0.45	Bellon <i>et al.</i> (2004)
Andesite dyke in Calang Volcanic Formation (CL 132)	⁴⁰ K– ⁴⁰ Ar	18.3 ± 0.44	Bellon <i>et al.</i> (2004)
Basalt, Sayeung Volcanic Formation	K–Ar, whole rock	17.7 ± 0.7	Kallagher (1990)
Andesite dyke, Calang area (CL 136)	⁴⁰ K– ⁴⁰ Ar	17.5 ± 0.42	Bellon <i>et al.</i> (2004)
Basalt, Sayeung Volcanic Formation	K–Ar, whole rock	17.1 ± 0.9	Kallagher (1990)
Basalt dyke, Sayeung Volcanic Formation	K–Ar, whole rock	16.4 ± 0.6	Kallagher (1990)
Basalt, Sayeung Volcanic Formation	K–Ar, whole rock	16.1 ± 3.9	Kallagher (1990)
Basalt dyke, Sayeung Volcanic Formation	K–Ar, whole rock	15.9 ± 1.0	Kallagher (1990)
Basaltic andesite dyke, Calang Volcanic Formation (CL 131)	⁴⁰ K– ⁴⁰ Ar	15.0 ± 0.38	Bellon <i>et al.</i> (2004)
Basalt, Sayeung Volcanic Formation	K–Ar, whole rock	13.7 ± 2.7	Kallagher (1990)
Andesite dyke in Barus Formation, Sibolga (SB 27B)	⁴⁰ K– ⁴⁰ Ar	19.6 ± 0.58	Bellon <i>et al.</i> (2004)
Andesite flow in Angkola Volcanic Formation (SB 85)	⁴⁰ K– ⁴⁰ Ar	18.2 ± 0.45	Bellon <i>et al.</i> (2004)
Andesite dyke in Angkola Volcanic Formation (SB 84)	⁴⁰ K– ⁴⁰ Ar	16.8 ± 0.47	Bellon <i>et al.</i> (2004)
Andesite dyke in Angkola Volcanic Formation (SB 83)	⁴⁰ K– ⁴⁰ Ar	16.8 ± 0.39	Bellon <i>et al.</i> (2004)
Andesite, P. Musala	K–Ar, whole rock	17.2 ± 5	Aspden <i>et al.</i> (1982b)

(continued)

