

Table VI-5a. The compositions of average shale and its related materials (all in ppm, noted otherwise).

|           | Upper crust | Soils    |          | Loess     | River mud | Shale    |           | Hemipela-gic mud | Mica schist |
|-----------|-------------|----------|----------|-----------|-----------|----------|-----------|------------------|-------------|
|           | (1)         | Ave. (2) | SO-4 (3) | GSS-8 (3) | GSD-9 (3) | Ave. (4) | SCO-1 (3) | MAG-1 (3)        | SDC-1 (3)   |
| Ag-47     | 0.06        | 0.13     | +0.12    | 0.06      | 0.09      | 0.07     | +0.13     | 0.08             | 0.04        |
| Al-13 %   | 7.83        | 6.62     | 5.4      | 6.3       | 5.6       | 8.8 b    | 7.23      | 8.65             | 8.33        |
| As-33     | 1.6         | +11      | +7.4     | +13       | +8.4      | +13      | +12.4     | +9.2             | 0.22-       |
| Au-79 ppb | 2.3         | *1 b     | *0.6     | 1.4       | 1.3       | 2.5 w    | 2.1       | 2.4              | 1.2         |
| B-5       | 12          | +48      | +43      | +54       | +53       | +100     | +72       | +136             | 13-         |
| Ba-56     | 570         | 470      | 700      | 480       | 430       | 580      | 570       | 480              | 630         |
| Be-4      | 3.2         | 2        | *1.3     | 1.9       | 1.8       | 3        | 1.8       | 3.2              | 3           |
| Bi-83     | 0.054       | +0.37    | +0.14    | +0.3      | +0.42     | +0.43m   | +0.37     | +0.34            | 0.26-       |
| Br-35     | 2.1         | +5.4     | +5.2     | 2.6       | 1.5       | +20 w    | 1.0g      | +250             | 0.1-        |
| C-6 %     | 0.023       | +2.0 b   | +4.4     | +1.6      | +1.1      | +1.2     | +0.81     | +2.2             | 0.027-      |
| Ca-20 %   | 3.15        | *1.54    | *1.11    | 5.91      | 3.8       | *1.6     | 1.87      | *0.98            | 1           |
| Cd-48     | 0.1         | 0.1      | +0.34    | 0.13      | +0.26     | +0.3     | 0.14      | +0.2             | 0.08-       |
| Ce-58     | 58          | 68       | 54       | 66        | 78        | 82       | 62        | 88               | 93          |
| Cl-17     | 150         | 100 b    | *30      | *70       | *50       | 180      | *51       | +31000           | 32-         |
| Co-27     | 17          | 13       | 10       | 13        | 14        | 19       | 11        | 20               | 18          |
| Cr-24     | 69          | 61       | 64       | 68        | 85        | 90       | 68        | 97               | 64          |
| Cs-55     | 3.7         | +8.2     | 2.9      | +7.5      | 5.1       | 5        | +7.8      | +8.6             | 4           |
| Cu-29     | 39          | 23       | 21       | 24        | 32        | 45       | 29        | 30               | 30          |
| Dy-66     | 3.5         | 4.1      | 3.5      | 4.8       | 5.1       | 4.7      | 4.2       | 5.2              | 6.7         |
