Correlation Analysis of Different Plant Species and Soil in Mandalay Region

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ABSTRACT

In study area, the most abundant of ten selected plant species with substrate soil were collected by random method on mineralized area in Taungni Taung in Mandalay Region. These plant species are *Croton joufra* Roxb., *Millettia brandisiana* Kurz., *Combretum apetalum* Wall., *Pavonia glechomifolia* A. Rich, *Hyptis suaveolens* L., *Corchorus olitorius* L., *Tephrosia villosa* Pers., *Cassia tora* L., *Biophytum sensitivum* L. and *Tectona hamiltoniana* L. The distinct absorbent chemical element is of plant species on Cu mineralization. The possible copper indicator species may be *Tectona hamiltoniana* L., *Hyptis suaveolens* L. and *Tephrosia villosa* Pers. since these plants occur only in the vicinity of the mineral deposits. Analytical element data of eight plant species underlying soil data, Histogram, Dendrom construct were described. Chemical uptake of these plant species with chemical content in underlying soil was compared to show *Tectona hamiltoniana* L. which clearly absorbed Cu and trace metals than other plant species. Therefore, *Tectona hamiltoniana* L. species are dominant on mineralized zone of the study area.

Keywords; Ten plant species, Analytical data, Histogram, Dendrogram construct

INTRODUCTION

Biogeochemical methods of exploration depend on chemical analysis of plants or humus, whereas geobotanical methods involve visual survey of vegetation cover in order to detect mineralization by means of plant distributions and the presence of indicator plants (Brooks, 1972).

The present study of biogeochemical method is used for searching location of the extension of mineralization by applying the trace elements variation in plants and soils sample media. Visual observation of the distribution and morphology of plants are related to ore. (Hawkes and Webb, 1962).

In this study, the most abundant of ten selected plant species with substrate soil are collected by random method on mineralized area. Ten selected plant species with substrate soil analysed by Atomic Absorption Spectrophotometer. Ten selected plant species with underlying soil data are calculated. *Cassia tora* L. and *Biophytum sensitivum* L. species are rare in relative uptake of trace elements. The rest plant species are more absorbent of various trace elements such as Cu, Pb, Zn, Ag, As, Sb, and Fe and these eight different plant species are *Tectona hamiltoniana* L., *Croton joufra* Roxb., *Combretum apetalum* Wall., *Tephrosia villosa* Pers., *Pavonia glechomifolia* A. Rich., *Millettia brandisiana* Kurz., *Hyptis suaveolens* L., *Corchorus olitorius* L.In this study, chemical uptake of different copper levels are correlated in *Tectona hamiltoniana* L., *Tephrosia villosa* Pers. and *Hyptis suaveolens* L..

The aim and objectives are to study the relations between soils and plants ash data of biogeochemical sampling media, to characterize relative uptake of ten different plant species from their underlying soil in the same conditions and to study the specific plant related to their geologic environment.

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MATERIALS AND METHOD

In geobotanical investigation, Taungnitaung Area lies within latitude N 20° 48‘ 7.9” and latitude N 20° 48’ 10.85” and longitude E 95° 15’ 33.15” and E 95° 15’ 22.74”. This area covers nearly 2 sq. miles. Biogeochemical surveys were carried out in the study area. In this study, ten selected plant species with substrate soils were collected by random method. Soil samples were collected from 15m interval. The most abundant ten plant species were selected and checked detail for sampling before analysis. Among them, the different levels of copper absorption in selected ten species were analysed and calculated, Pearson correlation, the correlation coefficient data to construct dendrogram by weight paired group method. Correlation coefficient values were above 0.75 (strongly correlation), between 0.5 to 0.75 (moderately correlation) and below 0.5 (weakly correlation).The analysis of Cu, Pb, Zn, Ag, As, Sb, and Fe elements absorption by ten selected plant species from underlying soil were measured by Atomic Absorption Spectrophotometer. After conducting analysis, the chemical data of plant species concerning with element concentration, and cluster analysis were calculated.