Table A4. Continued

Lithology	Dating method	Age (Ma)	Reference
Basalt meta-tuff, Simpang Gambir, Natal area (NL 42)	$^{40}\text{K}-^{40}\text{Ar}$	19.7 ± 0.48	Bellon et al. (2004)
Absarokite in Sikarara Volcanic Formation (NL 34)	$^{40}\text{K}-^{40}\text{Ar}$	18.2 ± 0.44	Bellon et al. (2004)
Andesite, Sarik Lawas	K-Ar, ?	22 ± 1.5	Koning & Aulia (1985)
Andesite flow in Painan Formation (PN 31)	$^{40}\text{K}-^{40}\text{Ar}$	19.2 ± 0.54	Bellon et al. (2004)
Andesite flow in Painan Formation (PN 22)	$^{40}\text{K}-^{40}\text{Ar}$	19.1 ± 0.45	Bellon et al. (2004)
Basalt flow in Painan Formation (PN 24)	$^{40}\text{K}-^{40}\text{Ar}$	19.0 ± 0.45	Bellon et al. (2004)
Basalt lava or tuff?, well N Pekanbaru	?KAr	17.5	Eubank & Makki (1981)
Andesite flow in Painan Formation (TP 32)	$^{40}\text{K}-^{40}\text{Ar}$	14.3 ± 0.34	Bellon et al. (2004)
Andesite flow, Bukit Sulap, Bengkulu (BSU 170)	$^{40}\text{K}-^{40}\text{Ar}$	16.5 ± 0.38	Bellon et al. (2004)
Andesite in Hulusimpang Formation (MN 116)	$^{40}\text{K}-^{40}\text{Ar}$	13.2 ± 0.43	Bellon et al. (2004)
Rhyolite dyke in Hulusimpang Formation (MN 118)	$^{40}\text{K}-^{40}\text{Ar}$	12.8 ± 0.31	Bellon et al. (2004)
Basaltic andesite dyke in Hulusimpang Formation (MN 117)	$^{40}\text{K}-^{40}\text{Ar}$	12.8 ± 0.38	Bellon et al. (2004)
Rhyolite tuff in (?)Tarahan Formation (TR 33)	$^{40}\text{K}-^{40}\text{Ar}$	19.7 ± 0.47	Bellon et al. (2004)
Basalt dyke in Sulan batholith (WS 5)	$^{40}\text{K}-^{40}\text{Ar}$	17.1 ± 0.44	Bellon et al. (2004)
Andesite dyke in Hulusimpang Formation (SMK 40)	$^{40}\text{K}-^{40}\text{Ar}$	16.9 ± 0.44	Bellon et al. (2004)
Basalt dyke in Hulusimpang Formation (SMK 39)	$^{40}\text{K}-^{40}\text{Ar}$	15.1 ± 0.38	Bellon et al. (2004)
Dacite flow in Sabu Formation (PCE 9A)	$^{40}\text{K}-^{40}\text{Ar}$	14.4 ± 0.35	Bellon et al. (2004)
Middle Miocene Volcanic Phase (c. 12–8 Ma)			
Basalt, Alem Fm	K-Ar, whole rock	11.2 ± 0.7	Kallagher (1990)
Basalt, Alem Fm	K-Ar, whole rock	10.3 ± 0.4	Kallagher (1990)
Basalt dyke, Alem Fm	K-Ar, whole rock	8.74 ± 0.82	Kallagher (1990)
Basalt dyke in Hulusimpang Formation (SMK 37)	$^{40}\text{K}-^{40}\text{Ar}$	10.9 ± 0.43	Bellon et al. (2004)
PLUTONS			
Granite, SE Padang	K-Ar	16 ± 0.7	Wikarno et al. (1993)
Lolo Pluton (98/13)	Rb-Sr, biotite	15.12 ± 0.18	Imtihanah (2000)
Lolo Pluton (98/13) Steps 900–1150°C	$^{40}\text{Ar}/^{39}\text{Ar}$, biotite	15.06 ± 0.13	Imtihanah (2000)
Lolo granodiorite	K-Ar, hornblende	11 ± 1	McCourt & Cobbing (1993)
Lolo Pluton (98/11) Steps 1100–1175°C	$^{40}\text{Ar}/^{39}\text{Ar}$, hornblende	9.0 ± 0.1	Imtihanah (2000)
Lolo Pluton (98/9)	Rb-Sr, biotite	7.89 ± 0.1	Imtihanah (2000)
Lolo Pluton (98/11)	Rb-Sr, biotite	6.03 ± 0.07	Imtihanah (2000)
Lolo Pluton (98/10)	Rb-Sr, biotite	5.82 ± 0.07	Imtihanah (2000)
Lolo Pluton (98/9) Steps 800–1250°C	$^{40}\text{Ar}/^{39}\text{Ar}$, biotite	5.81 ± 0.13	Imtihanah (2000)
Lolo Pluton (98/10) Steps 900–1100°C	$^{40}\text{Ar}/^{39}\text{Ar}$, biotite	5.8 ± 0.1	Imtihanah (2000)
Lolo Pluton (98/11) Steps 1100–1200°C	$^{40}\text{Ar}/^{39}\text{Ar}$, biotite	5.66 ± 0.04	Imtihanah (2000)
Lolo Pluton	K-Ar, biotite	5 ± 0.2	McCourt & Cobbing (1993)
Lolo Pluton (98/9) no plateau	$^{40}\text{Ar}/^{39}\text{Ar}$, plagioclase	4.67 ± 0.1	Imtihanah (2000)
Geunteut granodiorite	K-Ar, biotite, mean of 3 analyses	14.3 ± 1	Bennett et al. (1981a)
Tangse stock, quartz diorite porphyry	K-Ar, hornblende	13.1 ± 0.25	Van Leeuwen et al. (1987)
Tangse stock, dacite porphyry	K-Ar, hornblende	9.97 ± 0.50	Van Leeuwen et al. (1987)
Timbahan granite	K-Ar, hornblende	13.0 ± 0.5	Aspden et al. (1982b)
Medan granite	K-Ar, whole rock	12 ± 1	Hehuwat (1976)
Diorite in well in N Sumatra Basin	K-Ar, hornblende	12.1 ± 0.5	Wikarno et al. (1993)
Sigalagala granite	K-Ar, whole rock	11 ± 0.6	Hehuwat (1976)
Air Bangis granite	K-Ar, whole rock	10.4 ± 0.9	Wajzer (1986)
Granodiorite in well in N Sumatra Basin	K-Ar, biotite	9.77 ± 0.7	Wikarno et al. (1993)
Sigalagala granite	K-Ar, biotite	9.1 ± 2	Hehuwat (1976)
Lampung granite	K-Ar, biotite	8 ± 0.1	Hehuwat (1976)
Binail microdiorite	K-Ar, biotite	8.5	Rock et al. (1983)
Granite in well near Baturaja	K-Ar, biotite	7.9 ± 0.2	Hehuwat (1976)
LATE MIOCENE-PLIOCENE VOLCANIC EPISODE (6–1.6 Ma)			
VOLCANICS			
Andesite flow, Lam Teuba Volcanics (UB 110)	$^{40}\text{K}-^{40}\text{Ar}$	1.76 ± 0.06	Bellon et al. (2004)
Diorite dyke in Bohorok Formation (PR 61) near Parapat, Lake Toba	$^{40}\text{K}-^{40}\text{Ar}$	5.66 ± 0.14	Bellon et al. (2004)
Andesite flow in Haranggoal Formation (PR 70)	$^{40}\text{K}-^{40}\text{Ar}$	2.88 ± 0.07	Bellon et al. (2004)
Andesite flow in Sibayak Complex (BR 104)	$^{40}\text{K}-^{40}\text{Ar}$	2.09 ± 0.29	Bellon et al. (2004)
Basalt dyke in Sipiso-piso lava dome (PR 101B)	$^{40}\text{K}-^{40}\text{Ar}$	1.89 ± 0.23	Bellon et al. (2004)
Andesite flow in Angkola Formation, Sibolga (SB 28)	$^{40}\text{K}-^{40}\text{Ar}$	5.35 ± 0.23	Bellon et al. (2004)
Andesite, Suliki	K-Ar, ?	5.4 ± 0.3	Koning & Aulia (1985)
Basaltic andesite flow, Merapi volcano area (PY 82)	$^{40}\text{K}-^{40}\text{Ar}$	2.99 ± 0.08	Bellon et al. (2004)
Andesite flow, north border of Lake Maninjau (MNJ 55)	$^{40}\text{K}-^{40}\text{Ar}$	1.76 ± 0.05	Bellon et al. (2004)
Basalt flow in Bal Formation east of Bengkulu (BN 111)	$^{40}\text{K}-^{40}\text{Ar}$	6.45 ± 0.2	Bellon et al. (2004)
Basaltic andesite flow in Bal Formation (KP137)	$^{40}\text{K}-^{40}\text{Ar}$	5.40 ± 0.14	Bellon et al. (2004)
	$^{40}\text{K}-^{40}\text{Ar}$	5.47 ± 0.14	Bellon et al. (2004)
Basalt dyke, boulder in Gumai mountains (LH 173)	$^{40}\text{K}-^{40}\text{Ar}$	5.21 ± 0.5	Bellon et al. (2004)
Basaltic andesite flow in Pliocene volcanic	$^{40}\text{K}-^{40}\text{Ar}$	4.23 ± 0.15	Bellon et al. (2004)