| Er-68     | 2           | 2.5      | 2.2      | 2.8       | 2.8       | 3        | 2.5       | 3                | 4.1         |
| Eu-63     | 1.1         | 1        | 0.97     | 1.2       | 1.3       | 1.2      | 1.2       | 1.6              | 1.7         |
| F-9       | 700         | 480      | *300     | 580       | 490       | 740      | 770       | 770              | 600         |
| Fe-26 %   | 4.17        | 2.94     | 2.37     | 3.1       | 3.4       | 4.72     | 3.59      | 4.75             | 5.36        |
| Ga-31     | 18          | 18       | 11       | 15        | 14        | 19       | 15        | 20               | 21          |
| Gd-64     | 3.9         | 4.6      | 3.9      | 5.4       | 5.5       | 5.1      | 4.6       | 5.8              | 7.2         |
| Ge-32     | 1.5         | 1.7      | 3.5?     | 1.3       | 1.3       | 1.6      | 1         |                  | 1.5         |
| Hf-72     | 4           | 7.7      | 8        | 7         | 9.7       | (5)      | 4.6       | 3.7              | 8.3         |
| Hg-80     | 0.08        | 0.065    | *0.032   | *0.017    | 0.083     | +0.18m   | 0.05      | *0.018?          | 0.023-      |
| Ho-67     | 0.74        | 0.87     | 0.8      | 0.97      | 0.96      | 1.1      | 0.97      | 1                | 1.5         |
| I-53      | 0.5         | +3.8     | +3       | +1.6      | 0.61      | +19 b    |           | +380             |             |
| In-49     | 0.05        | 0.07     | +0.1     | 0.043     | 0.056     | +0.1     | +0.11     | +0.18            | 0.12        |
| Ir-77 ppb | (0.05)      |          |          |           |           | 0.05 e   |           |                  |             |
| K-19 %    | 2.56        | 1.86     | 1.73     | 2         | 1.7       | 2.66     | 2.28      | 2.95             | 2.72        |
| La-57     | 30          | (36)     | 28       | 36        | 40        | 43       | 30        | 43               | 42          |
| Li-3      | 23          | 33       | 17       | 35        | 30        | +66      | 45        | +79              | 34          |
| Lu-71     | 0.32        | 0.36     | 0.37     | 0.43      | 0.45      | 0.42     | 0.34      | 0.4              | 0.53        |
| Mg-12 %   | 1.64        | *0.78    | *0.56    | 1.4       | 1.4       | 1.5      | 1.61      | 1.81             | 1.02        |
| Mn-25     | 770         | 580      | 600      | 620       | 620       | 850      | 420       | 760              | 880         |
| Mo-42     | 1.6         | 2        | 1        | 1.2       | *0.64     | 2.6      | 1.4       | 1.6              | 0.25-       |
| N-7       | 20          | +2000b   | 3800     |           |           | +1000v   |           | +800             |             |
| Na-11 %   | 2.54        | *1.02    | *0.97    | *1.3      | *1.10     | *0.59 b  | *0.64     | 2.84             | 1.52        |
| Nb-41     | 15          | 10 b     | 10       | 15        | 18        | 11       | 11        | 12               | 18          |

