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Comparative Assessment of Trace and Major elements from the microhabitats of Basalt and Lateritic Plateaus of Western Ghats, Maharashtra

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Abstract - Western Ghats are considered as a chain of hilltops running along the West Coast of Peninsular India from the river Tapi in the North to Kanyakumari in South. Ghats are also characterized with many unique habitats like plateaus, which are peculiar. These plateaus are botanically rich and are characterized with high degree of endemism. Plateaus are exclusive habitats that offer several niches/microhabitats. Each microhabitat designates its own characteristic flora and has extremely specialized communities. These plateaus are facing pressures from mining activity, tourism etc. The plants growing on plateaus are mostly ephemeral communities. Plateaus which are botanically and ecologically rich areas have not been studied adequately so far. The present study has been carried out to understand the trace and major elements of the microhabitats of Basalt as well as lateritic Plateaus.

Keywords: Rock outcrops, Microhabitats, Ephemeral communities, Trace and Major elements.

I. Introduction

The said habitats popularly called as plateaus, which are IUCN recognised have been studied extensively for its botanical curiosities. These are very unique habitats that provide several micro-habitats. Each microhabitat designates its own characteristic flora and has extremely specialised communities. (Watve 2007) The plants that grow on the plateaus are typically monsoon ephemerals and are short lived. Some of the plants complete their life cycle within 10-15 days and some survive during the monsoon and even up to early winter. The plateaus are at all times surrounded by thick vegetation and since these are the grassy areas within the forest areas, they show fascinating activity of wild animals. Due to their uniqueness the vegetation of the plateaus is also unique, with high endemism. Recently lot of

threatened and new species of plants as well as animals have been recorded from these areas which are of great economic value, as they are consumed as a food by local communities, used as medicines as well as ornamental value. Ironically these botanically as well as geomorphologically interesting sites are facing a lot of anthropogenic pressures like miningas these are rich depositions of Iron and Aluminium ores, devastating monsoon tourism, wind mill construction and private land development and other similar activities. The human burdens will keep on increasing since there is a common view among the planners for these areas. Before their ecological value is correctlyevaluated it is dangerous to plan for change of their land use for any other activity under the name of development. So far botanists have studied these habitats extensively. The present study is one small stepto understand these areas with an objective to study in terms of trace and Major element composition of the microhabitats of these plateaus.

II. Study Area

Two basalt plateaus and two lateritic plateaus from the western ghat escarpment have been selected for the present study. The details of the study areas are mentioned in the table

Table 1: Study area Description

Sr No	Name of the Plateau	Latitude &Longitude	Elevation	Type of associated Rock and Area	Number of microhabitats
1	Durgawadi Plateau, Junnar, District Pune, Maharashtra	16°55'5.50"N, 73°47'50.62"E to 16°54'16.36"N,73°50'58.89"E Area:7 .67 sq. km	1156m ASL	Basalt Plateau	11
2	Naneghat Plateau, Junnar, District Pune, Maharashtra	19°16'15.63"N,73°43'14.45"E to 19°17'53.29"N,73°40'22.37"E Area: 2.01 sq. km	760m ASL	Basalt Plateau	10
3	Amba Plateau, Amba Ghat, District-Kolhapur, Maharashtra	16°59'7.72"N 73°47'04.72"E to 16°59'16.87"N73°47'23.15"E Area:4 sq. km	680m ASL	Lateritic Plateau	10
4	Zenda Plateau, Amba Ghat, District-Kolhapur, Maharashtra	16°55'5.50"N, 73°47'50.62"E to 16°54'16.36"N,73°50'58.89"E. Area:7 .67 sq. km	1025m ASL	Lateritic Plateau	10

