**APPENDIX 1**

*PCA of fossil samples*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **O** | **F** | **Mg** | **Al** | **Si** | **P** | **K** | **Ca** |
| **O** | 1 | 0.237747 | -0.013608 | 0.382947 | -0.604334 | 0.265950 | -0.581717 | -0.045830 |
| **F** | 0.237747 | 1 | 0.659311 | 0.672533 | -0.738391 | 0.727023 | -0.549037 | 0.327331 |
| **Mg** | -0.013608 | 0.659311 | 1 | 0.552876 | -0.624772 | 0.692856 | -0.497806 | 0.535217 |
| **Al** | 0.382947 | 0.672533 | 0.552876 | 1 | -0.844581 | 0.947200 | -0.624430 | 0.540020 |
| **Si** | -0.604334 | -0.738391 | -0.624772 | -0.844581 | 1 | -0.830090 | 0.794730 | -0.439885 |
| **P** | 0.265950 | 0.727023 | 0.692856 | 0.947200 | -0.830090 | 1 | -0.716253 | 0.650424 |
| **K** | -0.581717 | -0.549037 | -0.497806 | -0.624430 | 0.794730 | -0.716253 | 1 | -0.447705 |
| **Ca** | -0.045830 | 0.327331 | 0.535217 | 0.540020 | -0.439885 | 0.650424 | -0.447705 | 1 |

**Table 1**. Input correlation matrix of eight variables with unity in the principal diagonal. Data set includes (1) fossil carapace, and (2) rock matrix.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Component 1** | **Component 2** | **Component 3** | **Component 4** | **Component 5** | **Component 6** | **Component 7** | **Component 8** |  |
| **O** | 0.443283 | 0.853070 | 0.115493 | 0.057580 | 0.086117 | -0.201952 | 0.104066 | 0.009309 | 1 |
| **F** | 0.800062 | -0.075251 | -0.488964 | -0.044298 | -0.302260 | -0.144168 | 0.031592 | -0.006795 | 1 |
| **Mg** | 0.742499 | -0.433790 | -0.252072 | 0.343098 | 0.272922 | -0.035711 | 0.058159 | -0.011011 | 1 |
| **Al** | 0.903481 | 0.002334 | 0.048612 | -0.396494 | 0.115558 | 0.071730 | 0.027483 | -0.069942 | 1 |
| **Si** | -0.938384 | -0.232056 | 0.061869 | 0.001968 | -0.090186 | 0.063446 | 0.221899 | -0.018851 | 1 |
| **P** | 0.948792 | -0.151672 | 0.053168 | -0.197626 | 0.021283 | 0.149434 | 0.072741 | 0.082657 | 1 |
| **K** | -0.823274 | -0.288126 | -0.178209 | -0.327253 | 0.171162 | -0.265385 | -0.001193 | 0.024969 | 1 |
| **Ca** | 0.623344 | -0.495754 | 0.552096 | 0.053461 | -0.107973 | -0.215220 | -0.001912 | -0.004622 | 1 |
| Eigenvalue | 5.05129 | 1.32721 | 0.66155 | 0.42921 | 0.23616 | 0.21109 | 0.0705 | 0.01298 | 8 |
| Cumulative explained  variance % | 63.1411 | 79.7313 | 88.0007 | 93.3659 | 96.3178 | 98.9565 | 99.8378 | 100 |  |

**Table 2**. Solution of PCA.

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Component 1** | **Component 2** | **Variance \*** |
| **O** | 0.443283 | 0.853070 | 92.42282 |
| **Na** | 0.800062 | -0.075251 | 64.57619 |
| **Mg** | 0.742499 | -0.433790 | 73.94785 |
| **Al** | 0.903481 | 0.002334 | 81.62834 |
| **Si** | -0.938384 | -0.232056 | 93.44145 |
| **K** | 0.948792 | -0.151672 | 92.32107 |
| **Ca** | -0.823274 | -0.288126 | 76.07967 |
| **Fe** | 0.623344 | -0.495754 | 63.43298 |
| Eigenvalue | 5.05129 | 1.32721 | 6.3785 |
| Cumulative explained  variance % | 63.1411 | 79.7313 |  |

\* Variance explained by first 2 PC (%).

**Table 3**. Acceptable two-component solution of PCA.