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# APPENDIX A

*"Petrology and multi-mineral fingerprinting of modern sand generated from a dissected magmatic arc (Lhasa River, Tibet)"*

by Eduardo Garzanti, Wei An, Xiumian Hu, Mara Limonta, Giovanni Vezzoli and Jiangang Wang

## A1 - Forward compositional modelling

Terrigenous sediments are complex mixtures of single detrital minerals and rock fragments supplied in various proportions by numerous different end-member sources (e.g., rivers) to successive segments of a sediment-routing system. If the compositional signature of detritus in each end-member source is known accurately, then the relative contributions from each source to the total sediment load can be quantified mathematically with forward mixing models (Draper and Smith 1981; Weltje, 1997). Several assumptions are made to derive a forward model from a series of compositions (Weltje and Prins 2003): 1) the order of the compositional variables or categories is irrelevant (permutation invariance); 2) the observed compositional variation reflects linear mixing or an analogous process with a superposed measurement error; 3) end-member compositions are fixed; 4) end-member compositions are as close as possible to observed compositions.

### 1. Compositional data

Geological data are often presented in percentages that represent relative contributions of the single variables to a whole (i.e. closed data; Chayes, 1971). This means that the relevant information is contained only in the ratios between variables of the data (i.e., compositions; Pawlowsky-Glahn and Egozcue, 2006). Compositional data are by definition vectors in which each variable (component) is positive, and all components sum to a constant $c$, which is usually chosen as 1 or 100.

The sample space for compositional data with $D$ variables is not the real space $R^D$, but the simplex $S^D$ (Aitchison, 1986)

$$(1) \qquad S^D = \left\{ x = [x_1, x_2, \ldots, x_D]; \qquad x_i > 0; \qquad i = 1, 2, \ldots, D; \qquad \sum_{i=1}^{D} x_i = c \right\}.$$

Pearson (1897) first highlighted problems that arise with the analysis of such compositional datasets. The obvious and natural properties of compositional data are in fact in contradiction with most methods of standard multivariate statistics. Principal-component analysis, for instance, may lead to questionable results if directly applied to compositional data. In order to perform standard statistics, a family of logratio transformations from the simplex to the standard Euclidean space were introduced (Aitchison, 1986; Egozcue et al., 2003; Buccianti et al., 2006).

## 2. The mixing model

The forward mixing model (regression model) stipulates a linear relationship between a dependent variable (also called a response variable) and a set of explanatory variables (also called independent variables, or covariates). The relationship is stochastic, in the sense that the model is not exact, but subject to random variation, as expressed in an error term (also called disturbance term).

Let $y$ be the row vector of compositional data with $D$ columns representing variables, $X$ a matrix of end-member compositions with $n$ rows representing observations and $D$ columns representing variables, and $\beta$ a row vector of coefficients with $q = n$ columns representing the proportional contribution of the end members to the observation. In matrix notation, a forward mixing model can be expressed as

$$(2) \qquad y = \beta X + e.$$

The row vector $y$ consists of a non-negative linear combination $\beta$ of $q$ end-member compositions, and $e$ is the row vector of errors with $D$ columns representing variables.

In order to solve the linear-regression problem, we must determine an estimation of the row vector $\beta$ describing a functional linear relation $b$ between a matrix of end-member compositions $X$ and an output row vector $y$. The solution of equation (2) consists in the calculation of the row vector of coefficients $b$ such that

(3) $$\hat{y} = bX,$$

where $\hat{y}$ is a row vector of calculated compositional data with $D$ columns representing variables. This equation represents a forward mixing model (or "perfect mixing"). The model parameters are subject to the following non-negativity and constant-sum constraints

(4) $$\sum_{k=1}^{q} b_k = 1, \qquad b_k \geq 0,$$

(5) $$\sum_{j=1}^{D} x_{kj} = 1, \qquad x_{kj} \geq 0.$$

It follows from equations (4) and (5) that

(6) $$\sum_{j=1}^{D} \hat{y}_j = c, \qquad \hat{y}_j \geq 0,$$

and thus

(7) $$\sum_{j=1}^{D} e_j = 0.$$

The goodness of fit of the forward mixing model can be assessed by the coefficient of multiple correlation $R$

(8) $$R = \sqrt{1-(RSS/TSS)},$$

where $RSS$ is the residual sum of squares

(9) $$RSS = \sum_i (y_i - \hat{y}_i)^2,$$

and $TSS$ is the total sum of squares

(10) $$TSS = \sum_i (y_i - \bar{y})^2.$$

The coefficient $R$ departs from a decomposition of the total sum of squares into the “explained” sum of squares (the sum of squares of predicted values, in deviations from the mean) and the residual sum of squares. $R$ is a measure of the extent to which the total variation of the dependent variable is explained by the forward model. The $R$ statistic takes on a value between 0 and 1. A value of $R$ close to 1, suggesting that the model explains well the variation in the dependent variable, is obviously important if one wishes to use the model for predictive or forecasting purposes. In provenance studies, the coefficient of multiple correlation $R$ measures the similarity between theoretical detrital modes of sediments supplied by different combinations of diverse end-members sources and the observed detrital mode of one trunk-river sediment or sedimentary rock in the basin.