Micro habitats on study areas

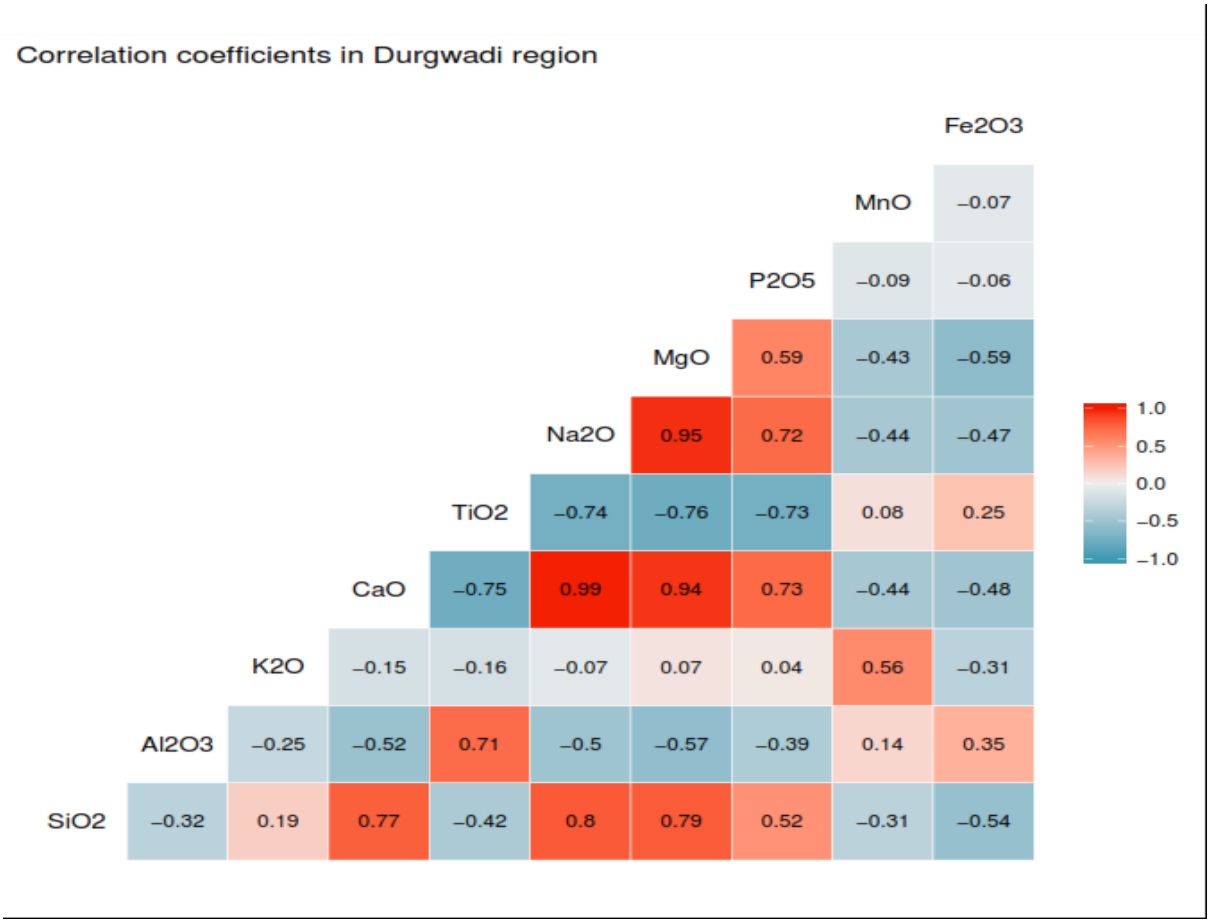
Plant communities on these plateaus are associated with different microhabitats. According to the microhabitats, the plant species differ. Each microhabitathas distinctive features with respect to soil, water as well as species composition. The microhabitats are classifiedinto rock surfaces, boulders, rock crevices, ephemeralpools, soil-filled depressions and ephemeral flushvegetation (Watve 2008, 2013). In the present study, 11 microhabitats are observed on Durgawadi plateau while 10 microhabitats are observed on Naneghat plateau, Amba plateau as well as Zenda plateau and mentionedin the results.