|           | Upper crust | Soils  |       | Loess  | River mud | Shale   |        | Hemipela-gic mud | Mica schist |
|-----------|-------------|--------|-------|--------|-----------|---------|--------|------------------|-------------|
|           |             | Ave.   | SO-4  | GSS-8  | GSD-9     | Ave.    | SCO-1  | MAG-1            | SDC-1       |
| Nd-60     | 26          | 26     | 25    | 32     | 34        | 33      | 26     | 38               | 40          |
| Ni-28     | 55          | 27     | 24    | 32     | 32        | (50)    | 27     | 53               | 38          |
| Os-76 ppb | (0.05)      |        |       |        |           | 0.05 e  |        |                  |             |
| P-15      | 860         | 800 b  | 920   | 790    | 660       | 700     | 1000   | 710              | 690         |
| Pb-82     | 17          | 26     | 14    | 21     | 23        | 20      | 31     | 24               | 25          |
| Pd-46 ppb | (1)         |        |       |        |           |         | 1g     | 1.7              | 1.1         |
| Pr-59     | 6.6         | 7.2    | 7.2   | 8.3    | 9.2       | 9.8     | 6.6    | 9.3              | 9.8         |
| Pt-78 ppb | (1)         |        |       |        |           |         | 0.7    | 1                | 1           |
| Rb-37     | 110         | 110    | 69    | 96     | 80        | 140     | 112    | 149              | 127         |
| Re-75 ppb | (0.4)       |        |       |        |           | 0.4 e   |        |                  |             |
| Rh-45 ppb |             |        |       |        |           |         |        |                  |             |
| Ru-44 ppb |             |        |       |        |           |         |        |                  |             |
| S-16      | 530         | 700 b  | 500   | *120   | *150      | +2400   | 630    | +3900            | 650-        |
| Sb-51     | 0.2         | +1.2   | +0.71 | +1     | +0.81     | +1.5    | +2.5   | +0.96            | 0.54-       |
| Sc-21     | 14          | 11     | 8.4   | 12     | 11        | 13      | 11     | 17               | 17          |
| Se-34     | 0.14        | +0.29  | +0.49 | 0.12   | 0.16      | +0.6    | +0.89  | +1.2             | 0.032-      |
| Si-14 %   | 30          | 33.0 b | 32    | 27.4   | 30.3      | 27.5    | 29.2   | 23.5             | 30.8        |
| Sm-62     | 4.5         | 5.2    | 4.7   | 5.9    | 6.3       | 6.2     | 5.3    | 7.5              | 8.2         |
| Sn-50     | 3.3         | 2.6    | 2.5   | 2.8    | 2.6       | (3)     | 3.7    | 3.6              | 3           |
| Sr-38     | 350         | 167    | *168  | 240    | *170      | *(170)  | *174   | *146             | 183         |
| Ta-73     | 1.5         | 1.2    | 0.62  | 1.1    | 1.3       | (1)     | 0.92   | 1.1              | 1.2         |
| Tb-65     | 0.6         | 0.63   | 0.61  | 0.89   | 0.87      | 0.84    | 0.7    | 0.96             | 1.2         |
| Te-52     | 0.003       | +0.035 | +0.03 | +0.046 | +0.04     | +(0.07) | +0.077 | +0.066           | 0.006-      |
| Th-90     | 11          | 13.8   | 8.6   | 12     | 12        | 12      | 9.7    | 12               | 12          |
| Ti-22     | 3300        | 3800   | 3400  | 3800   | 5500      | 4600    | 4000   | 4500             | 6050        |
| Tl-81     | 0.53        | 0.62   | *0.26 | 0.59   | 0.49      | (0.7)   | 0.72   | 0.59             | 0.7         |
| Tm-69     | 0.32        | 0.37   | 0.35  | 0.46   | 0.44      | 0.44    | 0.42   | 0.43             | 0.65        |
| U-92      | 2.8         | 3      | 2.4   | 2.7    | 2.6       | (2.7)   | 3.1    | 2.7              | 3.1         |
| V-23      | 140         | 82     | 85    | 82     | 97        | 130     | 131    | 140              | 102         |
| W-74      | 1.3         | 2.5    | 1     | 1.7    | 1.8       | 1.8     | 1.4    | 1.4              | 0.8         |
| Y-39      | 22          | 23     | 22    | 26     | 27        | 26      | 26     | 28               | 40          |
| Yb-70     | 2           | 2.4    | 2.1   | 2.8    | 2.8       | 2.8     | 2.3    | 2.6              | 4           |
| Zn-30     | 67          | 74     | 94    | 68     | 78        | 95      | 103    | 130              | 103         |
| Zr-40     | 170         | 260    | 270   | 230    | +370      | 160     | 160    | 130              | 290         |

Data sources: (1) Table V-4a, column 1/3B+2/3G; (2) National Environmental Monitoring Center of China (1990, 1994); (3) Govindaraju (1989); and (4) Turekian and Wedepohl (1961), REE from Nance and Taylor (1976); b: Bowen (1979); e: Esser (1991); g: Govindaraju (1994); m: Marowsky and Wedepohl (1971); v: Vinogradov (1959); w: Wedepohl (1969-1978). The values in parentheses are educated guesses based on other related samples in the table. The "plus" and

"asterisk" signs represent the values higher and lower than those for the upper crust over a factor of two. The "negative" signs in the mica-schist column represent the values lower than those for the average shale. The geometric means of the following elements in soils are: Br = 3.4, Ca = 0.71%, Hg = 0.04, I = 2.4, Mo = 1.2, and Sr = 120 ppm.