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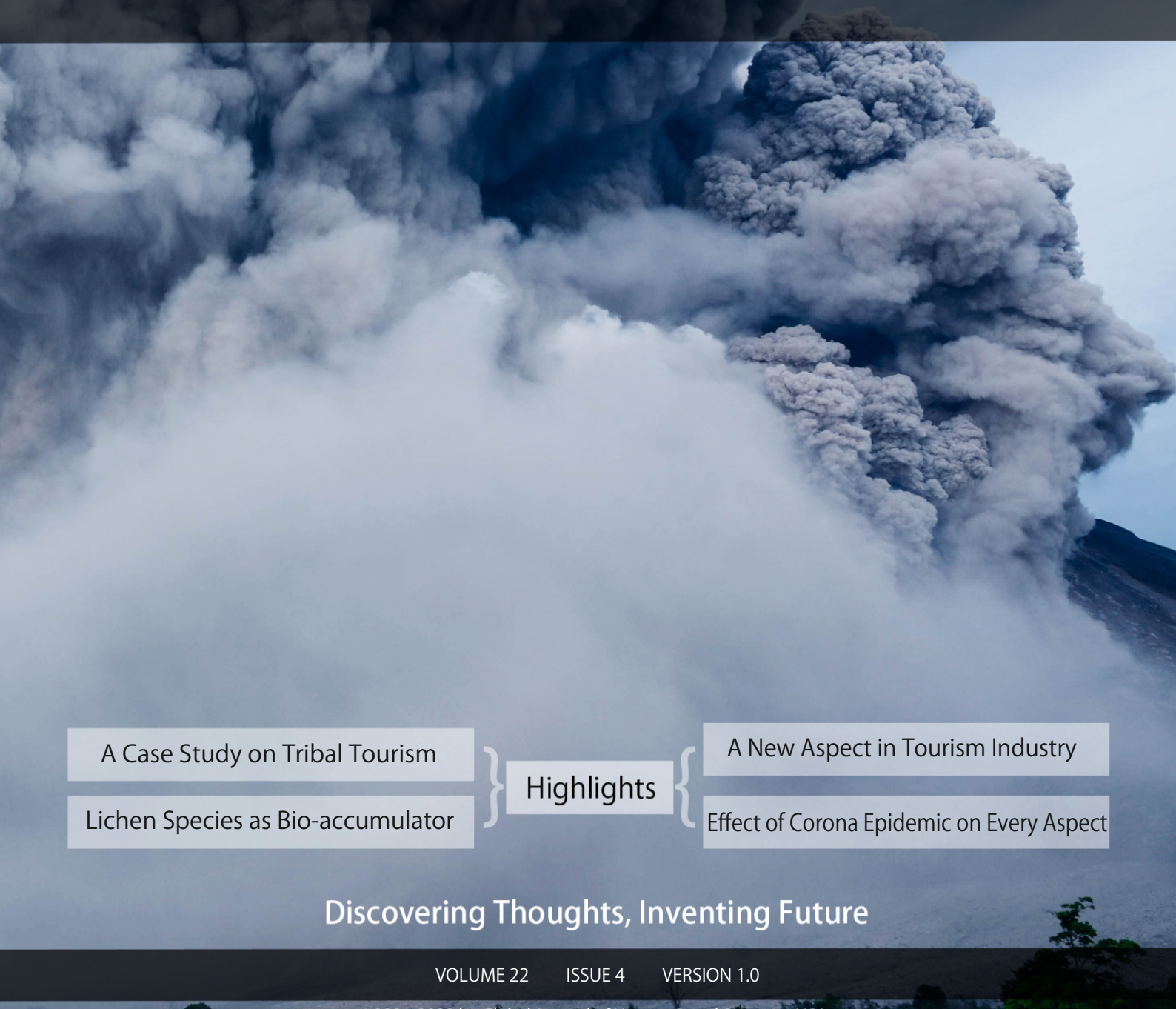

A Case Study on Tribal Tourism

Lichen Species as Bio-accumulator

Highlights

A New Aspect in Tourism Industry

Effect of Corona Epidemic on Every Aspect

Discovering Thoughts, Inventing Future

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Upper Jurassic Source Rock Evaluation and Thermal Maturity Evolution of the NW Sab'atayn Basin, Yemen

By Nabeel A. S. Al-Azazi, A. S. A. E. Alsrory & Mohammed Albaroot
Shabwa University

Abstract- The Sab'atayn Basin has the greatest oil and gas exploration potential in the Mesozoic basins of Yemen. The quantity and quality of the organic matter of sediments is a core focus of source rocks evaluation in exploration of hydrocarbon. Organic-rich sediments within the Meem (Lower) and Lam (Upper) members from four wells in the NW Sab'atayn basin were analyzed using organic geochemistry and total organic carbon content. The obtained data shows that the total organic carbon content (TOC) values from Meem source rocks are between 0.2 to 1.68 wt% indicating fair to very good source rocks. While the values for the Lam source rocks are between 0.2 to 3.81 wt% indicating excellent source rocks, only two samples have values more than 3 wt% in Kamaran-01 well. The Rock-Eval pyrolysis data reveals that most of the samples are consist of reworked organic matter with no interesting source rocks potential.

Keywords: upper jurassic source rocks, thermal maturity, hydrocarbon generation potential, sab'atayn basin, yemen.

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Nabeel A. S. Al-Azazi [α], A. S. A. E. Alsrory [σ] & Mohammed Albaroot [ρ]

Abstract- The Sab'atayn Basin has the greatest oil and gas exploration potential in the Mesozoic basins of Yemen. The quantity and quality of the organic matter of sediments is a core focus of source rocks evaluation in exploration of hydrocarbon. Organic-rich sediments within the Meem (Lower) and Lam (Upper) members from four wells in the NW Sab'atayn basin were analyzed using organic geochemistry and total organic carbon content. The obtained data shows that the total organic carbon content (TOC) values from Meem source rocks are between 0.2 to 1.68 wt% indicating fair to very good source rocks. While the values for the Lam source rocks are between 0.2 to 3.81 wt% indicating excellent source rocks, only two samples have values more than 3 wt% in Kamaran-01 well. The Rock-Eval pyrolysis data reveals that most of the samples are consist of reworked organic matter with no interesting source rocks potential. Most of the studied samples of Meem and Lam source rocks have Tmax less than 440 °C, which place them in immature to marginally mature and in the fringe of main stages of hydrocarbon generation. Based on results of generative potential (GP) of Meem source rocks, it shows that the GP values are less than 2 mg HC/gm rocks are in non-generative rocks. Furthermore, those source rocks with exceptionally high GP values in order of more than 10 mg HC/ g rock may provide an excellent source rock in Dahamr Ali-01 well, if the burial depth is sufficient to build a suitable temperature and pressure. On the other hand Lam source rock is classified as moderate source rocks. Non-generative potential has been reported from Lam source rock in Himyar-01 well where the GP is less than 1 mg HC/g rock. Kerogen type for Lam and Meem source units can be deduced by the cross-plots of pyrolysis parameters, such as HI vs Tmax (modified ven Krevelen diagram) and TOC vs S2 which are probably resulted from deposition of more terrigenous type III organic matters sourced from land. Finally the results of thermal maturation shows that the analyzed Meem source rocks are generally plotted in the mature zone, while the results of Lam source rocks samples show that the source rocks is still immature, marginally mature in Dahamr Ali-01 and Saba-01 wells.

Keywords: upper jurassic source rocks, thermal maturity, hydrocarbon generation potential, sab'atayn basin, yemen.

I. Introduction

Yemen economies are reliant mostly on oil production. The annual petroleum consumption was over 168000 barrel per day in Yemen of 2011 census (Yemeni petroleum exploration & production Authority, (PEPA). The petroleum exploration and production activities have been affected by security issues since 2011, remarkable drop have affect the country economy as well. Worse still, the traditionally large Yemeni oilfields, including Alif, Kharir and Halewah fields are facing a crisis of production reduction. Therefore, resource reassessment must carry out in parts of sedimentary basins previously little explored especially in northwestern part of the petroliferous Sab'atayn basin Fig. 1. The Sab'atayn basin, which conserved Mesozoic succession in its stratigraphy, favored petroleum accumulation because it contains the whole petroleum system element (Source, Reservoirs and Seal rocks). The upper Lam member is the first target of source rock assessment and hydrocarbon exploration because of organic matter richness and greater prolific oil prone source rock across Yemen (Brannin et al., 1999; Albaroot et al., 2016). The Lower Meem member made up of argillaceous limestone (Alaug et al., 2011; Al-Areeq, 2011; Al-Azazi, 2010 and Al-Areeq, 2004), consider the second target of source rock assessment. In the past decades, several wells have been drilled in northwestern (NW) part of Sab'atayn basin but unfortunately the results became frustrated. Due to the necessity to increases oil potential we try to re-evaluate this part of the basin by using the available geochemical data from the source rocks. Therefore, it is necessary to evaluate systematically the characteristic of the source rocks and their maturity evaluation within this part of the basin. This evaluation can improve our understanding of Lam and Meem source unit evolution and maturation. The characteristics of source rock evaluation include the kerogen type, organic matter abundance and source rock maturity. The source rocks thermal maturity investigation primarily includes vitrinite reflectance (% Ro) and temperature maximum (Tmax) from the Rock-Eval pyrolysis. The quantity of organic matter is commonly assessed by a measuring *total organic carbon (TOC)* contained in the rocks. Quality is measured by determining the types of *kerogen* contained in the organic matter. Thermal maturity is most often estimated by using *vitrinite reflectance* measurements in addition to data from *pyrolysis* analyses. However, drilling wells and samples are short in the NW part of the basin, because this area has not been subjected to extensive conventional oil and gas targets. Therefore, it is impossible to do any geochemical analysis and difficult to study using

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conventional experimental test methods due to core samples chips scarcity, only data of geochemical analysis can be obtained from (SPT, 1994) reports. Challenges and breakthroughs in recent research in hydrocarbon generation, expulsion, migration and accumulation led to more understanding the whole process of hydrocarbon. Therefore, source rock investigation is of increasing importance because it reduces risk potential and gives a quick insight of concerned area. Along with the development of petroleum geology theory and the wide application of computing technology, quantitative research on the thermal maturity evolution of source rocks in the geological period is of great significance.

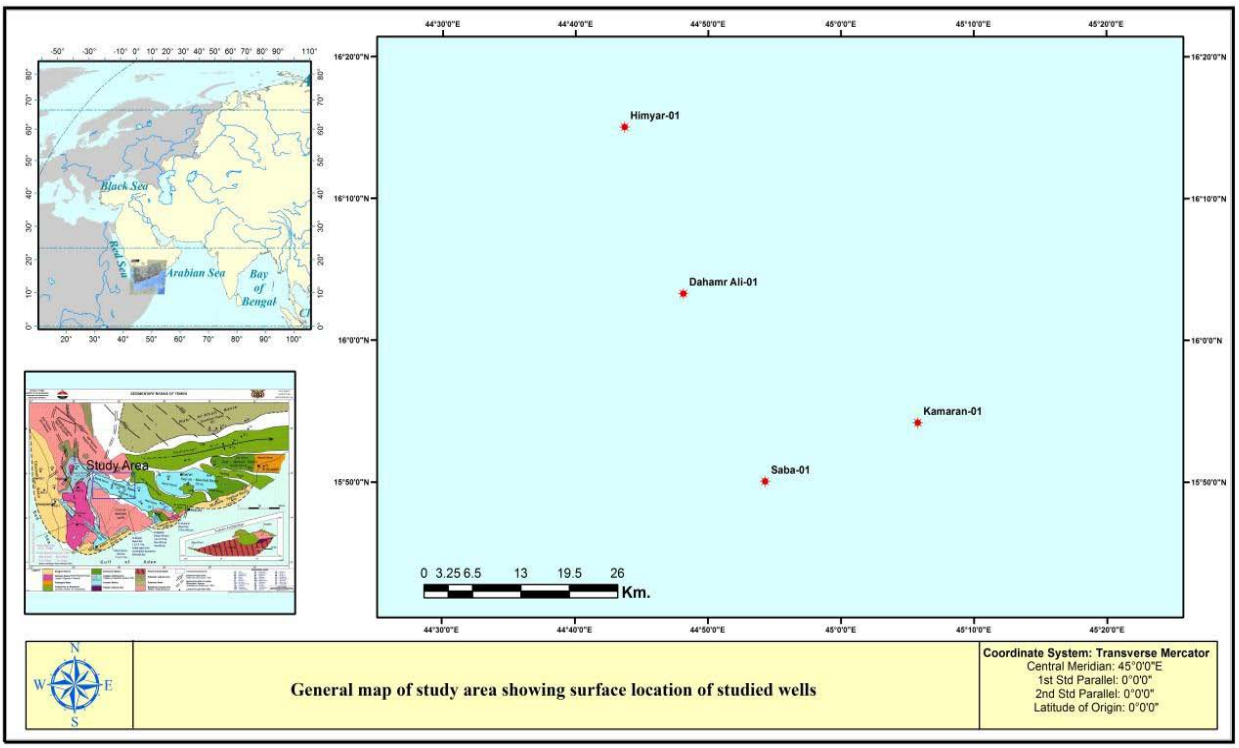

Figure 1: Location map of the studied wells in the NW Sab'atayn Basin, central Yemen.

II. Geological Setting

Yemen, situated at the southern end of the Arabian Peninsula, both are geographically and geologically has the same geological signature between the Arabian and African plate. It is located close to the Tertiary triple junction between the Red Sea, Gulf of Aden and Afar plume. The NW-trending Sab'atayn Basin (also called Marib-Shabwa-Hajar Basin, Marib-Shabwa Basin) is a Mesozoic rift basin in Yemen that follows a deep-seated Proterozoic structural trend (Redfern and Jones, 1995) and oriented NW–SE (Bott et al., 1992; Brannan et al., 1999). Basin formation was a consequence of several extensional phases related to the separation of India from Africa-Arabia (Redfern and Jones, 1995; Ziegler, 2001). The stratigraphic framework of the basin fill according to Beydoun et al. (1998) it varies from marginal to central. The development of Sab'atayn Basin can be subdivided into three tectono-stratigraphic megasequences: (a) a pre-rifting phase (Permian-Oxfordian/Kimmerdgian), (b) a syn-rifting phase (Kimmerdgian-Tithonian) and (c) a post-rifting phase (Early Cretaceous), Permian pre-rift phase not well proved. In the NW part of the basin, syn-rifting phase parts (Kimmeridgian-Tithonian) and post-rifting phase (Early Cretaceous) not encountered at all due to uplift and erosion. Pre-rift deposits are represented by non-marine to shallow-marine clastic rocks (Kuhlan Formation; (Beydoun et al., 1998)) overlain by shallow-marine carbonates (Shuqra Formation). A latest Triassic to Middle Jurassic age is generally accepted for both Formations (see also Al-Wosabi & Wasel, 2011), but Stephenson and Al-Mashaikie (2011) provided evidence for a Late Carboniferous age for the lower part of the Kuhlan Formation. The syn-rift sequence is characterized by horsts and nested fault blocks that were developed during Late Jurassic to Lower Cretaceous time (Redfern and Jones, 1995). During the Late Jurassic commencing in the Kimmeridgian, syn-rift sediments of the Madbi Formation were deposited (Beydoun et al., 1998). The Madbi Formation is composed of porous limestone to argillaceous lime mudstone. This Formation is divided into two members, the lower member (Meem Member) consists of source rock-quality shales, and sandy turbidites in the border of the basin and may form the reservoir rocks in some

oilfields of the northwestern Sab'atayn Basin. The Upper Lam Member is mostly composed of laminated organic rich shales and considered to be the most prolific oil-prone source rock in the basin (Brannan et al., 1999 and Csato et al., 2001). During Tithonian time, late stages of the syn- rift phase, ocean circulation in the Sab'atayn Basin became restricted, and an evaporitic succession (Safir Member) with an estimated original thickness of about 731 m was deposited (Albaroot, 2017). Massive halite occurs in the basin center, whereas anhydrite and clastic rocks rare along the basin margins (Seaborne, 1996), or totally absent. Interbedded thin shales within Safir member are rich in organic matter (Brannan et al., 1999). The Sab'atayn Formation is divided into four members named as Safir, Alif, Seen and Yah Member. Yah Member is dominated by fluvio-deltaic sandstone, mudstone and evaporate, followed by Seen Member, which is the second clastic sequence. Alif Member is composed of sandstone with shale, which form main reservoir in Sab'atayn Basin. Safir Member consists predominantly of halite with subordinate anhydrite divisible into several bodies separated by interbedded organic-rich shale and sandstone with minor argillaceous, dolomite and limestone. The interbedded organic rich shales within the Safir Member are considered to be the prolific oil-prone source rock in the Marib-Shabwa Basin within Sab'atayn Formation. The Safir Member constitute an excellent seal to the underling Alif Member reservoir and contain within them some potential good local reservoir seal pairs in the intra evaporate clastics and the evaporates (Beydoun et al., 1998). In the Northwestern part of the Sab'atayn basin during Tithonian time, deposition of late stages of the syn- rift phase clastic and evaporates sedimentations (Sab'atayn Formation) didn't extended and progressively thinned out for causes not well understood.