III. Materials and Methods

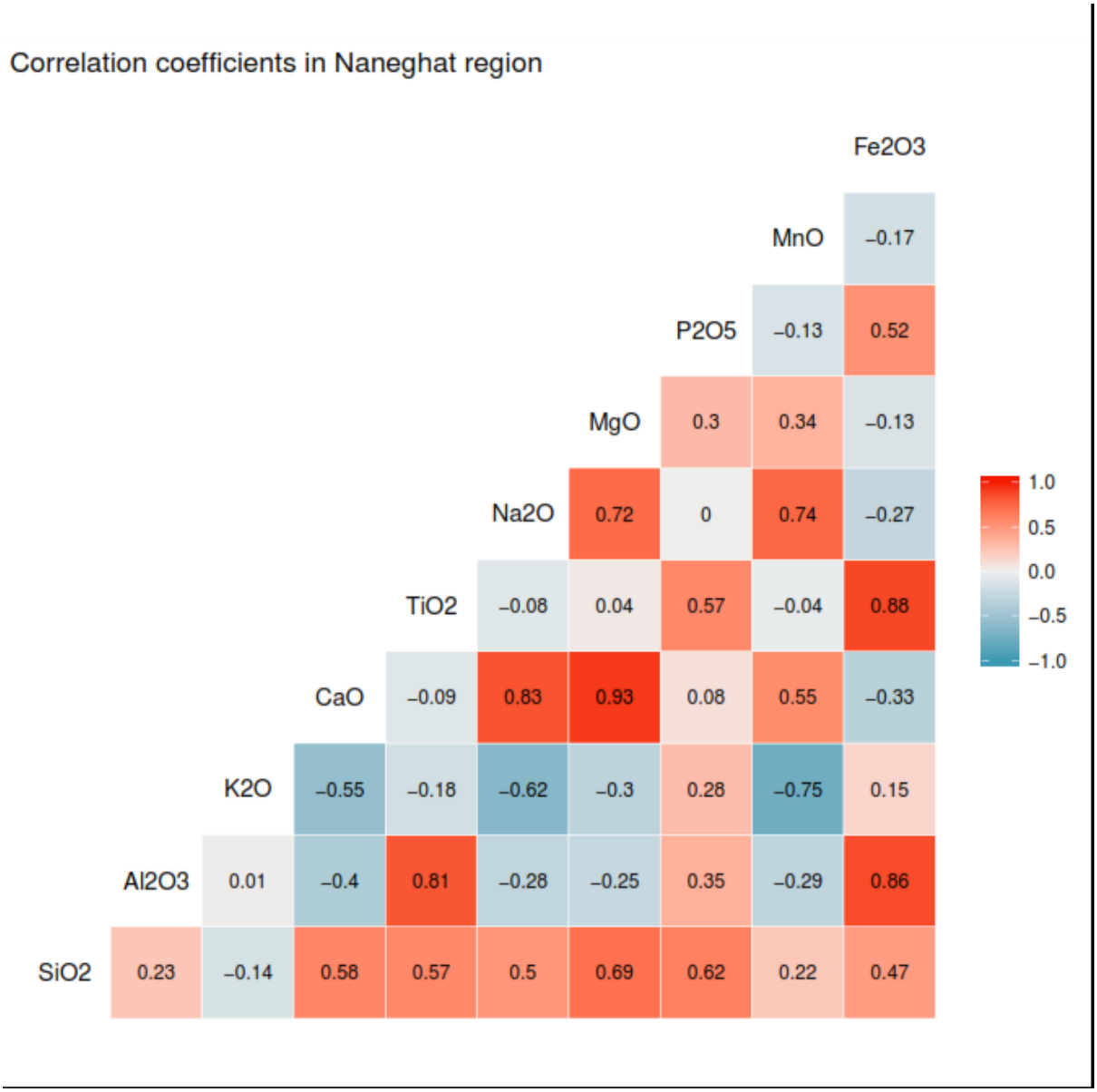
From the microhabitats marked using GIS the rock and soil sampling was done, wherever soil was accumulated in microhabitats soil samples were collected from 100 cm of the depth, the habitats like Boulders and Exposed Rock surfaces, the intact rocks were broken and then samples were collected. These samples were analyzed by using X-ray Fluorescence Spectrophotometry (XRF). It is a non-destructive analytical technique used to determine the elemental composition of materials. XRF analyzers determine the chemistry of a sample by measuring the fluorescent (or secondary) X-ray emitted from a sample when it is excited by a primary X-ray source. The method is used extensively to analyze trace and major elements of rock as well as soil in a powdered form. The data of XRF analysis is heterogenous distributed over 50 elements around two Rock types from four locations distributed over 10-11 microhabitats. Dimensions of which are 2*4*11*50 and types of measurements are percentage and part-per-million. The statistical analysis was carried out using R $v_{3.3.3}$ and ggplot2 $v_{2.2.0}$ package