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# A2 - TABLE AND FIGURE CAPTIONS

**Table A1. Sample location.** Location of the studied sediment samples (see also the Google Earth file *Lhasariver.kmz*).

**Table A2. Sand petrography.** GSZ= median grain size determined in thin section by ranking and visual comparison with in-house standards. Q= quartz (Qp= polycrystalline); F= feldspars (KF= K-feldspar; P= plagioclase; Mic= cross-hatched microcline); L= aphanitic lithic grains (Lvf= felsic volcanic and subvolcanic; Lvm= intermediate and mafic volcanic; Lc= carbonate; Lh= chert; Lp= shale/siltstone; Lms= low-rank metasedimentary; Lmv= low-rank metavolcanic; Lmf= medium/high-rank metapelite/metapsammite/metafelsite; Lmb= medium/high-rank metabasite; Lu= ultramafic). HM= heavy minerals. The Metamorphic Indices MI and MI* express the average metamorphic rank of rock fragments in each sample. MI varies from 0 (detritus shed by exclusively sedimentary and volcanic cover rocks) to 500 (very-high-rank detritus shed by exclusively high-grade basement rocks). MI* considers only metamorphic rock fragments, and thus varies from 100 (very-low-rank detritus shed by exclusively very low-grade metamorphic rocks) to 500 (Garzanti and Vezzoli, 2003). QFL, QPK LmLvLs parameters after Dickinson and Suczek (1979; Ingersoll, 1983).

**Table A3. Heavy minerals.** HM= heavy minerals; tHM= transparent heavy minerals; HMC and tHMC = total and transparent-heavy-mineral concentration indices (Garzanti and Andò, 2007); n.d. = not determined. The ZTR index (sum of zircon, tourmaline and rutile over total transparent heavy minerals) evaluates the "chemical durability" of the detrital assemblage (Hubert 1962). The HCI (Hornblende Colour Index) and MMI (Metasedimentary Minerals Index) vary from 0 in detritus from greenschist-facies to lowermost amphibolite-facies rocks yielding exclusively blue/green amphibole and chloritoid, to 100 in detritus from granulite-facies rocks yielding exclusively brown hornblende and sillimanite, and are used to estimate the average metamorphic grade of metaigneous and metasedimentary source rocks, respectively (Andò et al. 2014).

**Table A4.** Detrital zircon U-Pb geochronology.

**Table A5.** Hf isotope signatures of zircon grains.

**Table A6.** Trace-element data on detrital apatite

**Table A7.** Sm and Nd isotope signatures of apatite grains

**Table A8.** Geochemistry of detrital rutile

**Table A9.** Geochemistry of detrital garnet

**Table A10.** Geochemistry of detrital monazite

**Table A11.** Raman-spectroscopy data on detrital amphiboles, pyroxenes, and epidote-group minerals.

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# A3 - U-Pb age data of intrusive and volcanic rocks in the Lhasa Block

by Wei An

| No. | Location | Rock-type | Sample | Method | Age (Ma) | 1σ | Reference |
|---|---|---|---|---|---|---|---|
| | **NORTHERN LHASA** | | | | | | |
| 1 | N 32°30.06′ E 82°26.72' | Monzogranite | YH15-1 | LA-ICP MS | 110.1 | 0.7 | Zhu et al., 2011 |
| 2 | N 32°21.18' E 82°26.86' | Rhyolite | YH22-4 | LA-ICP MS | 110.6 | 0.6 | Zhu et al., 2011 |
| 3 | N 32°17.97' E 82°33.16' | Andesite | YH06-3 | LA-ICP MS | 131.2 | 1.4 | Zhu et al., 2011 |
| 4 | N 32°17.08' E 82°32.86' | Andesite | YH04-2 | LA-ICP MS | 116.7 | 1.2 | Zhu et al., 2011 |
| 5 | N 32°16.32' E 82°31.39' | Rhyolite | YH01-2 | LA-ICP MS | 109 | 1 | Zhu et al., 2011 |
| 6 | N 31°56.75' E 92°09.33' | Granodiorite porphyry | NR18-1 | LA-ICP MS | 110.4 | 0.7 | Zhu et al., 2011 |
| 7 | N 31°47.36' E 92°04.10' | Monzogranite | NQ16-1 | LA-ICP MS | 117.5 | 0.7 | Zhu et al., 2011 |
| 8 | N 31°45.97' E 92°37.40' | Monzogranite | NQ09-1 | LA-ICP MS | 110.7 | 0.8 | Zhu et al., 2011 |
| 9 | N 31°28.80' E 92°06.43' | Andesite | NQ12-10 | LA-ICP MS | 110.8 | 0.6 | Zhu et al., 2011 |
| 10 | N 31°02.86' E 91°41.45' | Syenogranite | 08DX21 | LA-ICP MS | 110.7 | 0.6 | Zhu et al., 2011 |
| 11 | N 30°59.60' E 92°33.34' | Monzogranite | SB01-2 | LA-ICP MS | 118.4 | 0.5 | Zhu et al., 2011 |
| 12 | N 31°19.70' E 88°54.89' | Dacite | DG05-1 | LA-ICP MS | 114.3 | 0.6 | Zhu et al., 2011 |
| 13 | N 31°50.63' E 87°05.25' | Dacite | NM01-1 | LA-ICP MS | 111.9 | 0.9 | Zhu et al., 2011 |
| 14 | N 31°14.45' E 90°43.33' | Andesite | BG17-1 | LA-ICP MS | 122.1 | 0.9 | Chen et al., 2010 |
| 15 | N 31°34.01' E 91°25.81' | Granodiorite porphyry | BG02-1 | LA-ICP MS | 114.6 | 0.8 | Zhang et al., 2010 |
| 16 | N 31°34.01' E 91°25.81' | Andesite porphyry | BG02-6 | LA-ICP MS | 113.6 | 0.7 | Zhang et al., 2010 |