III. Methology

Source rock evaluation within the study area depends on the determination of organic matter content, which is usually expressed as total organic carbon (TOC). The hydrocarbon potentiality depends on the type and quantity of organic matter (kerogen) preserved in the petroleum source rock, thermal maturity and finally the generation potential of kerogen. The geochemical data such as total organic carbon (TOC), Rock-eval pyrolysis data, and vitrinite reflectance are presented and discussed for the proposed Upper Jurassic rock units in Northwestern part of Sab'atayn Basin (Dahamr Ali-01, Himyar-01, Kamaran-01 and Saba-01 wells). TOC determination and Rock-Eval pyrolysis analysis were performed on 100 mg crushed whole rock samples, heated to 600° C in a helium atmosphere, using a Rock-Eval II unit with a total organic carbon module. The Rock-Eval pyrolysis data provide information on the quantity, quality and maturity of organic matter contained within the Lam and Meem rock units (Table 1). A total of 148 rock samples were collected from shales of the Lam and Meem Members in the studied wells. Initially, the studied shale samples were cleaned of contaminants from drilling mud additives by washing the samples with water several times until no mud was visible on their surface. Parameters measured include Total organic carbon (TOC), free hydrocarbons (S1) in the rock, remaining hydrocarbon generative potential, mgHC/g rock (S2), and temperature of maximum pyrolysis yield (Tmax). Hydrogen (HI), production yield (PY), and production (PI) indexes were mathematically calculated (Table 1). The temperature at which the maximum generation of the products of pyrolysis occurs was used to calculate the following:

OI, oxygen index [OI = (S3/TOC) x 100)]

HI, hydrogen index [HI = (S2/TOC) x 100].

Plot of HI versus OI can be used to deduce the type of organic matter present in the source rock.

PI, production index [PI = S1 / S1+S2)

Hydrogen richness in the kerogen = S2/S3

Genetic potential of the source rock = S1+S2

Details on the Rock-Eval method and parameters as well as a summary of interpretive guidelines for Rock-Eval data are available in (Espitalie et al. (1977), Peters (1986), Peters and Cassa (1994), and Snowdon et al. (1998).

IV. Results & Discussions

The capability of any prospective reservoir depends on an effective source rock. Petroleum geochemistry is proving its value in helping petroleum geologists to evaluate source rocks and quantify the elements and processes that control the generation of oil and gas. Geochemistry is also an important tool for reducing uncertainty inherent in exploration and production of frontier basins. This section will explore basic geochemical methods used to evaluate new prospects.

a) Quality and quantity of organic matter

The impact of quality and quantity of the organic matter (TOC) in the sediments are very important for hydrocarbon generation. The quality term of organic matter is refer to whether the source rock organic matter is oil prone or gas prone, since different types of organic matter have different hydrocarbon generating potential or quality. However, the amount of organic matter in source rocks is the results of a wide variety of environmental influences. Tissot and Welte (1984), Peters and Cassa (1994) and Peters (1986) presented a scale for the assessment of source rocks potentiality, based on the TOC weight % and Rock–Eval

pyrolysis data, such as S_1 and S_2. The obtained data in (Table 1) show that the total organic carbon content (TOC) values for the Meem source rocks are between 0.2 and 1.68 wt% indicating fair to good source rocks. While the values for the Lam source rocks are between 0.2 and 2.93 wt% indicating fair to excellent source rocks only two samples have values more than 3 wt% in Kamaran-01 well. These conclusions are confirmed by the plots of total organic carbon (TOC wt%) versus remaining hydrocarbon (S2 mgHC/g rock) Fig. 2A. The total organic carbon is mostly very poor in studied wells. The Rock-Eval pyrolysis data in (Table 1) reveal that most of the samples consist of reworked organic matter with no interesting source rocks potential. On the other hand, the plot of Tmax versus production index (PI) Fig. 2B provides an indication of source rock maturity and hydrocarbon genesis. Thermal maturity is influenced by source rock organic matter type and the presence of excess free hydrocarbon together with the other factors like mineral matter, content, depth of burial and age (Tissot and Welte, 1984). The degree of thermal evolution of the sedimentary organic matter was deduced from Tmax (°C) Production Index (PI) and Vitrinite Reflectance (% Ro). The increase of maturity level of organic matter corresponds to an increase in Tmax. This phenomenon is related to the nature of chemical reactions that occur through thermal cracking. The weaker bonds breakup in the early stages while, the stronger bonds survive until higher temperatures in the late stages (Whelan and Thompson, 1993). Combining and finding relations between the essential Rock-Eval parameter, Tmax, and calculated Rock-Eval parameter, PI, is a valuable method for indicating the maturity of organic matter. The following relations between Tmax and PI are observed:

1. *Immature organic* matter has Tmax and PI values less than 430 °C and 0.10, respectively;
2. *Mature organic* matter has a range of 0.1 – 04 PI. At the top of oil window, Tmax and PI reach 460°C and 0.4, respectively;
3. *Mature organic* matter within the wet gas-zone has PI values greater than 0.4; and
4. *Post-mature* organic matter usually has a high PI value and may reach 1.0 by the end of the dry-gas zone (Peters K.E. (1986), Peters and Cassa, (1994), and Bacon, et al, (2000).

In well Dahamr Ali-01, most of the samples of Meem source rocks especially in the lower part have Tmax more than 445 °C and PI of 0.34 – 0.73. This indicate that the lower part in mature stage, while the upper part are in early mature and immature stages. Most of the samples are non-indegenous hydrocarbon except for few samples which fall within the hydrocarbon generation zone. Most of the samples in Himyar-01, Kamaran-01 and Saba-01 wells have Tmax less than 445 °C, accordingly ranging from immature to early mature stage. Some samples have elevated Tmax more than 445 °C making them peak mature. Samples from aforesaid wells except four samples from Kamaran-01 well are in main stages of hydrocarbon generation. The reset samples are non-indigenous hydrocarbons (Fig. 3). Most of the samples from the Lam source rocks in Dahamr Ali-01, Himyar-01, Kamaran-01 and Saba-01 wells are have Tmax less than 435 °C, accordingly plotted in immature zone.

b) Generating potentialities

The generating potential of source rocks is used to evaluate their capacity for hydrocarbon generation and can be determined by using the results of pyrolysis analysis. Tissot and Welte, (1984) proposed a genetic potential (GP = S1 + S2) for the classification of source rocks. According to their classification scheme, rocks having GP of less than 2 mg HC/g rock correspond to gas-prone rocks or non-generative ones, rocks with GP between 2 and 6 mg HC/g rock are moderate source rocks, and those with GP greater than 6 mg HC/g rock are good source rocks. Based on the above criteria, the Meem source rocks with a GP of less than 2 are non-generative rocks. Furthermore those source rocks with exceptionally high GP values in order of more than 10 mg HC/g rock may provide either an excellent source rock in Dahamr Ali-01 well, if the burial depth is sufficient to build temperature and pressure. On the other hand Lam source rock is classified as moderate source rocks. Non-generative potential has been reported for Lam source rock in Himyar-01 well where the GP is less than 1 mg HC/g rock Fig. 3. It is worthy to mention that both of the source rocks are located in shallow depth in the study area even more exposed on the surface for some wells location.

c) Genetic type of organic matter

The initial genetic type of organic matter of a particular source rock is essential for the prediction of oil and gas potential. Waples, (1985) used the hydrogen index values (HI) to differentiate between the types of organic matter. Hydrogen indices <150 mg/g indicate a potential source for generating gas (mainly type III kerogen). Hydrogen indices between 150 and 300 mg/g contain more type III kerogen than type II and therefore are capable of generating mixed gas and oil but mainly gas. Kerogen with hydrogen indices >300 mg/g contains a substantial amount of type II macerals and thus are considered to have good source potential for generating oil and minor gas. Kerogen with hydrogen indices >600 mg/g usually consists of nearly type I or type II kerogen; they have excellent potential to generate oil. Kerogen type for Lam and Meem source units can be deduced by the cross-plots of pyrolysis parameters, such as HI vs Tmax (modified ven Krevelen diagram, Fig. 4 and TOC vs S2 (Fig. 2A) which are probably resulted from deposition of more terrigenous type III organic matters sourced from land. Type III kerogen is

composed of terrestrial organic material that is lacking in fatty or waxy components. Cellulose and lignin are major contributors. Type III kerogen have much lower hydrocarbon-generative capacities than do Type II kerogen and, unless they have small inclusions of Type II material, are normally considered to generate mainly gas. Majority of study area is dominated by type III kerogen, which is attributed to terrestrial environment where land derived organic matter is prevailed. This type of kerogen is characterized by small amount of Hydrogen is present; However this type of kerogen can generate gas only.

d) Thermal Maturation

Thermal maturity is the extent of heat-driven reactions that alter the composition of organic matter. The concentration and distribution of hydrocarbons contained in a particular source depend on both the type of the organic matter and its degree of thermal alteration (Longford et al, 1990). In the present paper, the thermal maturity level of the source rocks of Meem and Lam members has been determined by the study of the geochemical parameters as Rock–Eval temperature pyrolysis ''Tmax'', Hydrogen index ''HI' Fig. 4. Combining and finding relations between the essential Rock-Eval parameter, Tmax, and calculated Rock-Eval parameter, HI, is a valuable method for indicating the thermal maturity of organic matter. Based on pyrolysis data kerogen classification diagrams were constructed using the HI versus Tmax plot as carried out by previous workers (Espitalie et al, 1985) which is used to determine the kerogen type and maturity Fig. 4. The results show that the analysed Meem source rocks are generally plotted in the mature zone of type III kerogen. Some samples in Dahamr Ali-01 well are upgraded to marginally mature zone. In addition Kamaran-01 well ranges from mature to post mature zone. The wide variation in maturity level of Meem source rocks attributed to overburden rocks and depth. Results of Lam source rocks samples show that the source rocks are still immature. Marginally mature in Dahamr Ali-01 and Saba-01 wells. These results have led to classify the Meem member as fully mature source rocks, while the Lam member is immature source rocks in the study area, because the structural setting shows the deepening of Meem member and shallowing of Lam member.

V. Conclusion

Upper Jurassic source rocks in the NW Sab'atayn Basin central Yemen have been investigated. The main conclusions of the study are, Upper Jurassic source rocks consider the main source rocks in the study area. Deposition of the Meem and Lam source rocks succession did not result in a renewal of generation processes. As evident from kerogen type present in studied wells we can clearly argued this kerogen derived from land derived organic matter. The Rock-Eval pyrolysis data is reveal that most of the samples consist of reworked organic matter with no interesting source rocks potential. Organic rich source rock with poor to good potential to generate oil and gas is present in the Upper Jurassic Meem and Lam Members. Good to fair source rocks of Meem and Lam Members is located in study area. Results of TOC for the studied wells show that the quantity of source rocks are fair to good, some samples are graded to excellent. Most of the studied samples of Meem and Lam source rocks have Tmax less than 440 °C, which place them in immature to marginally mature. Majority of samples in main stages of hydrocarbon generation Based on generative potential of Meem source rocks, it shows non-generative rocks. Kerogen type for Lam and Meem source units is dominated by type III organic matters sourced from land.

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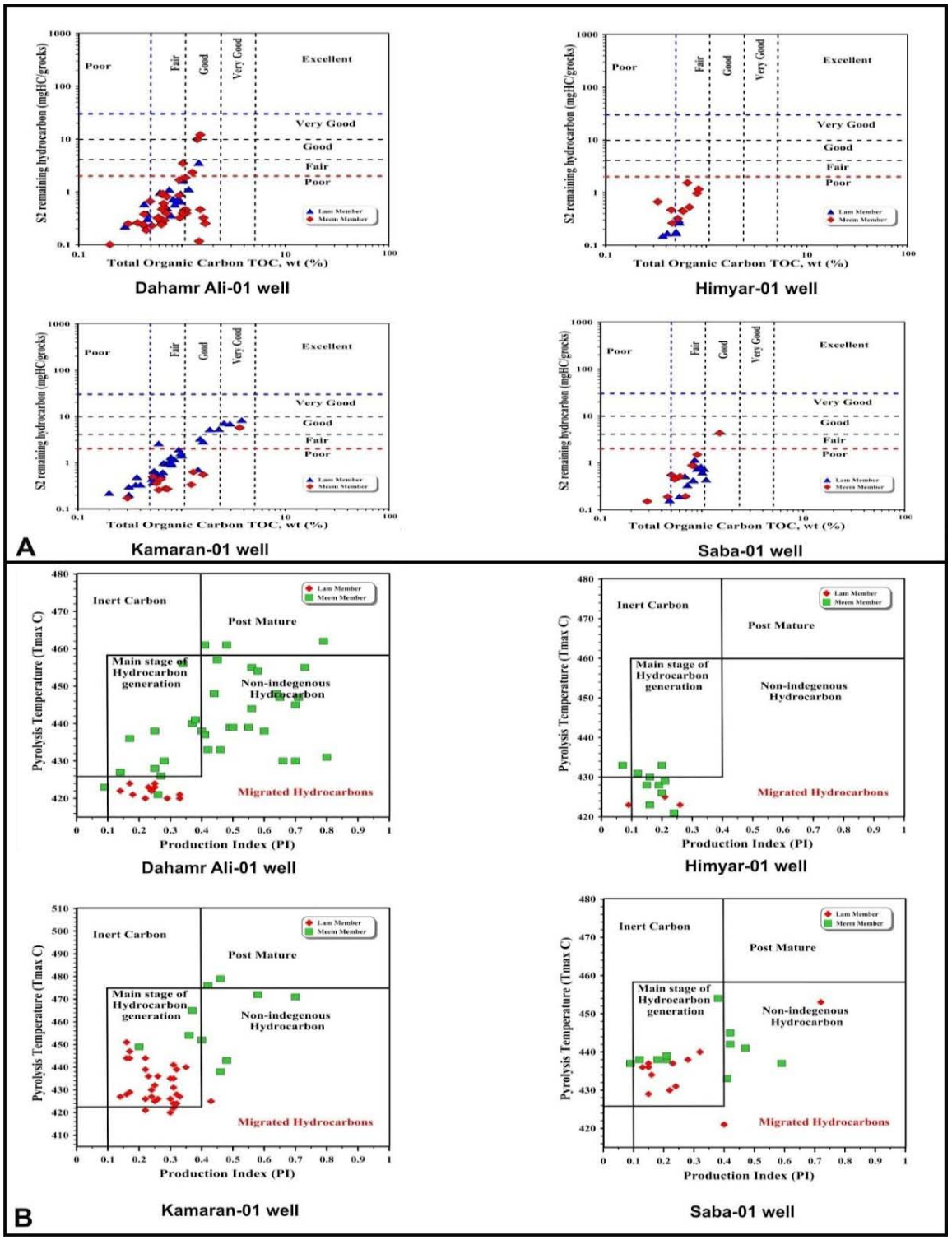

Figure 2: Quality and quantity of organic matter of Meem and Lam source rocks, NW Sab'atayn basin, Yemen.