IV. Results and Discussion

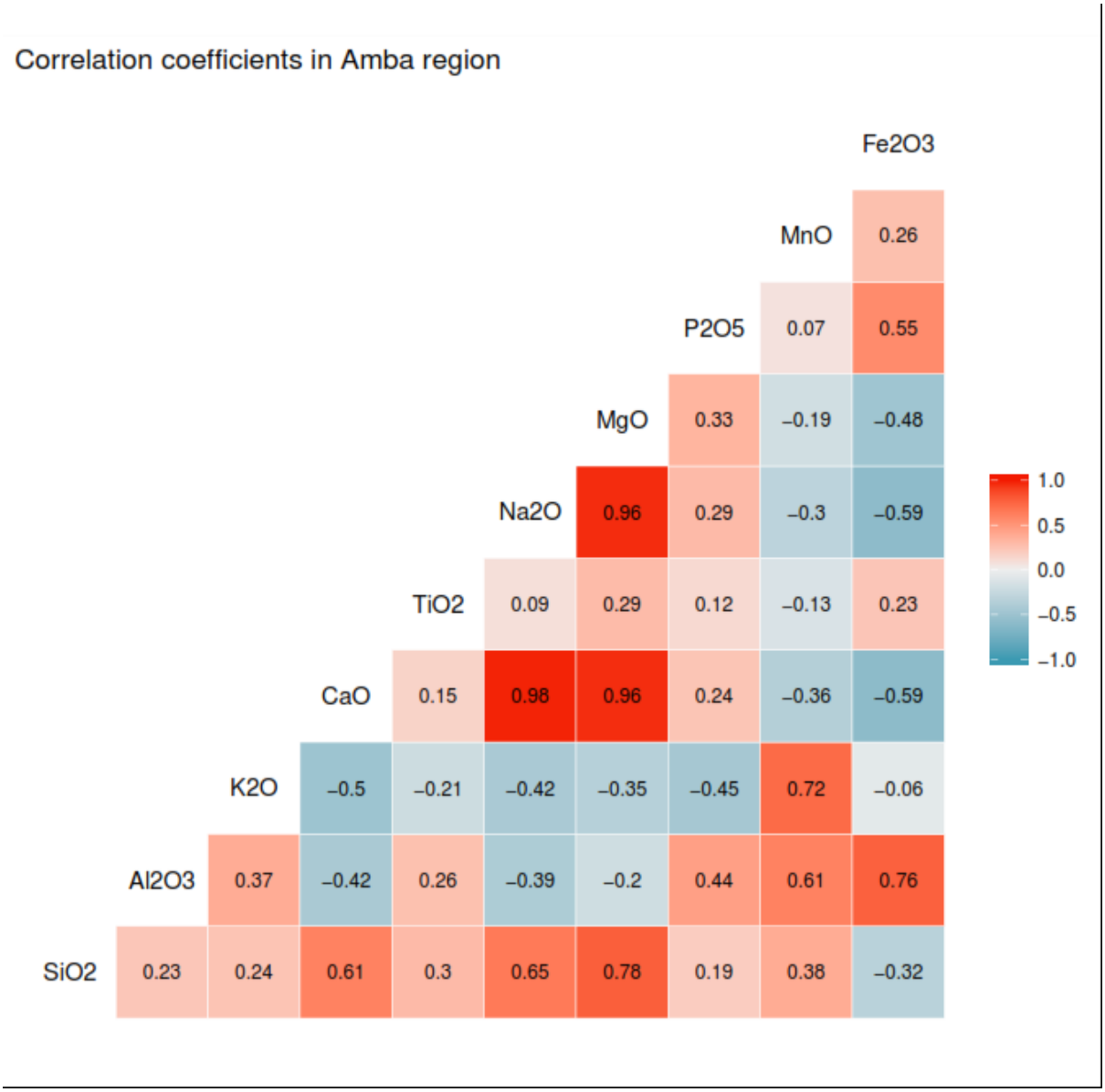
1. To find out correlation within the basalt as well as lateritic regions correlation plots have been elaborated.