| No. | Location | Rock-type | Sample | Method | Age (Ma) | 1σ | Reference |
|---|---|---|---|---|---|---|---|
| | **CENTRAL LHASA** | | | | | | |
| 30 | Coqin-Dajia Co segment | diorite | | SHRIMP | 49.9 | 0.9 | Wen et al., 2008 |
| 5 | W. Nyainqentanglha | tonalitic gneiss | | SHRIMP | 58.5 | 0.7 | Hu et al., 2003 |
| 6 | W. Nyainqentanglha | quartz dioritic gneiss | | SHRIMP | 63.5 | 0.8 | Hu et al., 2003 |
| 14 | Nyainqentanglha mountain | granitoid | | SHRIMP | 88 | 3 | Kapp et al., 2005 |
| 17 | N30°04.515, E92°09.248′ | Granodiorite | MB12-1 | LA-ICP-MS | 88.3 | 0.5 | Meng et al., 2010 |
| 15 | Nyainqentanglha mountain | granitoid | | SHRIMP | 98 | 4 | Kapp et al., 2005 |
| 38 | South of Gar | Andesite | SQ0666 | LA-ICPMS | 102 | 1 | Zhu et al., 2009a |
| 36 | Eyang section | Dacite | SZ52 | LA-ICPMS | 107 | 1 | Zhao et al., unpub. |
| 37 | East of Dawa Tso | Monzogranite | DX19-1 | LA-ICPMS | 107 | 1 | Zhou et al., 2008 |
| 47 | (S. of Zhari Nam Tso) | Diorite | NX5-3 | LA-ICPMS | 108 | 1 | Zhu et al., 2009a |
| 46 | West of Nixiong | Granodiorite | NX5-2 | LA-ICPMS | 109 | 1 | Zhu et al., 2009a |
| 71 | N30°45.960, E88°54.080′ | Dacite | SZ07-1 | LA-ICP-MS | 110.9 | 0.5 | Zhu et al., 2011 |
| 35 | Eyang section | Andesite | SZ48 | LA-ICPMS | 111 | 1 | Zhao et al., unpub. |
| 43 | SW of Coqen | Rhyolite | DX21-1 | LA-ICPMS | 111 | 1 | Zhu et al., 2009a |
| 50 | SE of Shenza | Diorite | SZ08-1 | LA-ICPMS | 111 | 1 | Zhu et al., 2009a |
| 52 | Southeast of Shenza | Dacite | SZ07-1 | LA-ICPMS | 111 | 1 | Zhu et al., 2009a |
| 44 | North of Daxiong | Rhyolite | DXL1-3 | LA-ICPMS | 112 | 1 | Zhu et al., 2009a |
| 49 | South of Shenza | Dacite | SZ10-1 | LA-ICPMS | 112 | 1 | Zhu et al., 2009a |
| 70 | N30°53.400, E88°39.740′ | Dacite | SZ10-1 | LA-ICP-MS | 112.1 | 0.4 | Zhu et al., 2011 |
| 21 | south of Coqin | granite | | SHRIMP | 113 | 4 | Murphy et al., 1997 |
| 25 | S.Coqen | granitoid | | SHRIMP | 113 | 4 | Schwab et al., 2004 |
| 51 | SE of Shenza | Granodiorite | SZ08-3 | LA-ICPMS | 113 | 1 | Zhu et al., 2009a |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 69 | N31°13.570, E88°07.610′ | Dacite | GRC03-2 | LA-ICP-MS | 113.8 | 0.5 | Zhu et al., 2011 |
| 68 | N31°03.980, E88°12.410′ | Dacite | GRC02-1 | LA-ICP-MS | 114 | 0.7 | Zhu et al., 2011 |
| 19 | Xiongba area | granite | | SHRIMP | 116 | 2 | Miller et al., 2000 |
| 20 | Bangba area | granitoid | | SHRIMP | 116 | 2 | Miller et al., 2000 |
| 48 | West of Nixiong | Granodiorite | GB-8 | SHRIMP | 116 | 1 | Zhu et al., 2009a |
| 23 | Xungba | granodiorite | | SHRIMP | 116.2 | 2.4 | Schwab et al., 2004 |
| 72 | Southeast of Shenza | Dacite | SZ01-1 | SHRIMP | 117 | 1 | Zhu et al., unpub. |
| 18 | Xiongba area | granite | | SHRIMP | 120 | 2 | Miller et al., 1999 |
| 42 | North of Daxiong | Dacite | DX13-1 | LA-ICPMS | 121 | 1 | Zhu et al., 2009a |
| 66 | N30°56.343, E84°34.281′ | Monzogranite | 08CQ35 | LA-ICP-MS | 122.6 | 0.8 | Zhu et al., 2011 |
| 13 | Nyainqentanglha mountain | granitoid | | SHRIMP | 125 | 3 | Kapp et al., 2005 |
| 33 | Eyang section | Granite porphyry | SZ39 | LA-ICPMS | 125 | 1 | Zhao et al., unpuB. |
| 45 | North of Bangdo | Rhyolite | CMN04-2 | LA-ICPMS | 125 | 1 | Zhu et al., 2009a |
| 2 | Yangbajin | two-mica granite | | SHRIMP | 126 | 2 | Ding et al., 2003 |