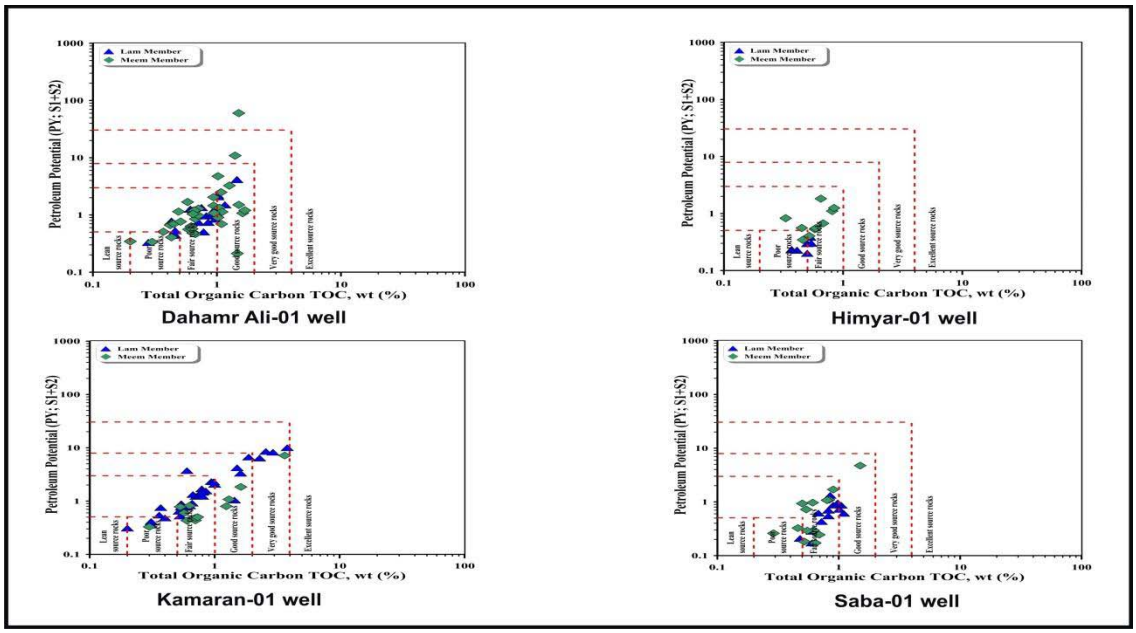

Figure 3: Generating potentialities of Meem and Lam source rocks, NW Sab'atayn basin, Yemen.

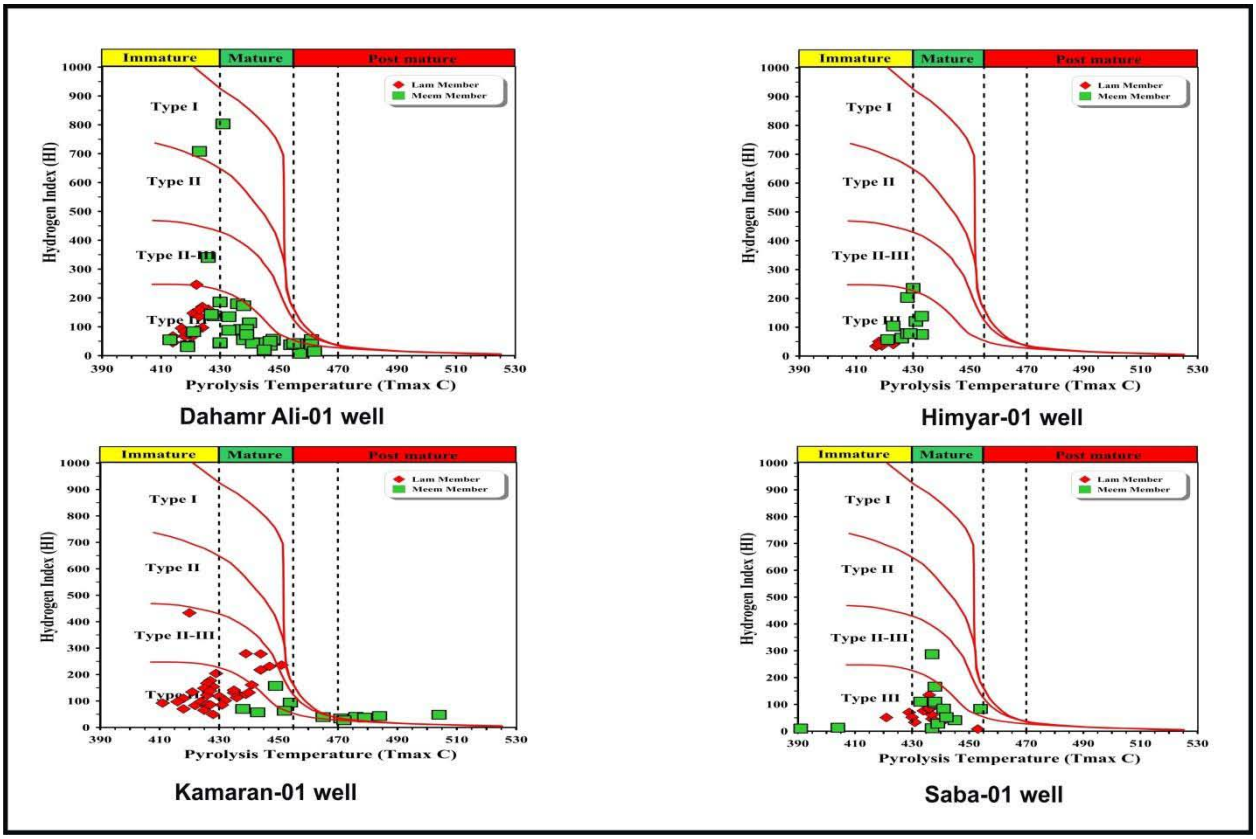

Figure 4: Kerogen type and Thermal maturation of Meem and Lam source rocks, NW Sab'atayn Basin, Yemen.

Table 1: Rock–Eval pyrolysis data for Lam and Meem source rocks in the studied wells.

Wells Name	Members	Depth (m)	TOC "wt%"	S1	S2	S1+S2	Tmax	HI	PI
Dahamr Ali-01	Lam Member	203.7	1.01	0.60	1.62	2.21	426	160	0.27
		323.2	1.16	0.38	1.13	1.50	424	97	0.25
		405.5	0.78	0.15	0.36	0.51	414	46	0.29
		484.8	0.97	0.19	0.66	0.85	420	68	0.22
		594.5	0.82	0.23	0.73	0.96	422	89	0.24
		640.2	0.85	0.16	0.58	0.74	418	68	0.22
		703.7	0.71	0.24	0.50	0.74	421	70	0.33
		722.6	1.45	0.58	3.57	4.15	422	246	0.14
		731.7	1.02	0.35	1.72	2.08	424	169	0.17
		798.8	0.9	0.29	0.70	0.99	420	78	0.29
		817.1	0.97	0.36	0.92	1.28	417	95	0.28
		881.1	0.46	0.13	0.31	0.44	414	67	0.3
		981.7	0.75	0.24	1.10	1.34	421	147	0.18
		1073.2	0.46	0.15	0.38	0.53	418	83	0.28
		1201.2	0.43	0.19	0.58	0.78	423	136	0.25
		1320.1	0.61	0.29	0.97	1.26	423	159	0.23
		1356.7	0.28	0.11	0.22	0.33	420	79	0.33
		1420.7	0.3	0.09	0.25	0.34	421	83	0.26
	Meem Member	1457.3	0.64	0.29	0.88	1.18	428	138	0.25
		1459.7	0.65	0.15	0.93	1.08	427	143	0.14
		1530.5	1.5	48.18	12.05	60.23	431	803	0.8
		1535.4	1.4	0.98	9.91	10.89	423	708	0.09
		1539.6	1.02	1.28	3.47	4.75	426	340	0.27
		1622.0	0.94	0.35	1.69	2.04	436	180	0.17
		1723.2	1.26	0.91	2.34	3.26	430	186	0.28
		1759.1	0.71	0.48	0.81	1.28	440	114	0.37
		1832.3	1.08	0.62	1.87	2.49	438	173	0.25
		1841.5	0.49	0.48	0.66	1.14	433	135	0.42
		1914.6	0.67	0.34	0.51	0.85	438	76	0.4
		1987.8	0.37	0.25	0.26	0.51	439	70	0.49
		2020.1	0.94	0.59	0.86	1.45	437	91	0.41
		2051.8	0.66	0.60	0.60	1.20	439	91	0.5
		2088.4	0.43	0.32	0.38	0.70	433	88	0.46
		2152.4	1.05	0.88	0.45	1.33	430	43	0.66
		2243.9	1.1	0.74	0.40	1.13	447	36	0.65

		2298.8	0.71	0.59	0.39	0.98	438	55	0.6
		2344.5	0.62	0.36	0.28	0.63	444	45	0.56
		2426.8	0.67	0.18	0.29	0.46	441	43	0.38
		2445.1	0.43	0.18	0.23	0.41	448	53	0.44
		2545.7	1.09	0.24	0.46	0.69	456	42	0.34
		2591.5	1.02	0.51	0.40	0.90	455	39	0.56
		2618.9	0.42	0.43	0.24	0.67	448	57	0.64
		2637.2	1.46	0.10	0.12	0.21	457	8	0.45
		2710.4	0.2	0.24	0.10	0.34	447	50	0.71
		2774.4	0.59	0.23	0.33	0.56	461	56	0.41
		2893.3	0.64	0.23	0.25	0.48	461	39	0.48
		3176.8	0.63	0.33	0.24	0.57	454	38	0.58
		3213.4	0.45	0.51	0.19	0.70	455	42	0.73
		3295.7	0.58	1.36	0.32	1.68	413	55	0.81
		3359.8	0.95	0.75	0.32	1.08	419	34	0.7
		3423.8	0.51	0.54	0.23	0.77	430	45	0.7
		3469.5	0.64	0.57	0.47	1.04	439	73	0.55
		3564.0	1.61	0.75	0.32	1.07	445	20	0.7
		3631.1	1.5	1.04	0.47	1.50	419	31	0.69
		3640.2	1.68	0.95	0.25	1.20	462	15	0.79
Himyer-01	Lam Member	91.5	0.50	0.03	0.27	0.297	423	54	0.09
		100.6	0.50	0.03	0.17	0.2	417	34	0.15
		295.7	0.50	0.02	0.18	0.2	419	36	0.1
		353.7	0.54	0.03	0.27	0.3	418	50	0.1
		362.8	0.41	0.06	0.17	0.227	423	41	0.26
		445.1	0.37	0.08	0.15	0.233	418	41	0.35
		454.3	0.37	0.08	0.15	0.23	418	41	0.34
		570.1	0.53	0.08	0.3	0.382	425	57	0.21
	Meem Member	628.0	0.52	0.08	0.32	0.403	426	62	0.2
		658.5	0.58	0.08	0.45	0.532	428	78	0.15
		686.0	0.45	0.09	0.47	0.557	423	104	0.16
		731.7	0.81	0.13	0.97	1.105	431	120	0.12
		750.0	0.84	0.09	1.16	1.246	433	138	0.07
		777.4	0.33	0.16	0.67	0.827	428	203	0.19
		817.0	0.59	0.11	0.44	0.553	433	75	0.2
		823.2	0.65	0.29	1.53	1.818	430	235	0.16
		828.0	0.46	0.08	0.26	0.345	421	57	0.24

		887.2	0.7	0.14	0.53	0.671	429	78	0.21
Kamaran-01	Lam Member	920.50	1.61	0.46	2.85	3.314	427	177	0.14
		938.78	0.36	0.21	0.33	0.543	411	92	0.39
		975.36	0.53	0.15	0.37	0.523	418	70	0.29
		993.65	0.66	0.29	0.62	0.912	424	94	0.32
		1011.94	0.4	0.15	0.33	0.481	422	83	0.31
		1030.22	0.2	0.09	0.22	0.31	418	110	0.29
		1085.09	0.31	0.15	0.2	0.354	425	65	0.43
		1131.08	0.71	0.27	0.95	1.22	421	134	0.22
		1176.53	0.54	0.24	0.53	0.767	424	98	0.31
		1222.25	0.31	0.11	0.3	0.412	416	97	0.27
		1277.11	0.81	0.24	1.25	1.485	428	154	0.16
		1295.40	0.94	0.39	1.92	2.31	429	204	0.17
		1331.98	0.54	0.23	0.66	0.89	426	122	0.26
		1350.26	0.79	0.37	1.32	1.691	426	167	0.22
		1368.55	0.67	0.33	0.99	1.322	425	148	0.25
		1408.18	0.6	1.11	2.6	3.711	420	433	0.3
		1426.46	0.55	0.2	0.65	0.854	430	118	0.24
		1481.33	0.57	0.19	0.58	0.775	432	102	0.25
		1548.38	0.75	0.29	0.96	1.247	436	128	0.23
		1600.20	0.6	0.23	0.53	0.754	426	88	0.3
		1645.92	0.63	0.27	0.54	0.809	427	86	0.33
		1691.64	0.52	0.2	0.44	0.641	431	85	0.31
		1773.94	0.85	0.37	1.17	1.543	427	138	0.24
		1828.80	0.8	0.32	0.9	1.222	436	113	0.26
		1901.95	0.78	0.44	1.02	1.46	435	131	0.3
		2002.54	1	0.63	1.41	2.043	435	141	0.31
		2066.54	0.98	0.71	1.58	2.287	441	161	0.31
		2075.69	1.87	1.47	5.22	6.689	439	279	0.22
		2139.70	0.79	0.46	0.99	1.452	439	125	0.32
		2148.84	2.57	1.36	7.14	8.505	444	278	0.16
		2157.98	1.51	0.92	3.28	4.201	444	217	0.22
		2167.13	2.29	1.08	5.29	6.373	447	231	0.17
		2176.27	2.93	1.32	6.91	8.232	451	236	0.16
		2194.56	0.37	0.26	0.49	0.751	440	132	0.35
		2258.57	1.44	0.33	0.71	1.038	428	49	0.32
		2267.71	3.81	1.7	8.31	10.01	444	218	0.17
		2276.86	3.64	1.43	5.71	7.144	449	157	0.2

	Meem Member	2322.58	0.63	0.38	0.44	0.817	438	70	0.46
		2404.87	0.3	0.16	0.17	0.329	443	57	0.48
		2450.59	0.53	0.28	0.5	0.778	454	94	0.36
		2505.46	0.57	0.24	0.36	0.599	452	63	0.4
		2587.75	0.7	0.16	0.27	0.433	465	39	0.37
		2660.90	0.7	0.2	0.28	0.483	476	40	0.42
		2752.34	0.6	0.17	0.26	0.43	484	43	0.4
		2843.78	0.73	0.23	0.27	0.5	479	37	0.46
		2907.79	1.62	1.29	0.55	1.836	471	34	0.7
		2926.08	1.24	0.46	0.33	0.797	472	27	0.58
		2944.37	1.3	0.45	0.62	1.076	504	48	0.42
Saba-01	Lam Member	48.768	0.82	0.28	0.42	0.697	421	51	0.4
		67.056	1.05	0.13	0.74	0.865	429	70	0.15
		112.776	0.82	0.12	0.43	0.547	430	52	0.22
		149.352	0.48	0.05	0.16	0.208	431	33	0.24
		204.216	0.72	0.1	0.33	0.43	437	46	0.23
		240.792	0.6	0.09	0.19	0.282	440	32	0.32
		286.512	0.68	0.1	0.52	0.615	434	76	0.16
		329.184	1.01	0.11	0.62	0.725	437	61	0.15
		356.616	0.9	0.13	0.74	0.868	436	82	0.15
		396.24	0.98	0.12	0.83	0.957	436	85	0.13
		423.672	1.1	0.17	0.44	0.611	438	40	0.28
		460.248	0.6	0.12	0.05	0.171	453	8	0.72
		496.824	0.85	0.17	1.15	1.319	436	135	0.13
	Meem Member	524.256	0.5	0.38	0.55	0.932	433	110	0.41
		560.832	0.9	0.2	1.49	1.698	438	166	0.12
		579.12	1.5	0.43	4.31	4.731	437	287	0.09
		624.84	0.83	0.23	0.86	1.093	438	104	0.21
		707.136	0.8	0.19	0.88	1.073	438	110	0.18
		743.712	0.61	0.45	0.51	0.967	441	84	0.47
		780.288	0.64	0.1	0.07	0.172	437	11	0.59
		816.864	0.69	0.05	0.19	0.245	439	28	0.21
		853.44	0.62	0.23	0.06	0.295	450	10	0.79
		885.672	0.52	0.12	0.07	0.183	404	13	0.63
		917.448	0.55	0.19	0.1	0.291	430	18	0.66
		944.88	0.46	0.14	0.19	0.325	445	41	0.42
		981.456	0.29	0.11	0.15	0.26	442	52	0.42
		1018.032	0.54	0.27	0.45	0.723	454	83	0.38

Table 2: Guidelines for interpreting source rock quantity, quality and maturation, and commonly used Rock-Eval parameters.