Fig(1)Location map of Taungni Taung Area

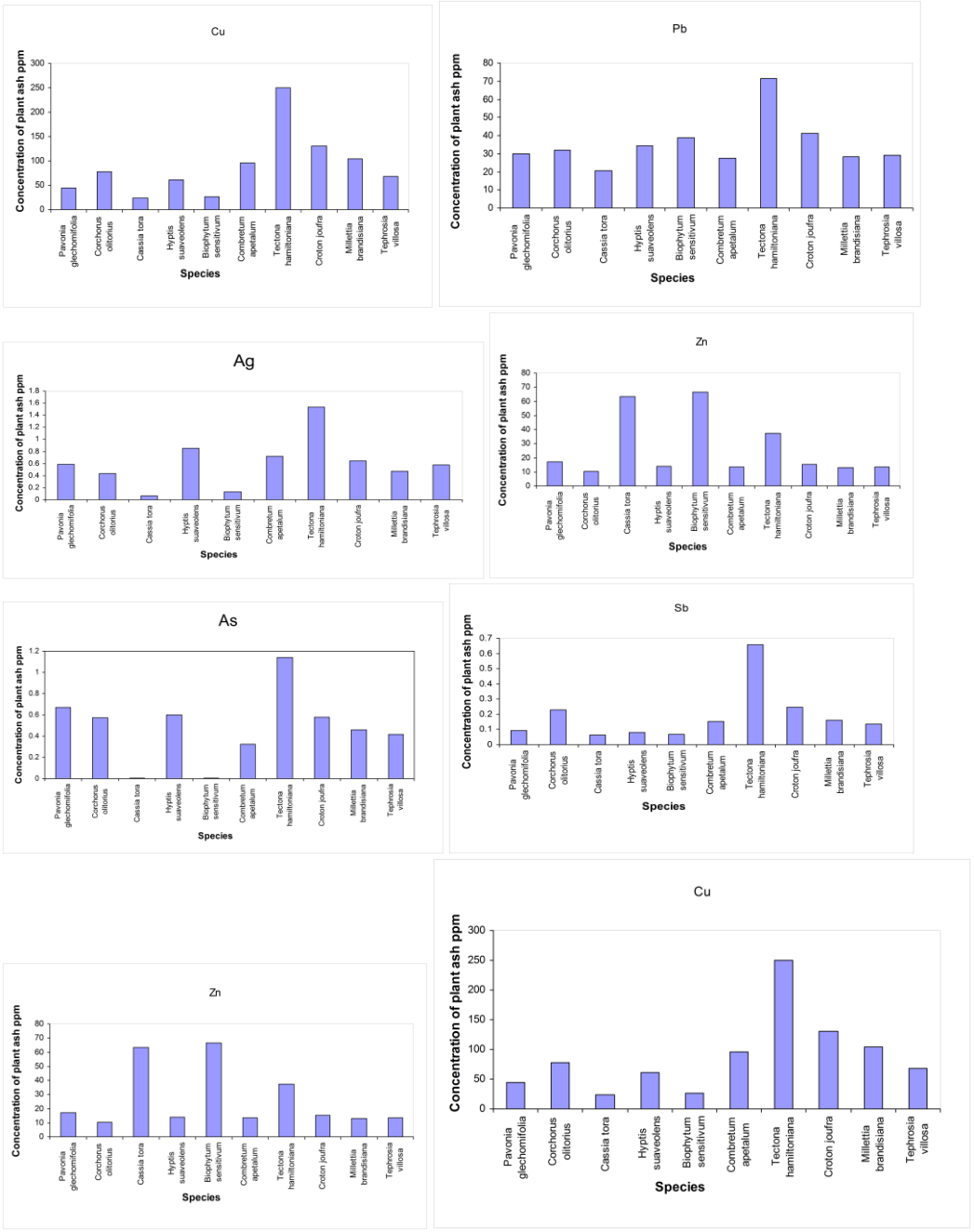
RESULTS

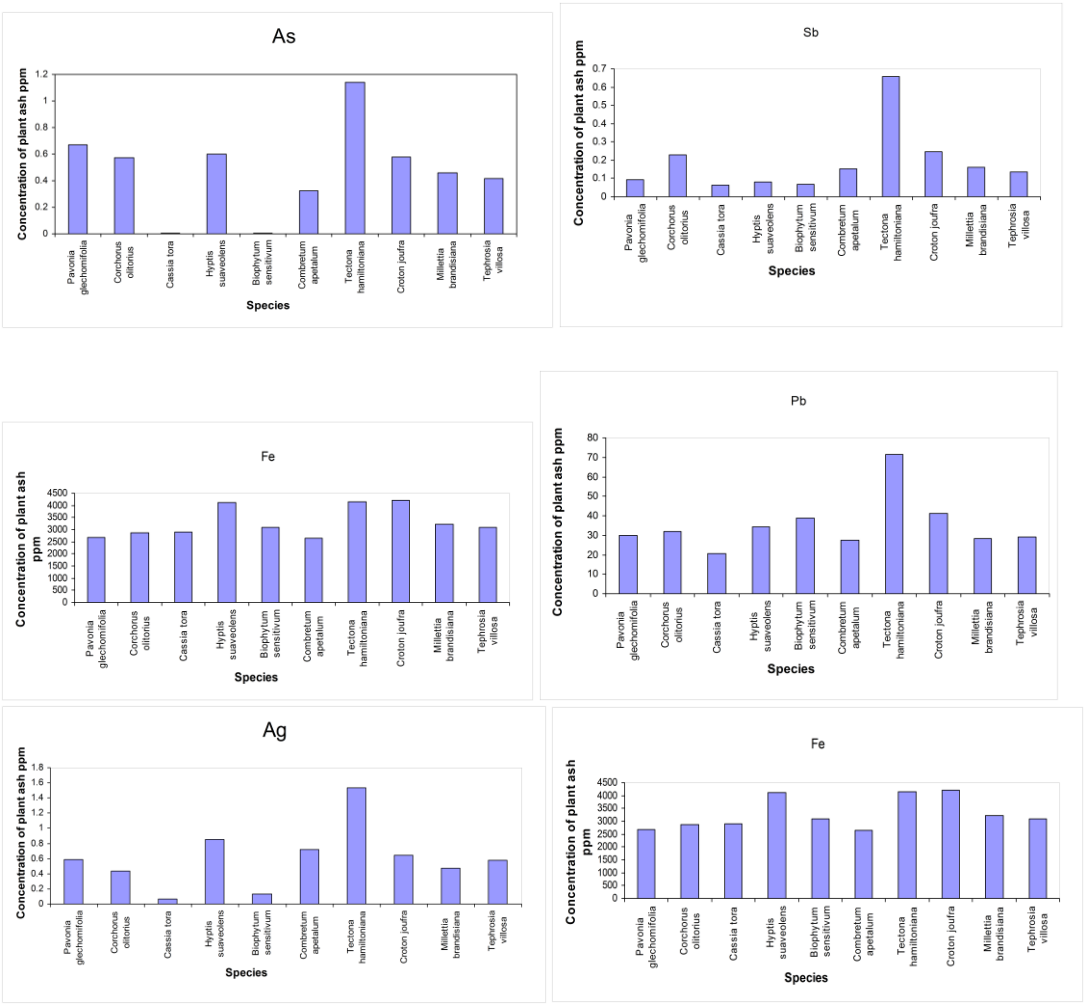
This study was dedicated to seven heavy metals (Cu, Pb, Zn, Ag, As, Sb and Fe) which showed different pattern of concentration in ten plant species. Relative uptake of seven elements by ten different plant species under the same condition was shown.