| 7 | Near Shiquan river | granitoid | | SHRIMP | 126 | 3 | Kapp et al., 2003 |
| 11 | Nyainqentanglha mountain | granitoid | | SHRIMP | 126 | 5 | Kapp et al., 2005 |
| 24 | Lonzi-La | granite | | SHRIMP | 126 | 3 | Schwab et al., 2004 |
| 1 | Yangbajin | two-mica granite | | SHRIMP | 128 | 2 | Ding et al., 2003 |
| 34 | Eyang section | Rhyolite | SZ43 | LA-ICPMS | 129 | 1 | Zhao et al., unpub. |
| 40 | East of Xiongba | Rhyolite | GJ0612 | LA-ICPMS | 129 | 1 | Zhu et al., 2009a |
| 67 | N30°06.067, E92°19.557′ | Monzogranite | MB05-7 | LA-ICP-MS | 129.9 | 1 | Zhu et al., 2011 |
| 10 | Nyainqentanglha mountain | granitoid | | SHRIMP | 130 | 4 | Kapp et al., 2005 |
| 41 | NW of Daxiong | Dacite | DX2-1 | LA-ICPMS | 130 | 1 | Zhu et al., 2009a |
| 64 | N31°41.533, E82°09.996′ | Rhyolitic breccia | 08YR14 | LA-ICP-MS | 133.8 | 1.1 | Zhu et al., 2011 |
| 63 | N31°43.812, E82°09.182′ | Tonalite | 08YR11 | LA-ICP-MS | 134.3 | 1.7 | Zhu et al., 2011 |
| 28 | South of Coqin | granitoid | | SHRIMP | 137 | 3 | Volkmer et al., 2007 |
| 3 | Yangbajin | two-mica granite | | SHRIMP | 138 | 2 | Ding et al., 2003 |
| 12 | Nyainqentanglha mountain | granitoid | | SHRIMP | 140 | 3 | Kapp et al., 2005 |
| 65 | N31°40.816, E82°10.550′ | Rhyolite | 08YR16 | LA-ICP-MS | 142.9 | 1 | Zhu et al., 2011 |
| 39 | East of Xiongba | Rhyolite | GJ0611 | LA-ICPMS | 143 | 2 | Zhu et al., 2009a |
| 29 | South of Coqin | granitoid | | SHRIMP | 144 | 6 | Volkmer et al., 2007 |
| 8 | Nyainqentanglha mountain | granitoid | | SHRIMP | 145 | 3 | Kapp et al., 2005 |
| 59 | N31°48.182, E82°08.403′ | Rhyolite | 08YR07 | LA-ICP-MS | 146.1 | 0.8 | Zhu et al., 2011 |
| 61 | N30°38.753, E85°07.825′ | Syenogranite | MD01-1 | LA-ICP-MS | 152.9 | 1.1 | Zhu et al., 2011 |
| 22 | south of Coqin | granodiorite | | SHRIMP | 153 | 6 | Murphy et al., 1997 |
| 27 | South of Coqin | granitoid | | SHRIMP | 153 | 6 | Volkmer et al., 2007 |
| 62 | N30°09.218, E92°19.407′ | Tonalite | MB01-1 | LA-ICP-MS | 154 | 0.8 | Zhu et al., 2011 |
| 26 | South of Coqin | granitoid | | SHRIMP | 158 | 6 | Volkmer et al., 2007 |
| 60 | N31°47.398, E82°08.426′ | Dacite | 08YR09 | LA-ICP-MS | 159.8 | 0.7 | Zhu et al., 2011 |
| 9 | Nyainqentanglha mountain | granitoid | | SHRIMP | 181 | 6 | Kapp et al., 2005 |
| 58 | N29°59.940, E93°04.652′ | Monzogranite | JD08-1 | LA-ICP-MS | 182.9 | 1.1 | Zhu et al., 2011 |
| 16 | Ningzhong | two-mica granite | | SHRIMP | 193 | 7 | Liu Q. et al., 2006 |
| 57 | N30°01.247, E92°57.690′ | Granodiorite | JD12-1 | LA-ICP-MS | 193.2 | 1.3 | Zhu et al., 2011 |
| 56 | N29°59.083, E91°54.358′ | Syenogranite | MB22-1 | LA-ICP-MS | 194.9 | 1.1 | Zhu et al., 2011 |
| 32 | North of Nanmulin | granodiorite | T457 | LA-ICP-MS | 202 | 1 | Zhang et al., 2007b |
| 31 | North of Nanmulin | two-mica granite | T450 | LA-ICP-MS | 205 | 1 | Zhang et al., 2007b |
| 53 | N30°05.080, E89°07.000′ | Two-mica granite | NML05-1 | LA-ICP-MS | 206 | 0.9 | Zhu et al., 2011 |
| 54 | N30°06.540, E89°09.460′ | Two-mica granite | NML06-1 | LA-ICP-MS | 206.5 | 2.8 | Zhu et al., 2011 |
| 4 | Menba | two-mica granite | | SHRIMP | 207.5 | 5.4 | He Z. et al., 2006a |
| 55 | N30°06.043, E92°13.768′ | Granodiorite | MB09-1 | LA-ICP-MS | 210.2 | 1.8 | Zhu et al., 2011 |