Quantity	TOC (wt%)	S1 (mg HC/g Rock)	S2 (mg HC/g Rock)
Poor	< 0.5	< 0.5	< 2.5
Fair	0.5-1	0.5-1	2.5 - 5
Good	1 - 2	1 - 2	5 - 10
Very Good	2 - 4	2 - 4	10 - 20
Excellent	> 4	> 4	> 20
Quality	HI (mg HC/g Rock)	S2/S3	Kerogen Type
None	< 50	< 1	IV
Gas	50 - 200	1-5	III
Gas and Oil	200- 300	5-10	II/III
Oil	300 - 600	10-15	II
Oil	> 600	> 15	I
Maturation	Ro (%)	Tmax (°C)	TAI
Immature	0.2 - 0.6	< 435	1.5 - 2.6
Early Mature	0.6 - 0.65	435 - 445	2.6 - 2.7
Peak Mature	0.65 - 0.9	445- 450	2.7 - 2.9
Late Mature	0.9 - 1.35	450 - 470	2.9 - 3.3
Post Mature	> 1.35	> 470	> 3.3

Source: (Espitalié et al., 1984) and (Peters, 1986).

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Sustainable Tourism a New Aspect in Tourism Industry: A Case Study on Tribal Tourism of Arunachal Pradesh

By Dr. Biplab Tripath & Subhechya Raha
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Abstract- Away from the glitches of monotonous life, every soul desires a retreat that could offer them memorable experience that could heal, teach, and help expand the mental periphery. A holiday and vacation can indeed add value to a human life. To spend a mind blowing holidays we need an amazing destination. Arunachal Pradesh offers a very distinct flavor of tourism. Along with the mind-blowing scenic beauty of the eastern Himalayas, Arunachal Pradesh serves a very spicy platter of her cultural diversity. Arunachal Pradesh is a home of 26 major tribes and many more sub tribes. There are approximately 3649 tribal villages present in the state, many of which opened their gate for the tourists to experience a world of unknown and wonders. The concept of sustainable tourism contains three important pillars which are economy, environment and culture or social issue. Tribal tourism of Arunachal Pradesh covers all these three aspects. It promotes the economy, sustain the environment and support the culture. Thus the prospect of tribal tourism is a golden opportunity both for the tourists and the local community in every possible way.

Keywords: *tribe, tribal tourism, tribal home-stay, cultural diversity, sustainability.*

GJHSS-B Classification: *DDC Code: 338.479172981 LCC Code: G155.C35*

Strictly as per the compliance and regulations of:

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I. Introduction

Travel is an important aspect of a human life. Travel helps expansion of knowledge and vision. It helps us to understand cultural differences and promotes tolerance towards each other. Travel actually helps us develop our consciousness, our inventiveness, and our perspective. It overall influences how we perceive the world around us. After a good long and meaningful travel experience mindset of any individual is bound to modify. Thus a sustainable travel is obviously going to bring some positive value in one's life. Sustainable tourism concerns economy, environment and also the social issues. Sustainable tourism covers every possible positive aspect of human civilization. It tourism doesn't only cover economy and environment, but also consider culture, community development as an integral part of travel experience. It involves providing job opportunity to the local youth. Encouraging and restoring the heritage, tradition etc. All these aspects happen to be part of a broader understanding of sustainable tourism.

Tribal tourism indeed promotes sustainability. Lifestyle of the tribal community is not only a different experience for the tourists but also lesson that should be learnt keenly. We can consider Tribal tourism as one of the beautiful, colourful and vibrant component of sustainable tourism. A very simple yet mundane life of the tribal people can be so much inspiring and empowering to change a city dwellers' mindset to something that regards kindness, care and tolerance towards our mother nature and surrounding. A simple and peaceful life of the tribal community can really be an eye opening event that can literally show us what we had been missing all the while.

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II. Objective

Objective of this study is to understand the scope of sustainable tribal tourism in North East India, with special concern to Arunachal Pradesh. The study aims to highlight the tribal tourism zones in Arunachal Pradesh and understanding the importance of different tribal communities and their contributions and value. The study also targets to realise the overall relationship of sustainable tourism with respective of tribal tourism. How culture and eco tourism blends with each other, the study also aims to find that.

III. Research Methodology

Secondary data is collected from travel network websites and government organisation websites. As the entire study has been conducted on the basis of secondary data and information government websites and tourism websites has been studied to find out different information related to the topic Research works on sustainable and eco tourism has been consulted. Different research activities and observations on the study have been studied to understand the concept of sustainable tourism and how tribal tourism fits into the concept.

A brief study on different tribal groups of Arunachal Pradesh is done, keeping in concern the tribal community that offers home-stay and is open for tourism. Their culture and tradition is understood properly and how it would help a tourist evolve with the experience they are going to have with them. Festivals of the tribal communities are also understood from the perspective of sustainability.

IV. Literature Review

Tribal tourism includes culture, diet, forestry and environment of the indigenous people. (Chang, Lin and Chuan 2021). Thus a tribal tourism embraces every aspect of lifestyle of indigenous people, their way of

living, their food habit, economy, agriculture, customs, festivals etc.

Indigenous tourism is a kind of tourism activity that is attracted by artistic performance, scenic point, historical heritage and customs of the aboriginal culture" as per Ryan and Huyton. Thus we can understand that the main USP of the tribal tourism is its raw exposure to a world which a city dweller can hardly imagine. They are attracted to their artistic performance, crafts, lifestyle, heritage custom etc.

Tribal tourism can also be termed as 'Ethnic tourism' or 'Ethno tourism'. (Rebecca Hallet 2020). Tribal tourism has so much to do with the culture. Tour to the hearth of ethnicity, so we can obviously term it as a ethno tourism or ethnic tourism.

Aboriginals retaining their culture and tradition can be the main attraction of such tourism. Thus tourism and culture exchange can put forward a positive impact on the environment and community. (Chang 2014) The safe cultural exchange of the tribal tourism, the objective of promoting the indigenous heritage, restoring the tribal culture etc all these aspects makes tribal tourism a real sustainable tourism.

V. Concept of Sustainable Tourism as an Aspect of Tribal Tourism

A sustainable tourism concerns a proper scope of economy without hampering, damaging or exploiting resource. A proper sustainable tourism must also seek to promote local culture, tradition and custom. A proper cultural understanding and exchange is what expected from Tribal tourism but without tampering the core essence of the indigenous culture. Tribal tourism does promote the culture of the tribal community, envisaging the value they hold like the tribal agricultural practice, their concern related to environment, their customs of worshipping different aspects of environment all can be a integral part of the tour which will eventually surfaces as vision and value for the visitors who might be living a very hectic city life.

Tribal tourism is indeed a tourism that embraces sustainability from every aspect. A home stay inside a tribal village does not require to burn down or destroy a huge area of forest or destroy any other natural resource, it does not require a gigantic infrastructure, thus it also doesn't require transportation of huge raw materials that would lead to a large amount of green house gas emission. Rather it promotes the ways to preserve the nature, how to grow your own organic food in your own garden, how recycling is being done etc. Tribal tourism upholds the culture, promote the traditions in true sense. With the advent of the wave of westernization the indigenous culture is in the verge of depletion. People are slowly being drifted from their own root, people are even forgetting their mother languages. Thus in such critical scenario a tribal culture, tradition, festival at any obscure corner world remains unseen, unheard, The sagas would remains unsung. Thus tribal tourism gives a platform to these indigenous tribal groups to show their culture, tradition, lifestyle to the people who might haven't experienced the life the way they does, or who doesn't perceive the nature as the tribal communities does.

VI. Scope of Tribal Tourism in Arunachal Pradesh

For amazing holidays we need an amazing destination. Arunachal Pradesh offers a very diverse zest of tourism. Along with the mind-blowing scenic beauty of the eastern Himalayas, Arunachal Pradesh serves a very spicy platter of her cultural diversity. Secluded and hidden from the rest of the world, the state became open for tourism since 1992. After 25 years the state celebrated a gala international tourism day on 27th September 2017, spotted as the paradise for the tourists who seek adventure and thrill. Arunachal Pradesh really does offer some splendid chroma of ethnology and heritage of respective tribal groups. Home of 26 major tribes and many more sub tribes, scattered in 3649 villages, tribal tourism is one of the vital attraction for the adventure seekers. And the interesting fact is that every tribe displays their own vibrant shade of praxis. These emerald green valleys of eastern Himalayas are civilized with diverse tribal legions. The Wanchos, Khamtis, Singpohs, Adis, Mishmis, Apatanis, Nyishis and many other ancestries has left their mark on this land, and now this is wide open for the cutting edge visitors. The tribal home stay is now a phenomenal opportunity for an exposure to this unique and exclusive tribal style of living. Highlighting here are some of the beautiful places of Arunachal Pradesh that offers a splendid experience of Tribal home stay within the ethnic heath of the tribal communities. Different tribal groups of Arunachal Pradesh had opened their door for the tourist letting them taste the flavour of a diverse culture.

i. *Tribal Villages*

- Yazili is a Nyshi Tribal Village is located at the Lower Subansiri district. It can be reach with only a 6 hour drive from Ziro. It is located near the beautiful Ranganadi river. Nyshis do demonstrate a very beautiful holistic, organic and sustainable way of living. They grow their own food, which is absolutely organic and chemical free. Yazili is located beside the majestic unexploited and also mostly unexplored dense forest. Even their religion embraces spirits associated with the nature. Thus few days of experience in Yazili would definitely influence the tourist's mindset, when he/she also becomes a part of beautiful organic lifestyle.

- Ziro Valley is known for being the house of the Apatani tribes. Beautiful villages of the Apatanis can be spotted near Ziro. Apatanis are known for their amazing skill of natural resource management. They have a very rich traditional knowledge about natural resource and how to conserve and manage them with sustainability. They are known for celebrating colourful festivals, they are also known for their skilled designing work on handloom, bamboo and cane. The pull of having experience with the Apatani tribe is absolutely magnetic. Because of their extremely high productive organic farming and traditional way of managing ecology, UNESCO proposed the Apatanis of the Ziro Valley to be included as the world heritage site.
- A Tagin Tribal Village is located at the Daporijo. The Tagins are one of the Major tribes of Arunachal Pradesh. They are known for utilising resources from the forest. They are also known for their exceptional knowledge of medicine and medicinal plants. They believe that this leads to conservation and protection of medicinal plant, conservation of culture and tradition and also conservation of Biodiversity. And another amazing thing what the Tagin tribe is that they are known is for their pure hearted, warm, hospitable and friendly nature. Thus a visit to a Tagin tribal village would add an amazing experience to one's life.
- Galo tribal Villages are located in Raglam Jungle Range. And Adi Gallong Tribal villages are located at Kombo, Pching area. Overnight stay at Along is required to pay a visit to these villages. A cane bridge connects the remote villages. Galos are the agricultural tribe and women are considered to be the backbone of the agricultural work.
- Villages of Adi and Adi Miniyongs are located near Pasighat. Adis are also known for being expert agriculturists. Their Villages comprising beautiful Bamboo homes demonstrates their excellent craftsmanship on bamboo works.

ii. *Tribal Festivals*

Festivals are an integral part of the Tribal society. They are the symbolism of the speciality and distinction of culture a tribal society holds. Every tribal community do have their special festival or celebration. And every festival has their own set of colour and vibrancy. These festivals are part of their lifestyle which demonstrates their beliefs, faith and practices as a whole. Tribal festivals are an excellent part of sustainable tourism. Tribal festivals are so magnetic that they can attract visitors from faraway places with their magnetism of vibrant colour.

- The Nyokom is the festival of the Nyshi tribe It is celebrated at Itanagar during 24th to 26th of February every year. Nyokom is the festival of Peace, prosperity and harmony. Thus a vision of a peaceful community and a world is demonstrated through this festival.
- Dree is a festival of the Apatani Tribe. It is celebrated at Ziro Valley. During 4th and 5th July every year. This is a festival of Harvest
- Mopin is a festival of the Galo Tribe. It is celebrated at Along during 4th to 5th April every year. Mopin is an agricultural festival
- Si-Donyi is a festival of the Tagin tribe. It is celebrated at Daporijo during 4th January to 6th January every year. This festival is celebrated to bring prosperity.
- Aran festival of the Adi Tribe. It is Celebrated at the Along Valley. It is celebrated around 7th March every year. This is celebrated mostly for harvest purpose.
- Etor is the festival of the Adi Tribe. It is celebrated at Along Valley around 15th May every year. Etor is related to the crop cycle.
- Solung is also a festival of the Adi Tribe celebrated at Pasighat and Boleng within 1st to 3rd September every year. This is also an agricultural festival of the Adi tribe
- Another Adi Tribal festival is Podi Barbi . It is celebrated at Along Valley around 5th September every year. This is a harvest festival which is more like a thanks giving to mother nature
- Torgy festival belongs to the Monpa Tribe. It is celebrated at Tawang. during 10th to 12th January every year. This festival has a religious significance. It runs for 3 days and demonstrate wonderful colourful costume dances with the objective of removing evil spirit and confirming happiness and prosperity.
- Reh is the Festival of the Mishmi Tribe. It is Celebrated at Roing and Anini during 15th to 17th February every year.
- There are many other festivals like Donjinn festival of the Adi tribe celebrated between 2nd to 5th February, Boori Boot festival, Myoko festival of the Apatanis celebrated during March.

VII. Conclusion

Tribal tourism is a sustainable tourism in real sense. Conservation of nature, economic development and promotion of culture all these three angels are predominant in Tribal tours. This can be look upon as follows:

- Tribal tourism of Arunachal is more than a tourism experience, rather it is a tour of lesson. Experience with the tribal community can prove to be really visionary.
- The tribal tourism of Arunachal Pradesh glorifies the culture and heritage of North East India.
- It helps promote the unique unity in diversity of India. It shows us a very distinct colour of the north eastern state being a very special and integral part

of our nation. A proper tourism opportunity in these areas would also help the tourists from all over nation and the world understand the glory and heritage of Arunachal Pradesh.

- It help understand how indigenous lifestyle and the conservation of nature is related. Conservation of nature does not always require a very big budget and number of workforce, but it also can be done in a very simple way that can be related to day to day activity of life.
- Tribal tourism of Arunachal Pradesh creating job opportunity for the youth. Creating the opportunity to grow is another important point of sustainable tourism.

Thus this becomes a sheer fact that culture and heritage are the true asset of any community and ethnicity. Culture and tradition is that magnet that pulls people from all over the world. The tribal home stay is now a phenomenal opportunity for an exposure to this unique and exclusive tribal style of living. The Wanchos inhabiting in the south-eastern part of the Tirap district, mesmerises people with their gorgeous headgear and heavy string beaded jewellery. The Vaishnav Noctes along the Indo-Myanmar border of the Changlang district would fascinate visitors with their traditional lifestyle. They are far more divided into sub tribes and exogamous clans. The excellent craftsmen Singpohs prevails along the Siang and Noa Dihing rivers. Agriculturists Khampti tribe occupies the fertile bank of Kamlang, Dihing and Tengapani. Mishmis and Mijis of the Dibang valley district are there to cherish the explorers with their rooted indigenous lifestyle. Hrussos or Akas with their painted face are similar enticing to an explorer's eye. The traditional Ponung dance of the Adis can contribute an unforgettable chapter in one's travel diary. The Galos had mastered the awesome art of weaving highly artistic designer clothes specially the popular traditional black and white designer skirt. Thus tribal art and culture is also a show stopper that would attract thousands of visitors.

Thus home stay opportunity with these tribes are gaining momentum and giving a fair acceleration in the Tourism industry of Arunachal Pradesh. Like the Ziro valley home stay with the Apatani tribes, Zomithang home stay with the Monpas, Nampong home stay near the densely forested Patkai hills are alluring enough to attract good number of tourists each year. So if one desires to learn how a tribal kitchen looks like or how does a chicken gets cooked inside a bamboo shell. How does a tribal dance feel around a luminous bonfire at night near a dense tropical forest, Arunachal Pradesh has to be a sure destination. For excitements and goose bumps, for adrenaline and peace mind for spicing up the vacation, for ultimate joy and exploration, Arunachal Pradesh welcomes the entire world with wide open arm.