Correlation Data

Element histograms of element concentration in plants are shown in Fig (2). Chemical content data in plant ash and concentration of elements are calculated by cluster analysis. Analytical elements data obtained from eight plant species with underlying soil (Table 1). Pearson correlation shows very strongly correlated elements Cu and Sb (r=0.958). Cluster analysis is to group the samples on the basis of the similarity in terms of their compositions.. Hierarchy Pearson correlations show ten plant species with trace element correlated. Second strongly correlated groups are As and Ag (r=0.900).Third strongly correlated groups are Cu and Pb (r=0.849) (Table 2 & 3). Biogeochemical data of ten plant species show that: There are five strongly correlated of plant species groups. The first group contains *Croton joufra* Roxb., *Millettia brandisiana Kurz.* and *Combretum apetalum* Wall. The second group is *Pavonia glechomifolia* A. Rich. and *Hyptis suaveolens* L. The third group is *Corchorus olitorius* L. and *Tephrosia villosa* Pers..The fourth group is *Cassia tora L.* and *Biophytum sensitivum* L.. The fifth group is *Tectona hamiltoniana* L (Fig 3).

First group is moderately correlated with second group. Fourth group is moderately correlated with groups one, two and three. Group five is weakly correlated with other groups. Relative uptake of trace metals in ten plant species with underlying soils is compared. *Tectona hamiltoniana* L. is more absorbent trace elements than other plant species. In dendrogram *Tectona hamiltoniana* L. is slightly associated than other plant species.





Fig(2) Different pattern of element concentrations in ten plant species ash of Histogram

Table (1) Analytical elements data obtained from eight plant species with underlying soil

	Sample No		As	Ag	Cu	Pb	Zn	Sb
Tectona hamitoniana	1	Plant	0.5	0.8	100	42	18	0.1
		Soil	2.5	0.5	100	50	25	0.05
	2	Plant	1.3	1.0	190	60	20	0.34
		Soil	5.0	1.0	210	100	50	0.1
	3	Plant	2.2	1.8	310	80	25	0.65
		Soil	7.5	1.5	300	150	75	0.25
	4	Plant	3.8	2.5	390	100	65	0.9
		Soil	10.0	2.0	400	200	100	0.5

	Sample No		As	Ag	Cu	Pb	Zn	Sb
Combretum apetalum.	1	Plant	0.4	0.8	50	25	18	0.15
		Soil	2.5	0.5	100	50	25	0.05
	2	Plant	0.3	1.0	80	40	10	0.1
		Soil	5.0	1.0	200	100	50	0.1
	3	Plant	1.0	1.2	100	30	10	0.2
		Soil	7.5	1.5	250	150	75	0.25
	4	Plant	0.5	1.0	120	45	20	1.0
		Soil	10	2.0	400	200	100	0.5

	Sample No		As	Ag	Cu	Pb	Zn	Sb
Croton joufra	1	Plant	0.5	0.7	50	38	18	0.2
		Soil	2.5	0.5	100	50	25	0.05
	2	Plant	0.4	0.5	150	40	10	0.25
		Soil	5.0	1.0	200	100	50	0.1
	3	Plant	0.3	0.8	180	45	20	0.35
		Soil	7.5	1.5	250	150	75	0.25
	4	Plant	0.8	0.9	210	50	25	0.25
		Soil	10	2.0	400	200	100	0.5

	Sample No		As	Ag	Cu	Pb	Zn	Sb
Tephrosia villosa	1	Plant	0.5	0.5	50	340	18	0.19
		Soil	2.5	0.5	100	50	25	0.05
	2	Plant	0.7	0.4	50	30	10	0.17
		Soil	5.0	1.0	200	100	50	0.1
	3	Plant	0.4	1.0	80	40	20	0.2
		Soil	7.5	1.5	250	150	75	0.25
	4	Plant	1.0	0.8	70	40	18	0.1
		Soil	10	2.0	400	200	100	0.5

Tectona hamitoniana

Sample No		As	Ag	Cu	Pb	Zn	Sb
1	Plant	0.5	0.8	100	42	18	0.1
	Soil	2.5	0.5	100	50	25	0.05
2	Plant	1.3	1.0	190	60	20	0.34
	Soil	5.0	1.0	210	100	50	0.1
3	Plant	2.2	1.8	310	80	25	0.65
	Soil	7.5	1.5	300	150	75	0.25
4	Plant	3.8	2.5	390	100	65	0.9
	Soil	10.0	2.0	400	200	100	0.5

Combretum apetalum.