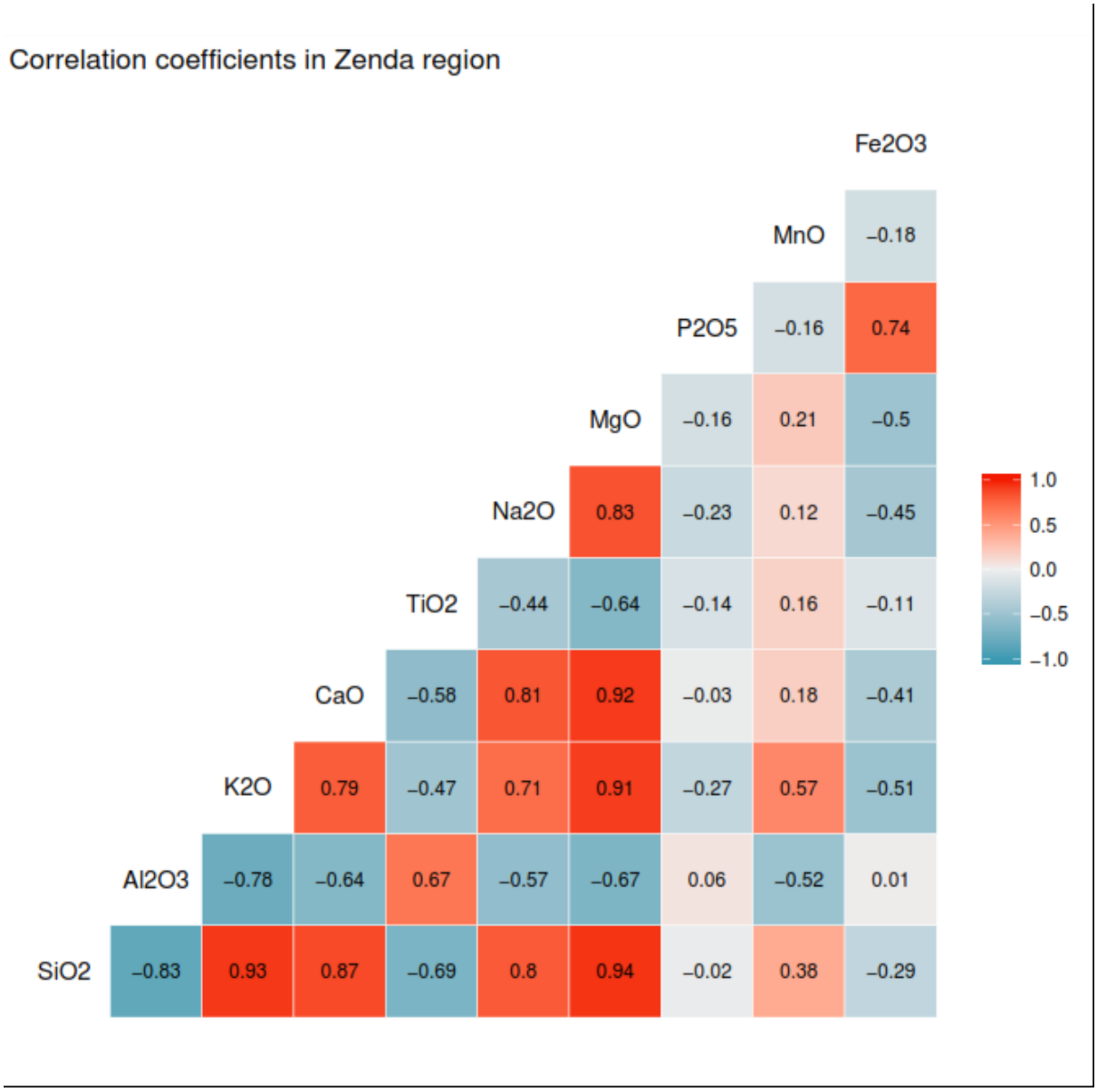
Significant correlation has been observed between magnesium and Sodium and Calcium.



Significant correlation has been observed between Magnesium and Calcium, as well as Sodium and Calcium