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Lichen Species as Bio-Accumulator of Some Halogens on Mount Cameroon Volcano, West Africa

By A. E. Orock, A. B. Fonge, E. M. Shemang, M. Zhai & C. E. Suh
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Abstract- Lichens diversities are informative indicators for assessing impacts of air pollution, climate change, environmental health, volcanic activities, habitat heterogeneity and continuity. Lacking roots, vascular tissues, stomata and waxy cuticle, they absorb and accumulate airborne nutrients/pollutants from the atmosphere over their entire surface. Halogens, especially fluorides are released into the atmosphere in large amounts by volcanic eruptions and their pollutants levels in lichens can be determined quantitatively by chemical analysis of species. The objective of this study was to examine the lichens potentials on Mount Cameroon (MC) as bio-monitors and bio-accumulators for some halogens (F, Cl, Br) levels. To achieve this objective, 34 lichen species were analysed using selective ion electrode. The species were collected from eight sampling sites on two flanks of MC at elevations ranging from 3-2178 m above sea level.

Keywords: lichens, mount cameroon, leptogium gelatinosum, fluorine and halogens.

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Abstract- Lichens diversities are informative indicators for assessing impacts of air pollution, climate change, environmental health, volcanic activities, habitat heterogeneity and continuity. Lacking roots, vascular tissues, stomata and waxy cuticle, they absorb and accumulate airborne nutrients/pollutants from the atmosphere over their entire surface. Halogens, especially fluorides are released into the atmosphere in large amounts by volcanic eruptions and their pollutants levels in lichens can be determined quantitatively by chemical analysis of species. The objective of this study was to examine the lichens potentials on Mount Cameroon (MC) as bio-monitors and bio-accumulators for some halogens (F, Cl, Br) levels. To achieve this objective, 34 lichen species were analysed using selective ion electrode. The species were collected from eight sampling sites on two flanks of MC at elevations ranging from 3-2178 m above sea level. The significance of the difference between means was tested using ANOVA test to compare the concentration of Halogens according to Elevation, Post Hoc Multiple Comparisons Altitudes, Independent Samples t-Test to compare the concentration of Halogens according to substrate types and Box – plot to confirm the test.

Student t-test for the comparism of the halogens with regards to the substrate (Table 4) shows no significance difference in the means of the all the halogens but a slight difference (p= 0.048 at 0.05 levels) in the variance of Cl. The box-plot (fig 3) also confirms the slight difference in Cl. *Leptogium gelatinosum* was identified as the highest sequesters, followed by *Heterodermia obculata* and least was *Parmotrem atinctorum*. Fluorine was the most dominant halogen with concentrations ranging from 0-188 µg/g with mean values of 78 ± 49 and bromine the least. The concentrations were higher for specimens located close to the coastal areas in the downwind direction compared to those found further inland.

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I. Introduction

Volcanic regions have always attracted many people worldwide because of the high fertility of their soils (Diana *et al.,* 2019). However, human proximity to volcanoes can lead to several health problems as consequence of the chronic exposure to the materials released from the volcanic activity. An element often found in elevated concentrations in volcanic regions is fluorine. Although fluoride is recognized to have a beneficial effect on the rate of occurrence of dental caries when ingested in small amounts, its excessive intake results in a widespread but preventable pathological disease called fluorosis (Dey and Giri, 2015) While skeletal fluorosis, the most severe form of fluorosis, requires a chronic exposure to high concentrations of fluoride in water (4–8 mg/L), dental fluorosis occurs after shorter periods of exposure to fluoride in lower concentrations (1.5–2.0 mg/L). In some volcanic regions, where exposure to elevated amounts of fluoride is persistent, biomonitoring programs are fundamental (Garcia and Borgnino, 2015).

In the present world pollution scenario, a comprehensive knowledge of pollutants and their adverse effects on the ecosystem are required for selection of a workable monitoring and conservation technique (Munzi *et al.,* 2012; Ahmad *et al.,* 2007). The increasing awareness of the potential hazards and impact of air pollution on the health of human populations, forest decline, climate change and loss of agricultural productivity, for example, has been a cause of increasing public concern throughout the world (Smodis, 2007). This has highlighted the need for continuous monitoring of the levels of pollutants in the environment (Garty *et al.,* 2002). Environmental monitoring approaches that are cheap, can be used anywhere, and respond to many kinds of airborne pollutants are needed to fingerprint the pollutant sources and their dispersion pattern (Larsen *et al.,* 2007). A comprehensive approach to reduce the impacts of pollution and climate change, an approach that decreases emissions across all sectors and enhances the adaptive capacity of all nations with economic reflections is needed (Pinhoa *et al.,* 2012).

Lichens emerge as the key answer to this monitoring problem and are the flora of choice for monitoring studies (Notcutt and Davis, 1989). They obtain their nutrients directly from the atmosphere and their chemical composition therefore holds the promise of becoming a natural or 'green' technique for monitoring the health of the environment around passively degassing volcanoes and industries. Bio-accumulation in lichen thalli has been used as a major tool for assessing air quality in volcanic and industrial areas (Bennett, 2006). They are extremely valuable in environmental monitoring since they exist worldwide and

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are sensitive to many different kinds of pollutants (Brodeková *et al.,* 2006). They are slow growing; do not shed parts and are perennial pioneer plants commonly described as sentinel organisms (Loppi *et al*., 2002). They are good bio-accumulators of heavy metals and trace elements and can be transplanted where they do not occur in nature (Llop *et al.,* 2012).

Lichens are mutual symbiosis between fungi with an algal and/or a cyanobacterial partner (Morris and Purvis, 2007). The success in lichenization is attributed to a genetic combination resulting from metabolic biomolecules and influenced by environmental factors (Jatinder *et al.,* 2012). This process has created unique characteristics in lichens such as the unique anatomical (absence of roots, stomata, vascular tissues and cuticle) and physiological (poikilohydry and absorbance of nutrient from general thallus surface from the atmosphere. These peculiarities, allow lichens to grow in all sorts of terrestrial habitats comprising 8% of vegetation.

According to Lawrey (1986), lichens produce a wide array of more than 1000 unique secondary metabolites (depsides, depsidones, *β*-orcinoldibenzyl esters, and xanthones, usnic acid and pulvinic acid derivatives, for example) as adaptations for life in marginal habitats. These secondary metabolites assist to maintain the lichen symbiotic association and compete with organisms sharing the same niche (Culberson and Culberson, 2001). Another characteristic stress-resistance mechanism is the accumulation of melanin and oxalate crystals in their thallus, which provide a crystal layer on the thallial surface making lichens tolerant to extreme environments and good bio-accumulators of atmospheric substances (Hess *et al.,* 2008). Most lichens are tolerant to high concentrations of atmospheric pollutants well beyond levels necessary for their physiological requirement by sequestrating and accumulating varied oxalate crystals (Garty *et al.,* 2002; Bjerke *et al.,* 2002; Chen *et al.,* 2000). The aggregates of these oxalate crystals disintegrate and provide a crystal layer on the thallial surface making lichens good bio-accumulators. Since lichens do not shed parts (Walker *et al.,* 2003; Monge-Nájera *et al.,* 2002), and bio-accumulate pollutants safely in their thalli over time, pollutants levels can be professionally determined quantitatively by chemical analysis of species and qualitatively by observing species diversity, abundance and distribution (Jovans, 2008). With their indiscriminate ability to absorb and bio-accumulate both nutrients/ pollutants from the atmosphere, elevated concentrations of certain elements in lichens are a sure sign of atmospheric deposition (van Herk, 1999).

Lichens can be used as bio-monitors of pollutants by quantifying the amount of trace element(s) accumulated within them over time (Srivastava *et al*., 2015, Bargagli, 2016). They have been used to assess deposition and air quality in hundreds of studies worldwide (Donahue, 2018). Ayrault *et al.,* 2007, have shown a relationship between the quantities of pollutants in the environment and those concentrated in lichen thallus. A variety of elements and chemical compounds affecting lichen growth and distribution are found in the atmosphere (Bajpai *et al*. 2011). Pollutants, including sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and fluoride (F) compounds, remain in the same chemical form after they are emitted into the atmosphere and are easily absorbed by lichens. Gases like chlorine and fluorine, leads to the injury of fundamental metabolic processes, which arise by acidifying the water and the substrates, resulting in the loss of most sensitive lichen species (Brodeková *et al.,* 2006). Many lichens are sensitive to fluorine pollutant as it can concentrate in hydrated lichens to more than 200 times ambient concentrations (Notcutt and Davis, 1989). Fluoride are highly toxic to lichens, and elevated levels of fluoride are correlated with chlorophyll breakdown, reduced ATP concentration, reduced photosynthesis and disappearance of species (Stefano and Luisa, 2006). In general, obvious damage to lichens begins at levels of 50-70 ppm.

In most parts of Europe like Germany for example, (Hauck, 2005), lichen transplants from pristine to polluted areas are carried out to bio-accumulate atmospheric pollutants. The lichen *Hypogimnia physodes* was used to bio-accumulate radionuclide Uranium (Golubev *et al.,* 2006) and rare earth elements in Czech Republic (Jitka *et al.,* 2010). The fruticose lichen *Stereocaulon vesuvianum*, growing on the slopes of Mount Vesuvius in South Italy, was used as a bio-monitor of ^{134}Cs, ^{137}Cs, ^{103}Ru and ^{106}Ru derived from the April 26, 1986 Chernobyl nuclear reactor disaster (Environment Canada, 2003). Grasso *et al.* (1999) found that lichen composition reflects the contribution of the volcanic activity in Mount Etna and Vulcano Island. They noted that, distribution of the degassing elements (arsenic (As), antimony (Sb), Br, and lead.

Volcanoes emit a variety of gases both between and during eruptions, including H_2O, CO_2, SO_2, HCl, NH_3, H_2S, HF and a few other minor constituents (Cronin and Sharp, 2002). These gases interact rapidly with the ash particles of a volcanic plume and especially atmospheric water to form acidic aerosols. These aerosols given off during and after volcanic eruptions caused problems on a number of occasions when it has accumulated in low lying areas. Exposure to excessive amounts of fluoride may cause adverse health effects for humans and animals (Conti *et al*., 2016) The plume dispersed by winds after a volcanic eruption contains volcanic ash that may also be a source of fluoride at levels that are potentially toxic. Fluorides are released into the environment naturally through the weathering and dissolution of minerals, the emissions from volcanoes and from marine aerosols (WHO, 2002)

fluoride emissions from volcanoes and the natural occurrence of excessive amounts of fluoride in drinking water have affected the health of humans and livestock for centuries, if not millennia. Although sometimes of anthropogenic origin, high levels of fluorine are generally related to natural sources. Volcanic emissions of fluorine take the form of either sluggish permanent release from quiescent volcanoes (passive degassing) or rarer but more impacting discharges during short-lived volcanic eruptions (Schwandner *et al.,* 2004 Linhares *et al.,* 2017). It has been estimated that passive degassing, like that existing at Mt. Etna (Italy) and Masaya (Nicaragua) volcanoes, accounts for about 90% of the volcanic fluorine release. The influence of these emissions on the surrounding environment and in particular on vegetation has been investigated by several authors (Nelson and Wheeler, 2016).

Little or no bio-accumulation and monitoring work have been carried out on the active Mt. Cameroon. Mount Cameroon volcano with a return period of 20 years (Suh *et al.,* 2003), has been the most frequent erupted volcano in West Africa, with eight eruptions in the last 100 years (1909, 1922, 1925, 1954, 1959, 1982, 1999 and 2000). It constantly releases various constituents into the environment during active eruptions and even in quiescent degassing periods (Suh *et al.,* 2008). These researchers reported that, Mt. Cameroon basanites melt inclusions has shown high levels of carbon dioxide with a concentration of 967 μg/g, sulphur 2400 μg/g, chlorine 1270 μg/g and fluorine 1530 μg/g. In spite of these findings, there is little knowledge of lichens toxic levels and remediation of the high levels of halides release from this volcano.

The objective of this paper was to determine the concentration levels of some halogens and identify potential lichens species that can be used as appropriate bio-accumulators of halide toxicity for Mt. Cameroon degassing volcano.

II. Materials and Methods

a) Description of the Study Area

i. Location

The study area (Fig.1) is the active MC volcano located in the coastal belt of the Gulf of Guinea, South West Region of Cameroon. It lies between Latitudes 3°57' to 4° 27'N and Longitudes 8° 58' to 9° 24'E (Suh *et al.,* 2003). It is the highest peak in West Africa, is of volcanic origin and rises from the Atlantic Ocean to a height of 4100 m. It covers a surface area of about 1750 km^2 (DeLancey and Mark, 2000).

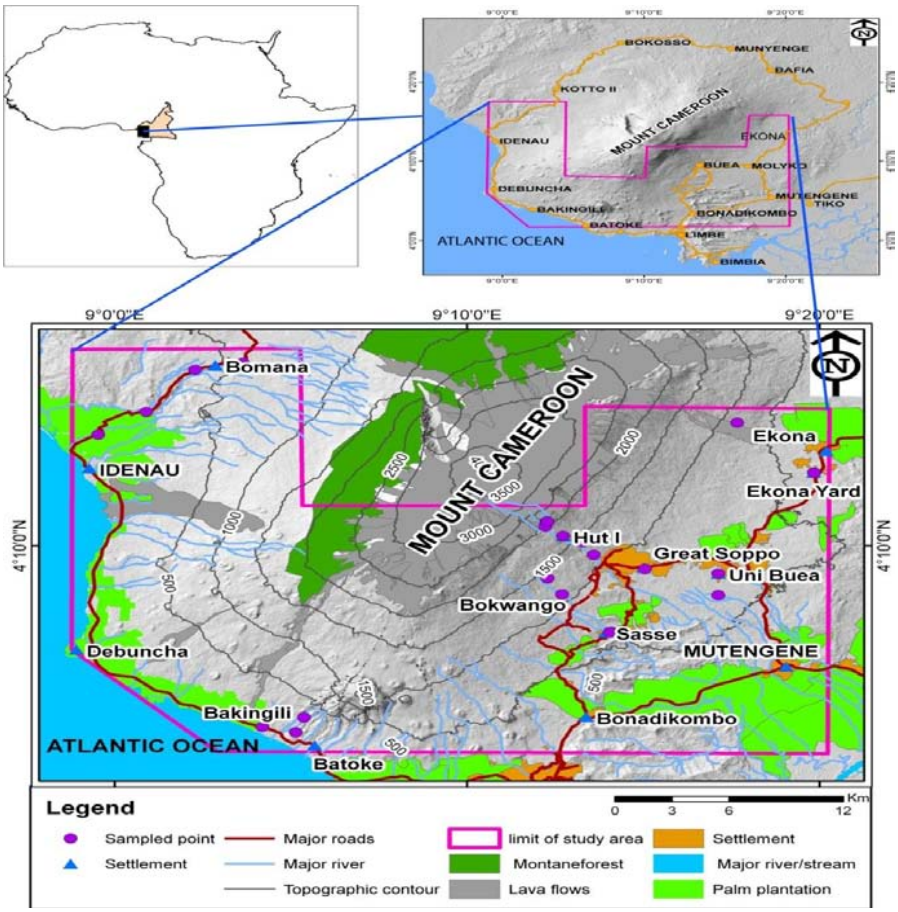

Fig. 1: Topographic features of Mt. Cameroon and location of sampling sites mentioned in the text.

b) Sample Sites

The survey sites were divided into Northern and Southern contrasting flanks following wind direction and ash fall trends from various eruptions. The northern flank was called the leeward and southern flank was called the windward. Out of the eight sites selected on the two flanks, four were on the leeward flank (Lower Buea, Upper Buea, IRAD-Ekona and Ekona-Mbenge) and four from the windward flank (Batoke, Bakingili, Idenau and Bomana). Lower Buea on the leeward flank comprises of University of Buea campus, Great Soppo, and Sasse. Some species were collected from control area of Mamfe (5.7512° N – 9.3146° E) about 270 km from Mt. Cameroon.