| **No.** | **Location** | **Rock-type** | **Sample** | **Method** | **Age (Ma)** | **1σ** | **Reference** |
|---|---|---|---|---|---|---|---|
| | **SOUTHERN LHASA** | | | | | | |
| 100 | Wuyu | granite | | SHRIMP | 188.1 | 1.4 | Chu et al., 2006 |
| 101 | Jiala valley, Dazi | rhyolite, Yeba Fm | | SHRIMP | 174.2 | 3.6 | Dong et al., 2006 |
| 102 | Qianggeren, Linzhou | granite | SH712032 | LA-ICP-MS | 51.9 | 2.5 | He S. et al., 2007 |
| 103 | Linzhou, Takala Fm | volcanic dike | SH522021 | LA-ICP-MS | 51.7 | 1.5 | He S. et al., 2007 |
| 104 | Linzhou, Takala Fm | volcanic dike | SH728032 | LA-ICP-MS | 52 | 1 | He S. et al., 2007 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 105 | Linzizhong Fm, Linzhou | rhyolite | SH530022 | LA-ICP-MS | 68.7 | 2.4 | He S. et al., 2007 |
| 106 | Linzizhong Fm, Linzhou | rhyolitic tuff | SH830034 | LA-ICP-MS | 62.6 | 2.4 | He S. et al., 2007 |
| 107 | Linzizhong Fm, Linzhou | lapilli tuff | SH831031 | LA-ICP-MS | 53.9 | 1.4 | He S. et al., 2007 |
| 108 | Linzizhong Fm, Linzhou | lapilli tuff | SH823034 | LA-ICP-MS | 47.1 | 1.2 | He S. et al., 2007 |
| 109 | North of Lhasa | Bi-monzogranite | 06FW101 | LA-ICP-MS | 64.7 | 1.1 | Ji et al., 2009 |
| 110 | North of Lhasa | Bi-monzogranite | 06FW104 | LA-ICP-MS | 64.4 | 0.9 | Ji et al., 2009 |
| 111 | Yangda | Bi-monzogranite | 06FW105 | LA-ICP-MS | 55.2 | 1.5 | Ji et al., 2009 |
| 112 | North of Gurong | Hb-Bi-granodiorite | 06FW108 | LA-ICP-MS | 56.8 | 0.7 | Ji et al., 2009 |
| 113 | Zhongduiguo | Bi-monzogranite | 06FW110 | LA-ICP-MS | 54.3 | 0.9 | Ji et al., 2009 |
| 114 | Caina | Hb-Bi-monzogranite | 06FW111 | LA-ICP-MS | 50.6 | 0.7 | Ji et al., 2009 |
| 115 | North of Caina | Hb-Bi-granodiorite | 06FW112 | LA-ICP-MS | 53.4 | 1 | Ji et al., 2009 |
| 116 | Niedang | Bi-monzogranite | 06FW118 | LA-ICP-MS | 51 | 0.7 | Ji et al., 2009 |
| 117 | Niedang | Bi-granodiorite | 06FW119 | LA-ICP-MS | 51.2 | 0.7 | Ji et al., 2009 |
| 118 | Niedang | Dioritic enclave | 06FW120 | LA-ICP-MS | 50.3 | 0.6 | Ji et al., 2009 |
| 119 | Niedang | Granitic dike | 06FW121 | LA-ICP-MS | 51.1 | 0.7 | Ji et al., 2009 |
| 120 | Nanmu Copper | Bi-monzogranite | 06FW123 | LA-ICP-MS | 17 | 0.9 | Ji et al., 2009 |
| 121 | Nanmu Copper | Granitic porphyrite | 06FW124 | LA-ICP-MS | 15.3 | 0.4 | Ji et al., 2009 |
| 122 | East of Nanmu Copper | Hb-Bi-monzogranite | 06FW125 | LA-ICP-MS | 17.7 | 0.6 | Ji et al., 2009 |
| 123 | Nanmu Power Station | Hb-granodiorite | 06FW126 | LA-ICP-MS | 55.3 | 1 | Ji et al., 2009 |
| 124 | Nanmu Power Station | Granitic dike | 06FW127 | LA-ICP-MS | 49.5 | 0.6 | Ji et al., 2009 |
| 125 | Nanmu Power Station | Dleritic dike | 06FW128 | LA-ICP-MS | 49.9 | 1 | Ji et al., 2009 |
| 126 | Nanmu | Hb-Bi-granodiorite | 06FW129 | LA-ICP-MS | 52.9 | 0.7 | Ji et al., 2009 |
| 127 | Jiangcun | Tonalitic gneiss | 06FW131 | LA-ICP-MS | 44 | 0.8 | Ji et al., 2009 |
| 128 | Galashan tunnel | Bi-Hb-monzonite | 06FW133 | LA-ICP-MS | 47.1 | 1 | Ji et al., 2009 |
| 129 | Galashan tunnel | Bi-monzogranite | 06FW134 | LA-ICP-MS | 41.9 | 0.6 | Ji et al., 2009 |
| 130 | East of Quxu | Qz monzonite | 06FW139 | LA-ICP-MS | 41.5 | 0.7 | Ji et al., 2009 |