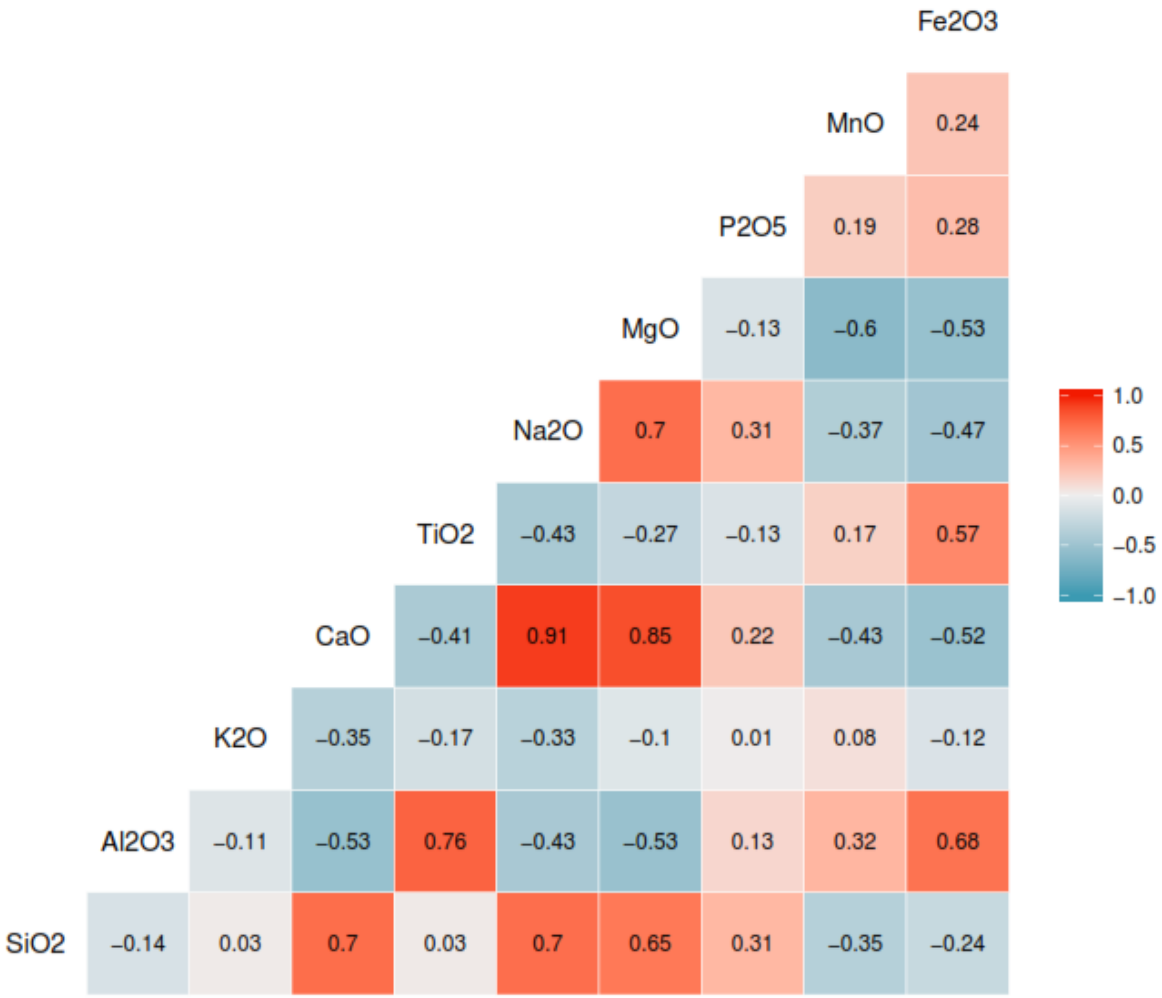
Significant correlation has been observed between magnesium and Sodium and Calcium.



Significant correlation has been observed between magnesium and Sodium and Calcium,Magnesium and Potssium,Magnesium and Silicon,Silicon and Potassium