The survey was also done based on altitudinal levels which ranged between 3 to 2178 m above sea level (Table 1). The altitudinal levels were divided into three (low, mid and high) ranges.

Table 1: Altitudinal ranges of sampling sites.

Altitude	Range(m)	Sites
Low	3 -499	IRAD-Ekona Batoke Bakingili Idenau
Mid	500-1000	Ekona-Mbenge Lower Buea Bomana
High	>1000	Upper Buea

c) Sample Selection

Thirty-four macro lichens (Foliose and Fruticose) species from six families, eight genera were collected from 8 sites around Mt. Cameroon. From each sites, different sampling points were surveyed given a total of about 12 sampling points in the study. These species were collected from trees and rocks (Table S2). All the collecting points were Georeferenced with a High Sensitive ErexGlobal Positioning System (GPS).

The samples were selected based on the criteria shown on Table 2. The selected species were common to most sites and represent various altitudinal levels on the two flanks of the edifice.

Table 2: Lichen species selected for halogens (fluorine (F), bromine (Br), and chlorine (Cl) analysis.

S/N	Criteria (species abundance at sites, elevation, flanks, morphology)	Species
1.	Foliose Species common to all sampling sites	*Leptogium gelatinosum,*
2.	Species of mid elevation	*Heterodermia obscurata* *Heterodermia jabonica*
3.	Species found on the same sampling (Leeward) site but differ in substrate (tree/rock)	*Parmotrema tinctorum*
4.	Species restricted to the mid and high altitudes	*Flavoparmelia caperata*
5.	Site-specific species (These are species found only in particular sampling points and not seen in any other area)	*Canoparmelia concrescens* *Cladonia sp, Sticta stenroos* *Usnea dasypoga,* *Usnea florida, Usnea articulate*

d) Sample preparation and analytical procedure

In the Life Sciences laboratory, University of Buea, the lichen species to be analysed for their halogens (F, Br and Cl) levels, were sorted and curated to remove adhering bark, mosses, other lichen species, soil particles, etc. Following Lorenzini *et al.,* 2006, no washing procedure was done, to avoid the leaching of soluble matter from tissues. The species were put in labeled envelops and oven-dried to constant weight in a Gallenkemp Hot box oven fan size 3 at 60 °C for 48 hours. The different species were put in small zip locked bags and labeled with chemical codes. Samples were chemically analysed by selective ion electrode method, at the department of geology, university of Botswana. A 0.5 g split of each sample was digested with hydrogen fluoride (HF), then aqua regia and the aliquots analysed. The detection limits ranged from 0.01 to 0.02 µg/g. Replicate analyses were performed on selected samples and data quality was excellent with standard deviation values less than 1%. Standards were run between samples and quality control of the analyses was ensured by inserting blanks into the analytical run after 6 samples. Prior to statistical analysis of the geochemical parameters, the data set was regrouped based on the lichen species. The entire data were then log-transformed to normalise skewed distributions. The significance of the difference between means was tested using ANOVA test to compare the concentration of Halogens according to Elevation, Post Hoc Multiple Comparisons Altitudes, Independent Samples t-Test to compare the concentration of Halogens according to substrate types and Box – plot to confirm the test.

III. Results

ANOVA test on the variation in the concentration of halogens across the different elevation revealed that there was a significant difference (p = 0.022) for F and Br and p= 0.030 for Cl at 95% confidence level (Table 2). The box-plots (fig 2) also revealed that Cl concentration are high at lower elevations.

ANOVA test to compare the concentration of Halogens according to Elevation

		Sum of Squares	Df	Mean Square	F	Sig.
Fluorine	Between Groups	17554.069	2	8777.035	4.321	.022
	Within Groups	62966.666	31	2031.183		
	Total	80520.735	33			
Chlorine	Between Groups	7630.711	2	3815.355	3.926	.030
	Within Groups	30129.760	31	971.928		
	Total	37760.471	33			
Bromine	Between Groups	2814.601	2	1407.300	4.322	.022
	Within Groups	10093.429	31	325.594		
	Total	12908.029	33			

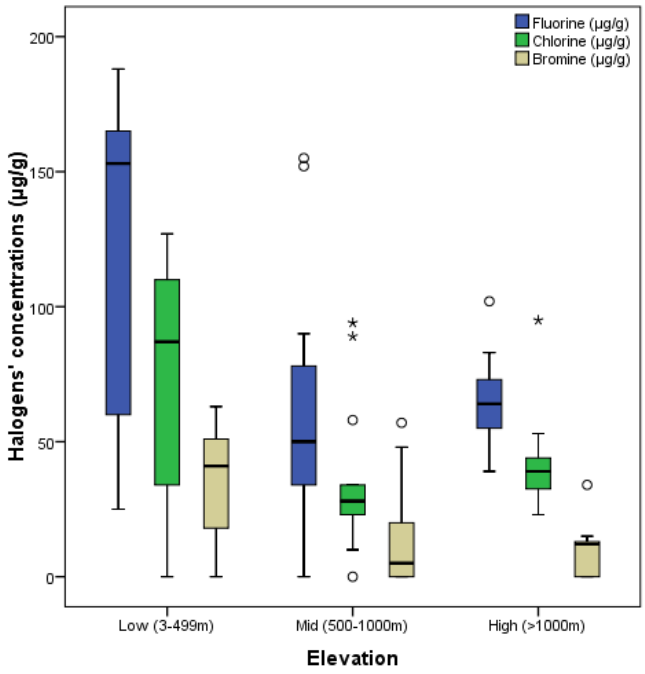

Fig. 3: Box – plot of Halogens concentrations in the different elevations

The Post Hoc Multiple Comparison test (Table 3) shows a significance difference at 0.05 levels of the halogens at low – mid altitude, F (p=0.030), Cl (p=0.027) and no significance difference of Br (p=0.053) at this altitude.

Table 3: Post Hoc Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Fluorine	Low (3-499m)	Mid (500-1000m)	51.849*	19.255	.030	4.46	99.24
		High (>1000m)	51.051*	20.257	.044	1.19	100.91
	Mid (500-1000m)	Low (3-499m)	-51.849*	19.255	.030	-99.24	-4.46
		High (>1000m)	-.799	18.159	.999	-45.49	43.89
	High (>1000m)	Low (3-499m)	-51.051*	20.257	.044	-100.91	-1.19
		Mid (500-1000m)	.799	18.159	.999	-43.89	45.49
Chlorine	Low (3-499m)	Mid (500-1000m)	36.357*	13.320	.027	3.57	69.14
		High (>1000m)	29.364	14.012	.107	-5.12	63.85
	Mid (500-1000m)	Low (3-499m)	-36.357*	13.320	.027	-69.14	-3.57
		High (>1000m)	-6.994	12.561	.844	-37.91	23.92
	High (>1000m)	Low (3-499m)	-29.364	14.012	.107	-63.85	5.12
		Mid (500-1000m)	6.994	12.561	.844	-23.92	37.91
Bromine	Low (3-499m)	Mid (500-1000m)	18.762	7.709	.053	-.21	37.74
		High (>1000m)	22.333*	8.110	.026	2.37	42.29
	Mid (500-1000m)	Low (3-499m)	-18.762	7.709	.053	-37.74	.21
		High (>1000m)	3.571	7.270	.876	-14.32	21.46
	High (>1000m)	Low (3-499m)	-22.333*	8.110	.026	-42.29	-2.37
		Mid (500-1000m)	-3.571	7.270	.876	-21.46	14.32

**. The mean difference is significant at the 0.05 level.*

Student t-test for the comparism of the halogens with regards to the substrate (Table 4) shows no significance difference in the means of the all the halogens but a slight difference (p= 0.048 at 0.05 levels) in the variance of Cl. The box-plot (fig 3) also confirms the slight difference in Cl.

Table 4: Independent Samples t-Test to compare the concentration of Halogens according to substrate types

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2- tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Fluorine	Equal variances assumed	3.568	.068	-.623	32	.538	-16.533	26.541	-70.595	37.528
	Equal variances not assumed			-.435	3.324	.690	-16.533	38.030	-131.152	98.086
Chlorine	Equal variances assumed	4.234	.048	-1.169	32	.251	-20.933	17.907	-57.408	15.541
	Equal variances not assumed			-.760	3.266	.498	-20.933	27.552	-104.716	62.849
Bromine	Equal variances assumed	2.837	.102	-.761	32	.452	-8.067	10.595	-29.648	13.515
	Equal variances not assumed			-.541	3.340	.623	-8.067	14.914	-52.907	36.774

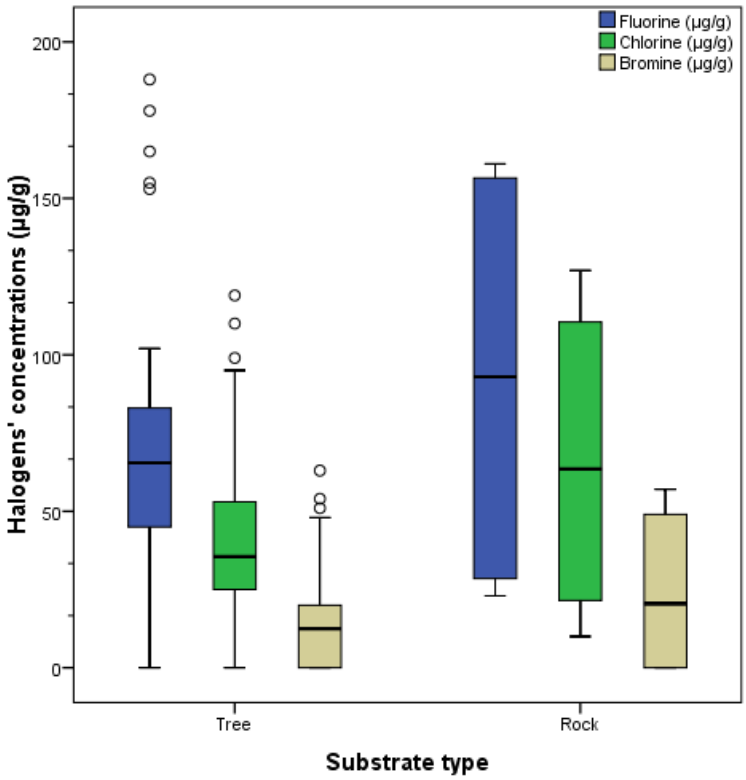

Fig. 3: Box – plot of Halogens concentrations in the substrate types

Table S2 revealed that, of the eight lichen genera used for analyses, *Leptogium* was the most abundant, widely distributed and had very high concentrations of halogens compared to all the other species. *Leptogium gelatinosum* accumulating ability differs between sites. *Leptogium gelatinosum* samples from northern leeward flank (MC 02 from Upper Buea, MC 04 from Bomana and MC 10 and MC 11 from Ekona-Mbenge) show low accumulation of halogens over samples collected from the western windward flank Sasse (MC01 and MC03), Idenau (MC 05 and MC06), Bakingili (MC07) and Batoke (MC08 and MC09).

Although, *Leptogium gelatinosum* recorded highest concentrations, other species like *Heterodermia obscurata, Cladonia sp, Usnea articulate* in BmtUM recorded high concentrations. Lichen species also showed differing accumulating potentials in substrates (*Parmotrema tinctorum* (MC27) a corticolous sample collected in Ekona-Mbenge accumulated more than the saxicolous specimen (MC26) collected in the same point).

All the eight lichen genera showed very high concentrations of F and low levels of Br. F concentration is highest in *Leptogium* (188 μg/g) and lowest in *Parmotrema* (0 μg/gto 23 μg/g). The geochemical analysis of the lichens indicated that F was the most dominant halogen (Fig. S1) with concentrations that range from 25-188 (mean = 78.00 ± 48.68 μg/g). The range for Cl concentration was 10-127 μg/g (mean =47.23 ± 33.37 μg/g), while that for Br, ranges from 0-63 μg/g (mean= 18 ± 19.58).

Fig.S2 shows that, there was highest F- bio-accumulation in *Leptogium gelatinosum* species in Idenau which ranges from (153 to188 μg/g), Batoke (165 μg/g), Bakingili (178 μg/g), Sasse (152 to155 μg/g) and low in Ekona-Mbenge (34 μg/g).

Cl bio-accumulation in the *Leptogium gelatinosum* species in Idenau ranges from (110 to119 μg/g) was highest and lowest in the *Leptogium gelatinosum* of Bomana (23 μg/g), Ekona (33 μg/g) and Hut 1(28 μg/g) (Fig. S3).

Fig. S4, revealed no Br bio-accumulation in the *Leptogium gelatinosum* species in Ekona (0 μg/g) and Bomana (0 μg/g) but higher in Idenau (63 μg/g).

IV. Discussion

Lichens from Mt. Cameroon demonstrated significant compositional variation between species as observed on the multi-element distribution patterns even for those growing in the same area. However, specimens from the same species tend to have similar element concentration patterns. This could be explained by the fact that lichens species selectively accumulated some elements. Similarly, Rani *et al*. (2011) found out that, the estimated nine heavy metals in lichen samples from 12 different sites of Dehradun city by periodic monitoring and spotted Zn, Ni, Cd and Cr were higher in lichens, collected from road side while maximum quantity of Fe, Cu and Al were reported in lichens collected from central sites of the city while the lowest amounts of all the metals were reported in sites farther from city.

The species *Leptogium gelatinosum* with very high concentrations of the halogens in all the sampling sites and even the control area of Mamfe 270 km from Mt. Cameroon has a higher tendency to sequestrate these elements than all the other species recorded in the study. This is in accordance with the study about the suitability of the fruticose lichens *Evernia prunastri, Cetraria islandica* and *Ramalina farinacea* collected from oak trees in a remote area located in the Chianti Region (Tuscany,central Italy), as transplants for biomonitoring trace element, showed that *E. prunastri* has to be preferred for its higher accumulating capacity (Cercasov *et al*., 2002). Different lichens species in different environments have different sequestration potentials, for example, *Ramalina fastigiata* has been used as a bio indicator of the impact of a coal mine in Portugal Jóźwiak, (2012).

The very high concentrations of F in lichens in this study reflects the study of Suh *et al*. (2008) who measured halogen content in melt inclusions at this volcano and their results indicated an average value of 1530 μg/g F and 1270 μg/g Cl. They recorded unusually high F concentrations when compared to glass inclusions from Etna, Hawaii and Piton de la Fournaise. However, the Cl concentrations from Mt. Cameroon were midway between the high values measured for Etna and the low values for Hawaii and Piton de la Fournaise. These exceptionally high values relative to those recorded in this study which maybe an indication that these halogens are an important component of the volatile budget at Mt. Cameroon. These researchers reported that, the concentrations of F in olivine hosted glass inclusion from Mt. Cameroon are the highest known F concentrations for basaltic glass inclusions in the world.

Altitude contributed to the halogens concentration variations as intra-species variations consistently yield high concentrations in samples collected from the downwind SW flank of the volcano. These localities lie in the path of wind bearing volcanic gas plumes from Mt. Cameroon and therefore pin their higher halogen content to passive degassing. Aiuppa *et al.* (2004) reported that, during explosive activity huge quantities of fluorine are deposited with ashes around the volcano up to distances of hundreds of km. Fluorine is present as an adsorbed outer layer on the tephra particles which adsorption occurs by condensation of fluoride onto the tephra particles in the plume above the volcano as it cools. The smaller tephra particles have a larger surface area, so carry more absorbed fluoride than the larger particles'". The smaller particles are likely

to be carried further from the volcanic source, and so their greater fluorine-carrying capacity extends the zone of potential fluorine poisoning considerably, even to regions where only a 1 mm thick deposit forms. It is advisable to sample and analyse the tephra or vegetation to identify hazardous regions.

This suggests that gases emitted from the volcano are blown south-westwards and are eventually deposited close to the coast resulting in higher halogen content in the lichen species from these areas. More so, the inputs from the sea and from agricultural farms might have increased the high levels in this coastal areas. Studies by *Ndlovu et al*. (2019), on moss and lichen biomonitoring of atmospheric pollution in the Western Cape Province (South Africa) observed halogens to have elevated concentrations for samples collected from areas with close proximity to the ocean. That is, for both moss and lichen samples at areas closer to the ocean had higher halogen concentrations. Their results also confirmed elevated concentration levels for halogens (Cl, I, Br) in areas closest to the ocean. However, since fluorides are released into the atmosphere in large amounts by volcanic eruptions (Bajpai *et al*., 2011) and fluoride (F) compounds, remain in the same chemical form after they are emitted into the atmosphere, the very high levels of F bioaccumulation in this study, might have come from the degassing volcanic winds of Mt. Cameroon. Also, since other sampling points inland shows high concentration of F, degassing winds and ash deposition should have a greater influence.