| 131 | Badi | Bi-monzogranite | 06FW140 | LA-ICP-MS | 43.7 | 0.9 | Ji et al., 2009 |
| 132 | Baijin | Bi-monzogranite | 06FW142 | LA-ICP-MS | 21.3 | 0.6 | Ji et al., 2009 |
| 133 | Qupu | Gabbro | 06FW146 | LA-ICP-MS | 56.9 | 1.4 | Ji et al., 2009 |
| 134 | Northwest of Quxu | Bi-granodiorite | 06FW147 | LA-ICP-MS | 51.5 | 0.8 | Ji et al., 2009 |
| 135 | Northwest of Quxu | Syenogranitic dike | 06FW148 | LA-ICP-MS | 51.3 | 0.6 | Ji et al., 2009 |
| 136 | West of Quxu | Diorite | 06FW151 | LA-ICP-MS | 55.5 | 1.2 | Ji et al., 2009 |
| 137 | Northwest of Quxu | Hb-Bi-monzogranite | 06FW114 | LA-ICP-MS | 86.4 | 1.6 | Ji et al., 2009 |
| 138 | East of Qulin | Diorite | 06FW152-2 | LA-ICP-MS | 57.3 | 0.9 | Ji et al., 2009 |
| 139 | Angang | Bi-monzogranite | 06FW154 | LA-ICP-MS | 51.3 | 0.7 | Ji et al., 2009 |
| 140 | Angang Power Station | Bi-monzogranite | 06FW155 | LA-ICP-MS | 61.1 | 1.2 | Ji et al., 2009 |
| 141 | Kongdonglang | Bi-monzogranite | 06FW156 | LA-ICP-MS | 55.4 | 0.8 | Ji et al., 2009 |
| 142 | Southwest of Nymo | Bi-monzogranite | 06FW158 | LA-ICP-MS | 14.9 | 0.3 | Ji et al., 2009 |
| 143 | Chongjiang Copper | Monzogranite | 06FW159 | LA-ICP-MS | 15.3 | 0.2 | Ji et al., 2009 |
| 144 | Chongjiang Copper | Granitic porphyrite | 06FW160 | LA-ICP-MS | 13.7 | 0.3 | Ji et al., 2009 |
| 145 | Chongjiang Copper | Dioritic porphyrite | 06FW161 | LA-ICP-MS | 13.5 | 0.4 | Ji et al., 2009 |
| 146 | Karu | Hb-diorite | 06FW174 | LA-ICP-MS | 50.2 | 1.5 | Ji et al., 2009 |
| 147 | Karu | Hb-quartz-diorite | 06FW175 | LA-ICP-MS | 52.6 | 1.2 | Ji et al., 2009 |
| 148 | Nymo | Hb-diorite | 06FW176 | LA-ICP-MS | 53.6 | 1 | Ji et al., 2009 |
| 149 | Numa | Granodiorite | 06FW162 | LA-ICP-MS | 50.9 | 0.8 | Ji et al., 2009 |
| 150 | Numa | Monzogranite | 06FW163 | LA-ICP-MS | 48.2 | 0.7 | Ji et al., 2009 |
| 151 | Numa | Monzogranite | 06FW164 | LA-ICP-MS | 184.9 | 3.8 | Ji et al., 2009 |
| 152 | North of Numa | Granodioritic gneiss | 06FW165 | LA-ICP-MS | 194 | 3.5 | Ji et al., 2009 |
| 153 | North of Numa | Monzogranitic gneiss | 06FW166 | LA-ICP-MS | 205.3 | 3 | Ji et al., 2009 |
| 154 | North of Numa | Monzogranite | 06FW167 | LA-ICP-MS | 155.9 | 2.3 | Ji et al., 2009 |
| 155 | North of Numa | Hb-diorite | 06FW168 | LA-ICP-MS | 174.2 | 2.5 | Ji et al., 2009 |
| 156 | North of Numa | Syenogranitic dike | 06FW169 | LA-ICP-MS | 151.8 | 1.6 | Ji et al., 2009 |
| 157 | North of Dazhuka | Bi-Hb-diorite | 06FW170 | LA-ICP-MS | 108.6 | 1.5 | Ji et al., 2009 |
| 158 | Linzhou basin | dacitic breccia, Linzizong | | SHRIMP | 62.5 | 1.1 | Lee et al., 2007 |
| 159 | Zedong | alkali feldspar granite | | SHRIMP | 92.4 | 1.4 | McDermid et al., 2002 |
| 160 | Xiongcun | granodior. porphyry dike | XC5002 | SHRIMP | 179 | 2.5 | Qu et al., 2007 |
| 161 | Xiongcun | granodiorite porphyry | XC501 | SHRIMP | 175 | 2.5 | Qu et al., 2007 |
| 162 | Xiongcun | dacite porphyry | XX28 | SHRIMP | 195 | 2.3 | Qu et al., 2007 |
| 163 | Langxian | granitoid | | SHRIMP | 86 | 2 | Quidelleur et al., 1997 |
| 164 | Langxian | granitoid | | SHRIMP | 86 | 1 | Quidelleur et al., 1997 |