Sample No		As	Ag	Cu	Pb	Zn	Sb
1	Plant	0.4	0.8	50	25	18	0.15
	Soil	2.5	0.5	100	50	25	0.05
2	Plant	0.3	1.0	80	40	10	0.1
	Soil	5.0	1.0	200	100	50	0.1
3	Plant	1.0	1.2	100	30	10	0.2
	Soil	7.5	1.5	250	150	75	0.25
4	Plant	0.5	1.0	120	45	20	1.0
	Soil	10	2.0	400	200	100	0.5

Croton joufra

Sample No		As	Ag	Cu	Pb	Zn	Sb
1	Plant	0.5	0.7	50	38	18	0.2
	Soil	2.5	0.5	100	50	25	0.05
2	Plant	0.4	0.5	150	40	10	0.25
	Soil	5.0	1.0	200	100	50	0.1
3	Plant	0.3	0.8	180	45	20	0.35
	Soil	7.5	1.5	250	150	75	0.25
4	Plant	0.8	0.9	210	50	25	0.25
	Soil	10	2.0	400	200	100	0.5

Tephrosia villosa

Sample No		As	Ag	Cu	Pb	Zn	Sb
1	Plant	0.5	0.5	50	340	18	0.19
	Soil	2.5	0.5	100	50	25	0.05
2	Plant	0.7	0.4	50	30	10	0.17
	Soil	5.0	1.0	200	100	50	0.1
3	Plant	0.4	1.0	80	40	20	0.2
	Soil	7.5	1.5	250	150	75	0.25
4	Plant	1.0	0.8	70	40	18	0.1
	Soil	10	2.0	400	200	100	0.5

Table (2) Chemical uptake of different plant species summation average data

Element Species	AS	Ag	Cu	Pb	Zn	Sb	Fe
Pavonia glechomifolia A. Rich.	0.67293	0.5839	44.4408	30.04276	17.11513	0.091678	2686.151
Corchorus olitorius	0.57211	0.4326	77.2105	32.00000	10.26316	0.231053	2869.474
Cassia tora L.	0.00553	0.0616	24.2632	20.52632	63.52632	0.063684	2910.000
Hyptis suaveolens L.	0.60211	0.8489	61.3158	34.26316	13.89474	0.08000	4101.579
Biophytum sensitivum L. *D.C.*	0.00495	0.1295	26.3158	38.78947	66.68421	0.069474	3081.053
Combretum apetalum wall.	0.32368	0.7195	95.3684	27.36842	13.26316	0.153158	2650.526
Tectona hamitoniana wall.	1.13789	1.5316	250.474	71.42105	37.26316	0.657368	4141.053
Croton joufra Roxb.	0.57947	0.6474	130.526	41.10526	15.42105	0.246316	4218.947
Millettia brandisiana kur.	0.45842	0.4737	104.842	28.15789	12.84211	0.161053	3222.105
Tephrosia villosa Pers.	0.41579	0.5779	67.5263	29.21053	13.42105	0.136842	3091.053

Table (3) Ten plant species with substrate soil Pearson correlation analysis

	As	Ag	Cu	Pb	Zn	Sb	Fe
As	1						
Ag	0.900	1					
Cu	0.800	0.869	1				
Pb	0.722	0.792	0.849	1			
Zn	-0.499	–0.364	–0.208	0.115	1		
Sb	0.783	0.817	0.958	0.899	-0.055	1	
Fe	0.539	0.599	0.604	0.663	–0.077	0.522	1