In this study, even though *Leptogium gelatinosum* was the highest bioaccmulator, *Stictastenroos* and *Heretodemia obscurata* are also good accumulators, while all the *Usnea* species are poor accumulators. According to Brodo *et al*. (2001) fruticose lichens like *Usnea* are very sensitive to air pollutants than foliose lichens and occur only in very pure environments. Out of different growth forms of lichens, foliose lichens are prior to metal accumulation followed by crustose and squamulose lichens (Kar *et al.,* 2014) and least by fruticose lichens (Shukla *et al.,*2014). However, lichens from the *Usnea* species have been used to evaluate heavy metal deposition patterns in the Antarctic (Poblet *et al.,* 2011). Certain epiphytic lichens have been particularly gained attention for their bioaccumulation potential like *Hypogymnia physodes* for bioaccumulation of trace elements and *Pyxine cocoes* for bioaccumulation of metals (Bajpai *et al*., 2012; Daimari *et al*., 2020).

The differing accumulating potentials in substrates of lichen species in this study, (example, *Parmotrema tinctorum* (MC27) a corticolous sample collected in Ekona-Mbenge accumulated more than the saxicolous specimen (MC26) collected in the same point).Contrary, the findings of (Chettri *et al.,*1997), who used the lichen species *Neophuscelia pulla and Xanthoparmelia taractica* to study the bioaccumulation of heavy metals in abandoned copper mines in Greece, where there was a significant correlation between the copper content in the soil(saxicolose) and that of the tree(corticolous) lichen thalli. However, it is for this reason that most studies use epiphytic macro lichens as bio-monitors for air pollutants (Loppi and Pirintsos, 2003). For example, Käffer *et al.* (2011) also reported corticolous lichens as environmental indicators in urban areas in southern Brazil. Furthermore, the no to slight significant difference in means of halogens concentrations with regards to substrates in this study is in accordance with the study of Bajpai *et al.* (2011) in Mandav city in central India illustrated that although most of the metals were absent, or present in insignificant amount in substrates, yet the thallus of lichens had significantly higher concentration of metals such as Cd, Cr, Ni and Zn. Thus it is apparent that the accumulated metals were air borne.

All the eight lichen genera showed very high concentrations of F and low levels of Br. Weinstein *et al*. (1998) reported that, Br and I emissions are not usually of environmental importance and there is virtually no scientific literature on either element. The gas Cl is potentially very hazardous but it is very rare to be released in sufficient quantities to pose a risk (Temple *et al*., 1998). Chlorine concentrations of 0.4 - 2.5 µg/g range cause severe symptoms like upper surface bleaching, epinasty (distorted growth), chlorosis (yellowing) and leaf drop to plants (Temple and Krause, 1998). The Cl/F ratio in the specimens' ranges from 0.29 to 0.94, which is lower than those measured in lichen specimens at Mt. Etna which ranges from 0.51 to 1.46 (Notcutt and Davies, 1989). According to Delmelle *et al.* (1997) changes in the Cl/F ratio may reflect different physico-chemical behaviour of the gases entering the atmosphere. However, Halmer *et al*. (2002) reported that in areas without nearby emission sources, the mean concentrations of fluoride in ambient air are generally less than 0.1µg/g. This was observed from the control area (Mamfe 270 Km) with lower concentrations as compared to those from Mt. Cameroon. Even near emission sources, the levels of airborne fluoride usually do not exceed 2–3 µg/g and in most soils, fluoride is present at concentrations ranging from 20 to 1000 µg/g. This figure can reach several thousand µg/g in mineral soils with natural phosphate or fluoride deposits. Therefore, the atmospheric halogens load at Mt. Cameroon is significantly high and lichens can be potential monitors of this volcanic gas flux.

V. Conclusion

Leptogium gelatinosum and *Heretodemia obscurata*are good accumulators, while *Usnea* species poor accumulators and therefore can be used for pollution bio-monitoring programs in Cameroon. The

Leptogium gelatinosum species is therefore a suitable species for monitoring passive degassing at Mt. Cameroon. Also, considering that, lichens of the windward flank of MC accumulated more elemental contents than those from the leeward flanks, shows that wind direction and ash fall contribute largely to pollutant load in lichen species in the windward flanks of mount Cameroon reflecting volcanic degassing as the source. This chemical analysis serves as a baseline data for future studies.

Supplementary Information

The online version of this article offers supplementary material (https://doi.org/xxxxx).

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Conflict of Interests

The authors declare that there is no conflict of interest whatsoever

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Supplementary Material

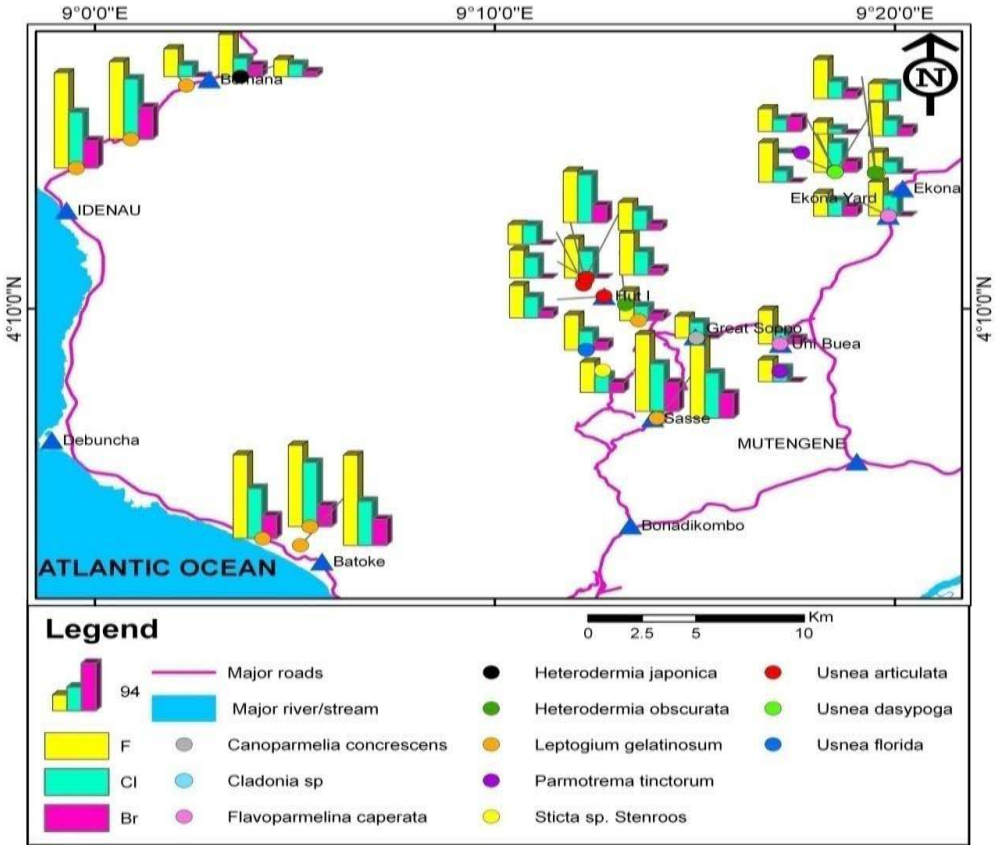

Figure S1: The different Halide concentrations in lichen species studied at the various sampling sites.

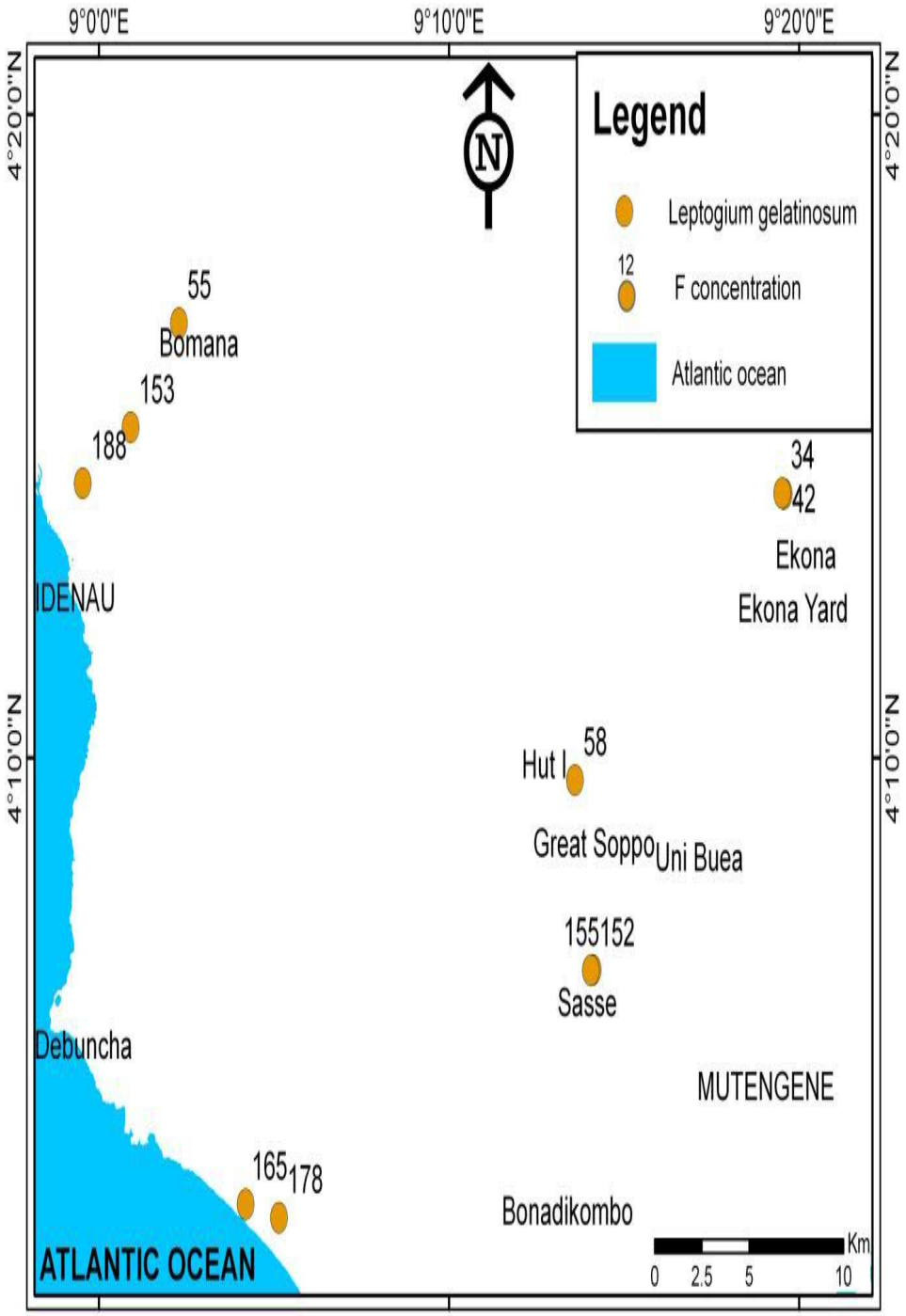

Figure S2: F bio-accumulation in *Leptogium gelatinosum* from different sampling sites on MC.

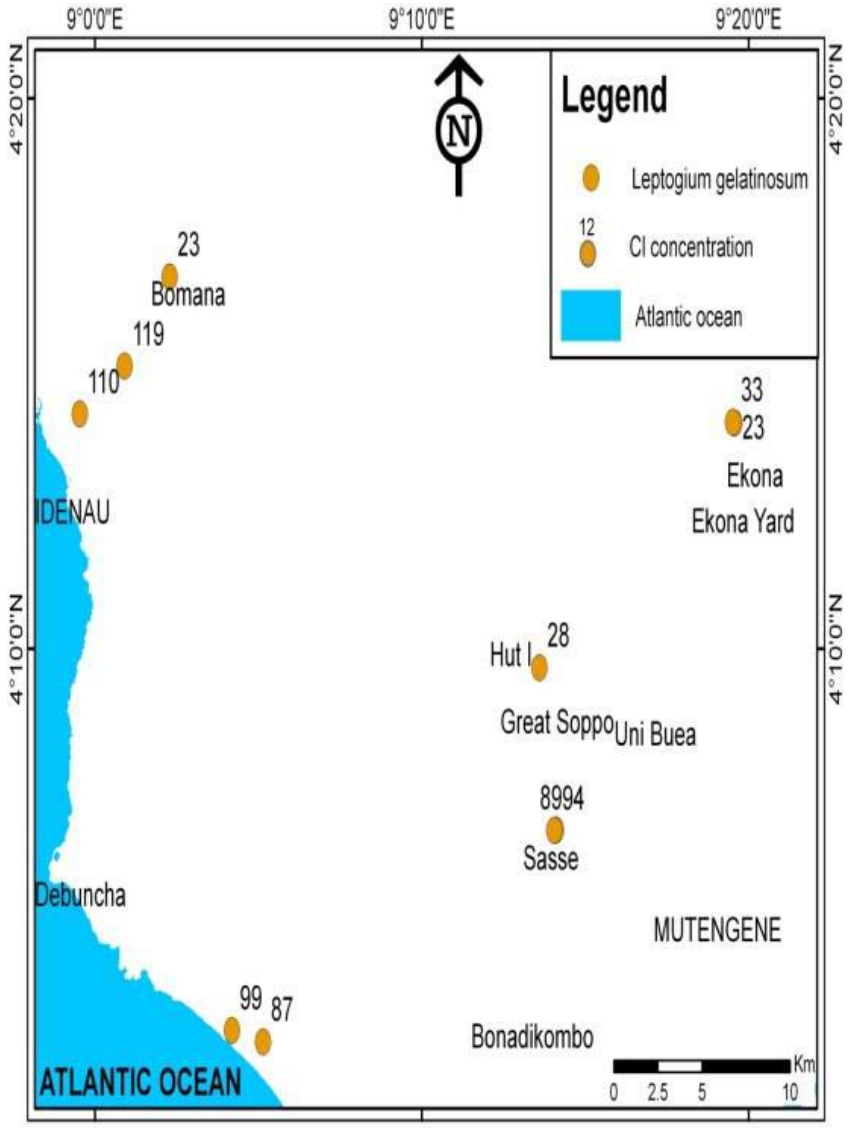

Figure S3: Chlorine bio-accumulation in *Leptogium gelatinosum* species in the different sampling sites on MC.