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|---|---|---|---|---|---|---|---|
| 165 | Langxian | granitoid | | SHRIMP | 101 | 1 | Quidelleur et al., 1997 |
| 166 | Langxian | granitoid | | SHRIMP | 90 | 7 | Quidelleur et al., 1997 |
| 167 | Langxian | granitoid | | SHRIMP | 82 | 1 | Quidelleur et al., 1997 |
| 168 | Langxian | granitoid | | SHRIMP | 83 | 1 | Quidelleur et al., 1997 |
| 169 | Langxian | granitoid | | SHRIMP | 84 | 3 | Quidelleur et al., 1997 |
| 170 | Langxian | granitoid | | SHRIMP | 96 | 3 | Quidelleur et al., 1997 |
| 171 | Langxian | granitoid | | SHRIMP | 68 | 4 | Quidelleur et al., 1997 |
| 172 | Nimu area | granitoid | | SHRIMP | 93 | 1 | Schwab et al., 2004 |
| 173 | Nimu area | granitoid | | SHRIMP | 94 | 1 | Schwab et al., 2004 |
| 174 | Linzhou basin | granitoid | | SHRIMP | 58.7 | 1.1 | Wang et al., 2007 |
| 175 | Xietongmen-Nanmulin | granodiorite | | SHRIMP | 50.7 | 1 | Wen et al., 2008 |
| 176 | Xietongmen-Nanmulin | granodiorite | | SHRIMP | 50.4 | 1.2 | Wen et al., 2008 |
| 177 | Xietongmen-Nanmulin | gabbro | | SHRIMP | 48.3 | 1.2 | Wen et al., 2008 |
| 178 | Xietongmen-Nanmulin | gabbro | | SHRIMP | 90.5 | 2.5 | Wen et al., 2008 |
| 179 | Dazhuka-Nimu | diorite | | SHRIMP | 94.1 | 2.4 | Wen et al., 2008 |
| 180 | Dazhuka-Nimu | diorite | | SHRIMP | 84.8 | 1.6 | Wen et al., 2008 |
| 181 | Dazhuka-Nimu | diorite | | SHRIMP | 85.2 | 1.4 | Wen et al., 2008 |
| 182 | Dazhuka-Nimu | diorite | | SHRIMP | 50.6 | 0.7 | Wen et al., 2008 |
| 183 | Dazhuka-Nimu | diorite | | SHRIMP | 102.2 | 2.4 | Wen et al., 2008 |
| 184 | Quxu-Lhasa | granodiorite | | SHRIMP | 50.7 | 1.9 | Wen et al., 2008 |
| 185 | Quxu-Lhasa | mafic enclave | | SHRIMP | 50 | 1.6 | Wen et al., 2008 |
| 186 | Quxu-Lhasa | gabbro | | SHRIMP | 52.7 | 1.4 | Wen et al., 2008 |
| 187 | Quxu-Lhasa | granodiorite | | SHRIMP | 46.4 | 1 | Wen et al., 2008 |
| 188 | Quxu-Lhasa | granite | | SHRIMP | 59.3 | 1.8 | Wen et al., 2008 |
| 189 | Sangyi-Zedong | granitoid | | SHRIMP | 89.3 | 2.5 | Wen et al., 2008 |
| 190 | Sangyi-Zedong | granitoid | | SHRIMP | 95 | 3.3 | Wen et al., 2008 |
| 191 | Sangyi-Zedong | granitoid | | SHRIMP | 64.6 | 2.5 | Wen et al., 2008 |
| 192 | Sangyi-Zedong | granitoid | | SHRIMP | 64 | 1.4 | Wen et al., 2008 |
| 193 | Sangyi-Zedong | granitoid | | SHRIMP | 60.1 | 1.4 | Wen et al., 2008 |
| 194 | Sangyi-Zedong | granitoid | | SHRIMP | 60.5 | 1.8 | Wen et al., 2008 |