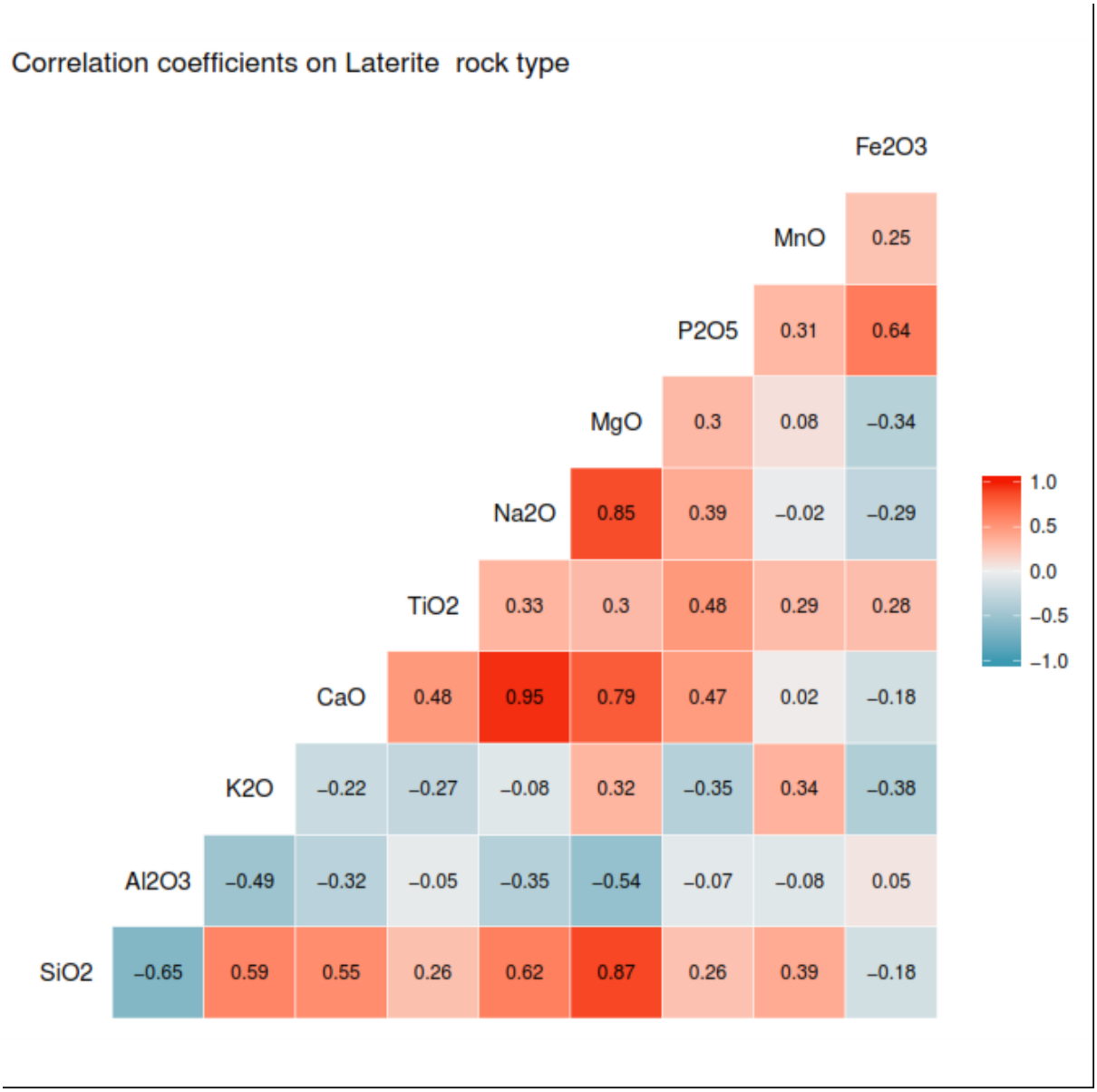
2. 1. To find out correlation between the basalt as well as lateritic regions correlation plots have been elaborated.

Correlation coefficients on Basalt rock type



3. _____

Between the Basalt rocks type of plateau habitat significant correlation has been observed between Sodium and Calcium as well as Magnesium and Calcium.



While compared with the Lateritic rock type of plateau habitat significant correlation has been observed between Magnesium and Sodium, Sodium and Calcium, Magnesium and Calcium, Magnesium and Silicon.

4. Inferential test Statistics:

To identify elements that are significantly different between different regions, welch two sample t-test was performed. Multiple testing correction was carried out using Benjamini & Hochberg method. Columns represent the regions between which significance was observed while each row corresponds to element. Values represent adjusted p-values. Adjusted p-value<0.05 are highlighted

T-test for Major Elements:

	Durgawadi_Naneghat	Durgawadi_Zenda	Durgawadi_Amba	Naneghat_Zenda	Naneghat_Amba	Zenda_Amba
SiO2	0.369877	0.151948	0.797345	0.053003	0.348249532	0.238453112
Al2O3	0.121709	0.216397	0.776705	0.11083	0.110829733	0.23911672

K2O	0.776705	0.833229	0.592675	0.963121	0.501161611	0.592675317
CaO	0.192221	0.142915	0.550249	0.008171	0.492165509	0.03678654
TiO2	0.553239	0.114922	0.016514	0.369877	0.013377633	0.007741529
Na2O	0.373015	0.398174	0.553239	0.02819	0.797344768	0.140018032
MgO	0.006053	0.492166	0.553239	0.00241	0.013483058	0.238453112
P2O5	0.125587	0.167999	0.238453	0.754788	0.028189585	0.030774489
MnO	0.016514	0.00241	0.553239	0.02819	0.194653563	0.110829733
Fe2O3	0.11083	0.963121	0.270081	0.400177	0.042741006	0.400177105

Significant difference has been observed between Calcium, Titanium, Sodium, Magnesium, Phosphorous, Manganese and Iron concentration. Highlighted elements are important one which should be further analysed in detail

t-test for Trace Elements:

	Durgawadi_Naneghat	Durgawadi_Zenda	Durgawadi_Amba	Naneghat_Zenda	Naneghat_Amba	Zenda_Amba
S	1	0.28582457	1	0.33596007	0.990180017	0.324424401
Cl	0.387247524	0.499511209	0.752480571	0.242597719	0.859036599	0.399077248
V	0.174752886	0.453319718	0.045776406	0.21445981	0.006342536	0.763010383
Cr	0.019791619	0.04185952	0.047520115	0.668663912	0.381461933	0.268542625
Co	0.011518837	9.90E-05	0.31696213	0.006342536	0.752480571	0.081140619
Ni	0.040116161	0.381461933	0.390226284	0.004636684	0.239531485	0.065310241
Cu	0.123016565	6.48E-05	0.123016565	0.002061104	0.014735466	0.000102173
Zn	0.64751243	0.002156796	0.422186087	0.022998655	1	0.006430486
Ga	0.047161408	0.202543557	0.859036599	0.02770288	0.130287167	0.169942749
Ge	0.44484512	0.944563183	0.641003626	0.660629093	0.859036599	0.865997615
As	0.86634749	0.024295308	0.161239343	0.02770288	0.204906631	0.12893889
Se	0.668663912	0.339518545	0.877335717	0.204906631	0.588632249	0.668663912
Br	1	0.668663912	0.86634749	0.787213346	0.873111792	0.339977797
Rb	0.588632249	1	0.859036599	0.763010383	1	0.866885079
Sr	0.169942749	0.387247524	0.660629093	0.065310241	0.300323034	0.130287167
Y	0.002156796	0.02770288	0.339977797	0.86634749	0.21445981	0.250129556
Zr	0.000117722	0.13781416	0.757055491	0.002156796	6.48E-05	0.204906631
Nb	0.274669983	0.001855426	0.006562248	0.000472843	0.002061104	0.668663912
Mo	0.64751243	0.219165301	1	0.162646148	0.838547104	0.231971625
Ag	0.520774622	0.748825787	1	0.274669983	0.33596007	0.560910332
Cd	0.300323034	0.349758901	0.897590464	0.588592459	0.339518545	0.381461933
Sn	1	1	0.204713421	1	0.140229041	0.095926119
Sb	0.588592459	0.268542625	0.390226284	0.339518545	0.41909727	0.742274116
Te	1	1	1	1	1	1
I	0.877335717	0.573903276	0.742274116	0.274669983	0.47915508	1
Cs	0.381461933	0.33596007	0.200268552	0.888807969	0.58658684	0.788857599
Ba	0.087463739	0.021807044	0.040116161	0.298750108	0.588592459	0.668663912
La	0.946014632	0.219165301	0.436297201	0.204713421	0.387247524	0.660629093
Ce	0.032494648	0.958971718	0.040116161	0.13781416	1	0.15168837
Er	0.596238575	0.535137818	0.802099468	0.414031741	0.75219945	0.349758901

Yb	1	1	1	1	1	1
Hf	0.887047939	0.130287167	0.385324505	0.106300479	0.394669335	0.065310241
Ta	0.387247524	0.381461933	0.381461933	0.440101759	0.909834132	0.453319718
W	0.90433714	0.763010383	0.748825787	0.505062174	0.582381697	1
Hg	1	1	1	1	1	1
Tl	0.830627234	0.324424401	0.859036599	0.386946663	1	0.324424401
Pb	0.453319718	0.584077339	0.668663912	0.859036599	0.399077248	0.453403561
Bi	1	1	1	1	1	1
Th	0.324424401	0.025577473	0.324424401	0.071350862	0.94794917	0.053070337
U	0.763010383	0.86634749	0.94794917	0.660629093	0.677532254	0.991522421

Significant difference has been observed between Vanadium, Chromium, Cobalt, Nickel, Copper, Zinc, Gallium, Arsenic, Yttrium, Zirconium, Barium, Cerium, Thorium Highlighted elements are important one which should be further analysed in detail.

V. Conclusion

Within as well as between Basalt and Lateritic plateaus significant differences have been observed in the trace as well as Major element concentration. As compared with the Major elements, Trace elements show more differences. The overall results show that each of the plateaus under study is unique in terms of elemental composition whether it is Basalt or Lateritic region. As these areas vary in their elemental status that might be the reason for the varied type of species, they are supporting.The species which are associated with these microhabitats require specific elements each microhabitat is specific not only in terms of species but its elemental composition also. That is why it is more important to protect each micro habitat, to protect the unique species surviving on it. The anthropogenic pressures will disturb the micro habitat composition threatening the vary survival of the species. More such studies are required to understand the dynamics as well as association between elements and Plant species composition.

VI. Acknowledgement

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