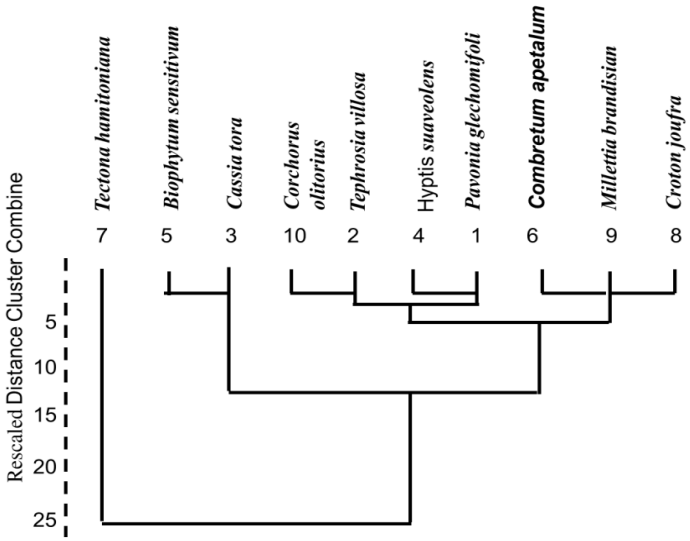


Fig (3) Dendrogram constructed using average linkage between plant group association

Tectona hamiltoniana L. ***Hyptis suaveolens*** **(L.) Poit.** ***Tephrosia villosa*** **Pers.**

(Dahat) (Tawpinsein) (Me-yaing-ga-lay)

Fig. (4) Different levels of copper absorption of three plant species

DISCUSSION AND CONCLUSION

Trace element analysis of path-finder elements in vegetation sample involved the collection of plant samples from preselected sample location around the Cu mineralization. In the field, random method of plant species with underlying soil samples were collected to ash and analyzed for trace elements using AAS. After analysis, the element concentrations in the vegetation were calculated.

The present study discusses the distinct absorbent chemical element of plant species on Cu mineralization. The possible copper indicator species may be *Tectona hamiltoniana* L., *Hyptis suaveolens* L. and *Tephrosia villosa* Pers. since these plants occur only in the vicinity of the mineral deposits and contain anomalous concentrations of the path-finder elements in their ashes. Correlation analyses of these

elements, derived from the indicator species, are particularly strong, indicating the potential value of these species in geobotanical studies for mineral exploration.

In this study, chemical uptake of ten plant species is observed. The relative accumulation of Cu and other elements from the soil and plant samples are abundantly occurred in *Tectona hamiltoniana* L. Metal uptake by plants varies widely according to the particular species and elements. Certain species have the ability to concentrate metals from the soil. (Levision, 1980)

These ten species are uptake from specific trace elements. *Tectona hamiltoniana* L. is more than other plant species show significance in elements uptake. In this research, it is clearly seen that, among plant species, *Tectona hamiltoniana* L. is found to be more significance.

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REFERENCES

Brooks, R. R. (1972). Geobotany and Biogeochemistry in Mineral Exploration, Happer and Row, New York, 292 p.

Davis J. C. (1973). Statistical and Data Analysis in Geology, John Wiley and Sons, New York.

Duornikou, A. K. and Ovsyannikova, L. B. (1973). Biogeochemical Dispersion Aureoles of Chalcophile Elements at Yesaulov Lead-Zinc Deposit (Donbas), Geochemistry International, Vol. 1972, No. 7-8, p 591-596.

Han Sein (2005). Economic Geology and Geochemical Study of Taungnitaung and It Environs, Popa Areas, Kyaukpadaung Township, Mandalay Division, Ph.D. Dissertation.

Hawkes, H. E. and Webb, J. S. (1962). Geochemistry in Mineral Exploration, Harper & Row, Publishers, New York and Evanston, Printed in the United States of America.

Hewarth, R. J. (1983). Mapping Handbook of Exploration Geochemistry Vol. 2. Statistic and Data Analysis in Geochemical Prospecting, Elsevier Scientific Publishing Company Govett. G. J. S. (Editor) Amsterdam, Netherland, p. 111-120.

Levison, A. A. (1980). Introduction to Exploration Geochemistry, Applied Publishing Wilmette. Illinois.

Maluga, D.P. (1964). Biogeochemical Methods of Prospecting Authorized Translation from 1959. Publication of New York.

Thet Thet Mar Win. (2007). Relative Accumulation of Trace Elements in Plants Species at Khwayaiktaung Copper Deposit, Heho, Kalaw Township, Southern Shan State.