| 195 | Langxian-Bayi | granodiorite | | SHRIMP | 103 | 1.6 | Wen et al., 2008 |
| 196 | Langxian-Bayi | granodiorite | | SHRIMP | 82.7 | 1.6 | Wen et al., 2008 |
| 197 | Langxian-Bayi | granodiorite | | SHRIMP | 80.4 | 1.1 | Wen et al., 2008 |
| 198 | Langxian-Bayi | calc-alkaline granite | | SHRIMP | 55 | 1.2 | Wen et al., 2008 |
| 199 | Gangrinboche region | granodiorite | | SHRIMP | 48.3 | 1.5 | Xia et al., 2007 |
| 200 | Dazi area | dacite, Yeba Fm | DZ07-4 | SHRIMP | 174.2 | 3.6 | Zhu et al., 2008 |
| 201 | E.Zedang | Andesite, Mamuxia Fm | MM01-1 | SHRIMP | 136.5 | 1.7 | Zhu et al., unpub. |
| 202 | N29°15.210, E91°58.530′ | Adakitic andesite | MM02-3 | LA-ICP-MS | 136.5 | 1.7 | Zhu et al., 2009b |
| 203 | N29°40.940, E93°18.733′ | Granodiorite | ML45-1 | LA-ICP-MS | 201.3 | 1.2 | Zhu et al., 2011 |
| 204 | N29°37.467, E93°18.417′ | Syenogranite | ML38-5 | LA-ICP-MS | 203.2 | 1.3 | Zhu et al., 2011 |
| 205 | N29°36.368, E93°19.277′ | Monzogranite | ML31-1 | LA-ICP-MS | 191.9 | 1.3 | Zhu et al., 2011 |
| 206 | N31°03.615, E82°11.630′ | Rhyolite | 08YR27 | LA-ICP-MS | 80.6 | 0.6 | Zhu et al., 2011 |
| 207 | N29°15.920, E90°24.700′ | Diorite | RGZ01-1 | LA-ICP-MS | 87.4 | 1 | Zhu et al., 2011 |
| 208 | N29°26.450, E89°05.670′ | Diorite | NML01-1 | LA-ICP-MS | 87.7 | 1.2 | Zhu et al., 2011 |
| 209 | N29°06.792, E93°27.117′ | Monzogranite | ML11-1 | LA-ICP-MS | 82.2 | 0.7 | Zhu et al., 2011 |
| 210 | N29°03.433, E93°22.813′ | Granodiorite | ML06-1 | LA-ICP-MS | 79.3 | 0.4 | Zhu et al., 2011 |
| 211 | N29°00.365, E93°18.907′ | Tonalite | ML01-1 | LA-ICP-MS | 84.2 | 1.1 | Zhu et al., 2011 |
| 212 | N31°00.524, E82°09.565′ | Andesite | 08YR28 | LA-ICP-MS | 50.8 | 0.4 | Zhu et al., 2011 |
| 213 | N30°58.128, E82°10.980′ | Dacite | 08YR29 | LA-ICP-MS | 61.2 | 1.5 | Zhu et al., 2011 |
| 214 | N30°53.926, E82°09.145′ | Monzogranite | 08YR30 | LA-ICP-MS | 54.2 | 0.5 | Zhu et al., 2011 |
| 215 | N30°08.213, E85°24.528′ | Diorite | 08CQ13 | LA-ICP-MS | 51.5 | 0.4 | Zhu et al., 2011 |
| 216 | N29°53.717, E85°44.454′ | Granodiorite porphyry | 08CQ09 | LA-ICP-MS | 50 | 0.4 | Zhu et al., 2011 |
| 217 | N29°46.881, E85°45.484′ | Monzogranite | 08CQ03 | LA-ICP-MS | 51.9 | 0.4 | Zhu et al., 2011 |
| 218 | N29°37.504, E85°44.605′ | Syenogranite | 08CQ02 | LA-ICP-MS | 43.9 | 0.3 | Zhu et al., 2011 |
| 219 | N29°37.348, E89°03.641′ | Diorite | NML03-1 | LA-ICP-MS | 62.4 | 0.3 | Zhu et al., 2011 |

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