(continued)

Table A5. Continued

Lithology	Dating method	Age (Ma)	Reference
Formation, NW of Curup (CR 145)			
Andesite dyke in Air Benakat Formation (LH 178)	$^{40}\text{K}-^{40}\text{Ar}$	2.91 ± 0.09	Bellon et al. (2004)
Basaltic andesite dyke in Lemau Formation (BS 129)	$^{40}\text{K}-^{40}\text{Ar}$	2.41 ± 0.08	Bellon et al. (2004)
Andesite, Gunung Batu	K-Ar	4.76 ± 0.32	Gafoer et al. (1992c)
Andesite flow in ?Lakitan Formation (PC 16)	$^{40}\text{K}-^{40}\text{Ar}$	4.93 ± 0.13	Bellon et al. (2004)
PLUTONS			
Langkup Granodiorite (*?)	K-Ar, hornblende	3.48 ± 0.5	Kusnama et al. (1993b)
Sungeipenuh, no plateau	$^{40}\text{Ar}/^{39}\text{Ar}$, biotite	~5.5	Imtihanah (2000)
Sungaipenuh granitoid*	K-Ar, ?biotite, mean 2 dets.	3.5	Kusnama et al. (1993b)
Granite in well N Sumatra Basin	K-Ar, plagioclase	2.5 ± 1	Hehuwat (1976)

*Suspected deformation age.

†Location of sample position uncertain.

Locations on Figs 5.1, 8.4–8.7 & details in references.

Table A5. Radiometric dates of deformed and metamorphosed rocks from Sumatra

Unit	Method	Age (Ma)	Reference
Beruk NE No. 1 well micaceous material in shears in brecciated quartzite	K-Ar, mica	276 ± 10	Koning & Darmono (1984)
INDOSINIAN OROGENY			
Berembang well, phyllite	K-Ar, muscovite	251 ± 10	Katili (1973)
Berembang well, phyllite	K-Ar, feldspar	247 ± 10	Katili (1973)
90 km NNW Pakanbaru, 'quartzite'	K-Ar, ?	222 ± 3	Eubank & Makki (1981)
Talawi, hornfels (?contact metamorphism)	K-Ar, ?	154 ± 5	Koning & Aulia (1985)
BENTARO-SALING ARCS COLLISION			
Beruk NE No. 4 hornfelsed argillite	K-Ar, muscovite	123 ± 6	Koning & Darmono (1984)
Tanjungan amphibolite	K-Ar, amphibole	125 ± 5	Andi Mangga et al. (1994a)
Tanjungan amphibolite	K-Ar, amphibole	115 ± 6	Andi Mangga et al. (1994a)
Tanjungan amphibolite	K-Ar, amphibole	108 ± 5	Andi Mangga et al. (1994a)
Beruk NE No. 3 well argillite	K-Ar, ?	116 ± 5	Koning & Darmono (1984)
S. Mundaran, schist	K-Ar, ?	95 ± 3	Koning & Aulia (1985)
Early Eocene event			
Beruk No. 2 well, shale	K-Ar, ?	54.5 ± 0.6	Koning & Darmono (1984)