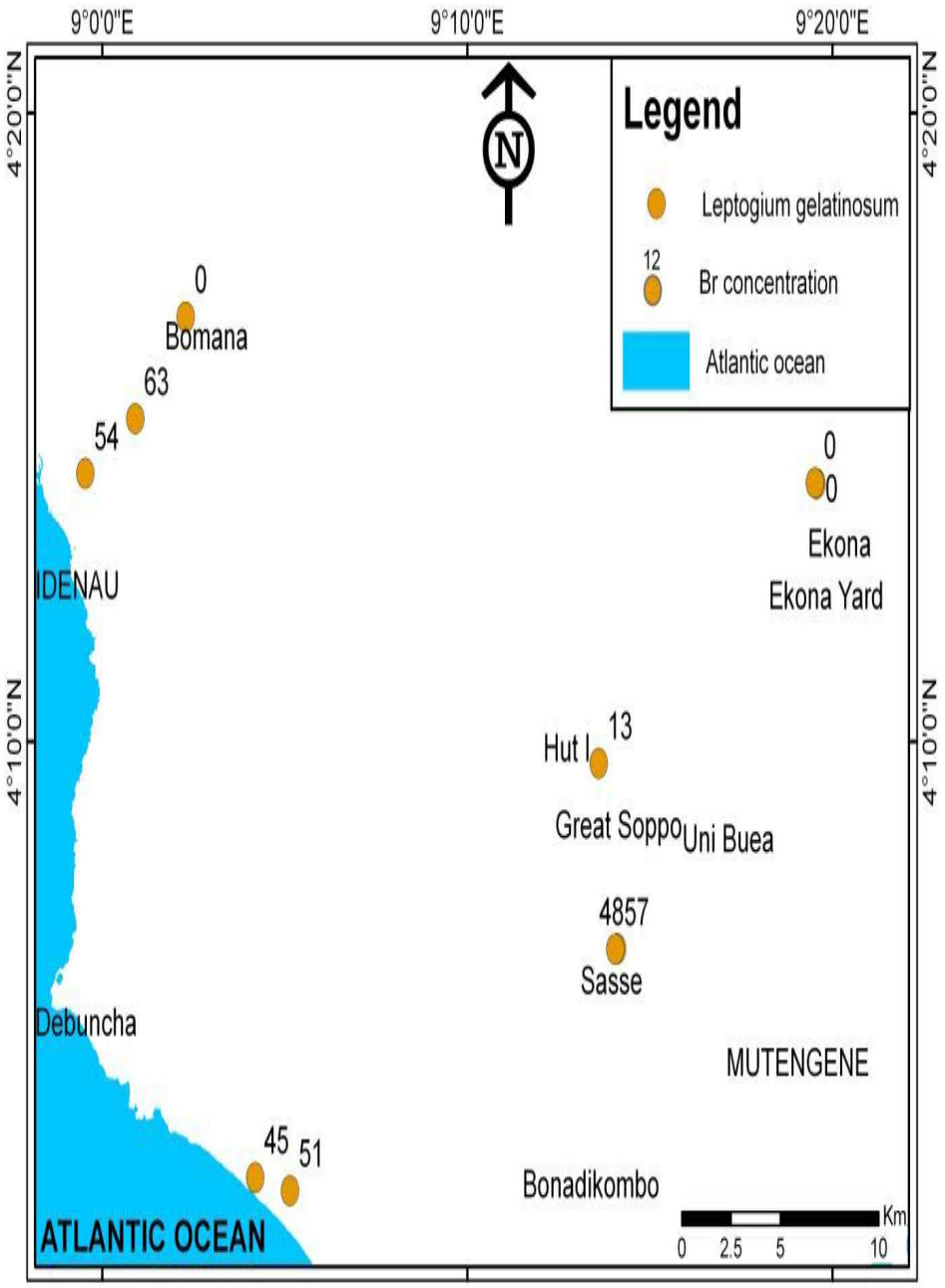

Figure S4: Br bio-accumulation in *Leptogium gelatinosum* at the different sampling sites of MC

List of Tables

Table S1: Lichen species code, sites and names used for chemical analysis.

Chemical Code	Site	Species name	Chemical Code	Site	Species name
MC 01	BmtSas	*Leptogium gelatinosum*	MC 18	BmtBok	*Sticta stenroos*
MC 02	Bmt UM	*Leptogium gelatinosum*	MC 19	BmtUM	*Cladonia sp*
MC 03	BmtSas	*Leptogium gelatinosum*	MC 20	BmtUM	*Usnea articulata*
MC 04	Boma	*Leptogium gelatinosum*	MC 21	BmtUM	*Usnea articulata*
MC 05	Iden	*Leptogium gelatinosum*	MC 22	BmtUM	*Usnea articulata*
MC 06	Iden	*Leptogium gelatinosum*	MC 23	BmtUM	*Usnea florida*
MC 07	Bakin	*Leptogium gelatinosum*	MC 24	BmtSop	*Canoparmelia concrescens*
MC 08	Batok	*Leptogium gelatinosum*	MC 25	EkLav	*Parmotrema tinctorum*
MC09	Batok	*Leptogium gelatinosum*	MC 26	EkLav	*Parmotrema tinctorum*

MC 10	EkLav	*Leptogium gelatinosum*	MC27	EkLav	*Parmotrema tinctorum*
MC 11	EkLav	*Leptogium gelatinosum*	MC 28	Eklrad	*Parmotrema tinctorum*
MC 12	Mamfe	*Leptogium gelatinosum*	MC 29	EkLav	*Flavoparmelia caperata*
MC 13	BmtUM	*Parmotrema tinctorum*	MC 30	Eklrad	*Flavoparmelia caperata*
MC 14	BmtUB	*Parmotrema tinctorum*	MC 31	EkLav	*Heterodermia obscurata*
MC 15	BmtUM	*Flavoparmelia caperata*	MC 32	EkLav	*Heterodermia obscurata*
MC 16	BmtUB	*Flavoparmelia caperata*	MC 33	EkLav	*Usnea dasypoga*
MC 17	BmtUM	*Heterodermia obscurata*	MC34	Boman	*Heterodermia japonica*

Table S2: Concentration of halogens analyzed for in lichen samples from MC(µg/g).

Chemical Code	Site	Species name	Substrate type	F	Cl	Br
MC 01	BmtSas	*Leptogium gelatinosum*	Tree	155	89	48
MC 02	Bmt UM	*Leptogium gelatinosum*	Tree	58	28	13
MC 03	BmtSas	*Leptogium gelatinosum*	Rock	152	94	57
MC 04	Boma	*Leptogium gelatinosum*	Tree	55	23	0
MC 05	Iden	*Leptogium gelatinosum*	Tree	188	110	54
MC 06	Iden	*Leptogium gelatinosum*	Tree	153	119	63
MC 07	Bakin	*Leptogium gelatinosum*	Tree	165	99	45
MC 08	Batok	*Leptogium gelatinosum*	Tree	178	87	51
MC09	Batok	*Leptogium gelatinosum*	Rock	161	127	41
MC 10	EkLav	*Leptogium gelatinosum*	Tree	42	23	0
MC 11	EkLav	*Leptogium gelatinosum*	Rock	34	33	0
MC 12	Mamfe	*Leptogium gelatinosum*	Tree	25	0	0
MC 13	BmtUM	*Parmotrema tinctorum*	Tree	55	39	12
MC 14	BmtUB	*Parmotrema tinctorum*	Tree	43	27	0
MC 15	BmtUM	*Flavoparmelina caperata*	Tree	55	41	0
MC 16	BmtUM	*Flavoparmelina caperata*	Tree	67	23	11
MC 17	BmtUM	*Heterodermia obscurata*	Tree	83	46	12
MC 18	BmtBok	*Stictastenroos*	Tree	60	34	19
MC 19	BmtUM	*Cladonia sp*	Tree	102	95	34
MC 20	BmtUM	*Usnea articulate*	Tree	64	42	13
MC 21	BmtUM	*Usnea articulate*	Tree	39	38	0
MC 22	BmtUM	*Usnea articulate*	Tree	77	53	0
MC 23	BmtUM	*Usne aflorida*	Tree	69	37	15
MC 24	BmtSop	*Canoparmelia concrescens*	Tree	43	31	0
MC 25	EkLav	*Parmotrema tinctorum*	Tree	0	0	0
MC 26	EkLav	*Parmotrema tinctorum*	Rock	23	10	0
MC27	EkLav	*Parmotrema tinctorum*	Tree	67	32	15
MC 28	Eklrad	*Parmotrema tinctorum*	Tree	45	31	18
MC 29	EkLav	*Flavoparmelina caperata*	Tree	78	23	0
MC 30	Eklrad	*Flavoparmelina caperata*	Tree	67	41	0
MC 31	EkLav	*Heterodermia obscurata*	Tree	90	58	20
MC 32	EkLav	*Heterodermia obscurata*	Tree	77	34	13
MC 33	EkLav	*Usnea dasypoga*	Tree	45	24	27
MC34	Boma	*Heterodermia japonica*	Tree	34	25	10
Mean				78	47	18
Min				0	0	0
Max				188	127	63
SD				49	33	20

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Geographic Feelings in the Music of Dino Saluzzi: Relationship between Emotions and Spaces in the Album Cité de la Musique (ECM, 1996)

By Agustín Arosteguy
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Abstract- The objective of this article is to demonstrate in the album Cité de la musique by the composer and musician from Salta Dino Saluzzi the relationship that is woven between the spaces and the emotions, consequently, the spatial reminiscences of his hometown Campo Santo, a city in the province of Salta, Argentina. The methodology used was based on asking people of different Argentine nationality profiles to listen to three pieces of music and tell what feelings, sensations, smells, flavors, images, textures and landscapes aroused in them. Based on these stories, the analysis of the nine compositions that make up this album was structured. The starting point is the idea that music can function as a mediator of the emotional relationships that associate the human and the places that the Brazilian geographer Beatriz Furlanetto develops in her text Geografia da Música: rodas de choro, emoções e encontros, thought in which the space in its connection with music has a privileged place.

Keywords: *geographic feelings, music, folklore of salta, bandoneon, Dino Saluzzi*

GJHSS-B Classification: *DDC Code: 808.2 LCC Code: PN1040.A5*

Geographic Feelings in the Music of Dino Saluzzi: Relationship between Emotions and Spaces in the Album Cité de la Musique (ECM, 1996)

Los Sentimientos Geográficos en la Música de Dino Saluzzi: Relación Entre Emociones y Espacios en el Disco *Cité de la Musique* (ECM, 1996)

Agustín Arosteguy

Resumen- Este artículo tiene por objetivo evidenciar en el disco *Cité de la musique* del compositor y músico salteño Dino Saluzzi la relación que se teje entre los espacios y las emociones, por consecuencia, las reminiscencias espaciales de su Campo Santo natal, ciudad de la provincia de Salta, Argentina. La metodología utilizada se basó en pedir a personas de diferente perfil de nacionalidad argentina que escuchasen tres músicas y contasen qué sentimientos, sensaciones, olores, sabores, imágenes, texturas y paisajes éstas les provocaban. A partir de esos relatos, se estructuró el análisis de las nueve composiciones que integran este álbum. El punto de partida es la idea de que la música puede funcionar como mediadora de las relaciones emotivas que asocian lo humano y los lugares que la geógrafa brasileña Beatriz Furlanetto desarrolla en su texto *Geografia da Música: rodas de choro, emoções e encontros*, pensamiento en el cual el espacio en su conexión con la música posee un lugar privilegiado.

Palabras clave: *sentimientos geográficos, música, folclore de salta, bandoneón, Dino Saluzzi.*

Abstract- The objective of this article is to demonstrate in the album *Cité de la musique* by the composer and musician from Salta Dino Saluzzi the relationship that is woven between the spaces and the emotions, consequently, the spatial reminiscences of his hometown Campo Santo, a city in the province of Salta, Argentina. The methodology used was based on asking people of different Argentine nationality profiles to listen to three pieces of music and tell what feelings, sensations, smells, flavors, images, textures and landscapes aroused in them. Based on these stories, the analysis of the nine compositions that make up this album was structured. The starting point is the idea that music can function as a mediator of the emotional relationships that associate the human and the places that the Brazilian geographer Beatriz Furlanetto develops in her text *Geografia da Música: rodas de choro, emoções e encontros*, thought in which the space in its connection with music has a privileged place.

Keywords: *geographic feelings, music, folklore of salta, bandoneon, Dino Saluzzi.*

I. Introducción

En su libro *Topophilia: a study of environmental perception, attitudes and values* publicado en 1974, el geógrafo Yi-Fu Tuan planteaba que la percepción ambiental es la respuesta de los sentidos de los seres humanos a los estímulos externos emitidos por el espacio que los rodea. Esta idea permitiría pensar, por un lado, que los estímulos que emiten los espacios están vinculados no solo a lo humano sino también a lo no-humano y aproximarse, entonces, a las contribuciones recientes de las geografías no representacionales[1] (Thrift, 2007) y, por otro, que estos espacios son una confluencia de trayectorias heterogéneas en coexistencia y con la particularidad de estar siempre en devenir (Massey, 2005). En este punto podemos introducir el pensamiento de la historiadora y geógrafa cultural italiana Giuliana Andreotti (1996) para quien "un abordaje emocional en la geografía significa investigar la influencia de la dimensión interior del individuo en la experiencia del mundo, predisponiéndose a recoger las emociones que los lugares provocan en las personas" (*apud* Furlanetto, 2018, p. 202-203). Es en esta relación entre emociones y espacios que este artículo propone indagar en las constelaciones geoafectivas presentes en el álbum *Cité de la musique* (ECM, 1996) del bandoneonista y compositor salteño Timoteo "Dino" Saluzzi (Campo Santo, n. 20 de mayo de 1935). La ciudad de Campo Santo está localizada a solo 50 kilómetros al este de la capital provincial y pertenece al departamento General Güemes. A su vez, dista 15 kilómetros de la provincia de Jujuy dirección norte. Esta pequeña localidad, según datos del Instituto Nacional de Estadística y Censos (INDEC, 2020), posee aproximadamente 7 mil habitantes. Esta ciudad salteña se destaca por el fuerte perfil histórico debido a que fue un escenario destacado de la Guerra Gaucha[2] y de la defensa de la frontera norte por parte de Manuel Belgrano. Frente a la Plaza Central, sobre la calle General Güemes, se encuentra el

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[1] Según Nigel Thrift (2007) el concepto de geografías no representacionales implica aproximaciones a la geografía desde la experiencia corpórea y afectiva, así como performática de lo humano y no-humano.

[2] Con el nombre de Guerra Gaucha se conoce la lucha de milicias y guerrillas llevada adelante en el noroeste argentino contra los ejércitos realistas durante la Guerra de Independencia de la Argentina (1810-1824), en la provincia de Salta durante el período comprendido entre 1814 y 1825 (Fuente Wikipedia).

algarrobo que está considerado árbol histórico y cuenta entre 450 a 500 años de existencia. Fue declarado monumento nacional porque a su sombra descansó el general Belgrano en 1812 mientras organizaba su ejercito para ir a combatir a Jujuy, en lo que se conoció como el éxodo jujeño[3].

El cultivo más importante de la región es la caña de azúcar, que se concentra en una superficie de aproximadamente 3 mil hectáreas ubicadas en la zona que abarca Campo Santo, Betania y El Bordo. Por eso los cañaverales son el paisaje predominante no solo en Campo Santo sino también en Güemes y Cobos. En 1760, el coronel de milicias reales Juan Adrián Fernández Cornejo fundó el Ingenio San Isidro y fue quien introdujo la caña de azúcar desde el Perú, e instaló su trapiche en la hacienda de la Viña de Siancas, cuyos cultivos progresaron de manera paulatina dando origen al primer ingenio azucarero del país.

Esta región salteña se caracteriza por tener una frecuente actividad sísmica, aunque su intensidad suele ser baja. Se considera que se producen terremotos de medios a graves cada 40 años aproximadamente. De acuerdo con el Instituto Nacional de Prevención Sísmica (INPRES, 1991), en el sitio donde están ubicados El Bordo y Campo Santo se encuentra la transición de las zonas 2 y 3 de moderado a alto riesgo o peligrosidad sísmica.

En relación a la gastronomía, entre los platos auténticos se destacan las empanadas, los tamales y las humitas, además de los dulces regionales, como el tradicional dulce de cayote, mermeladas de un solo sabor o combinadas, miel de caña, turrones, alfajores y colaciones. En materia cultural, Campo Santo es cuna de cantores y poetas, entre los que podemos nombrar al músico y pianista José Lo Guidice, al compositor y músico Ariel Petrocelli, al cantante popular Beto Fernán y el poeta Ricardo Nallar[4].

De esta forma, este trabajo se inscribe dentro del reciente giro emocional (Davidson, Bondi y Smith, 2007; Labanyi, 2010; Lozano, 2012) en la Geografía al plantearse investigar cómo la música popular puede ser entendida como una experiencia humana en la que confluyen una simultaneidad de historias que incluyen componentes transhumanos o posthumanos presentes en la configuración de los espacios que, a su vez, están en constante construcción. Parte de la premisa que es factible instaurar nuevas modalidades de comprensión y de relación con el mundo a través de la música, y a su vez, piensa que es "posible crear un mundo particular con la música, o, mejor dicho, construir y anclar nuestro ser en el mundo musicalmente" (Furlanetto, 2018, p. 201). Por lo cual, creo que Campo Santo funciona para Saluzzi como un anclaje geoafectivo dentro de su universo musical en constante devenir y que de alguna forma cada una de las 9 músicas que componen el álbum parecieran retornar, cual *ritornelo* deleuziano (Ferraz, 2005) una y otra vez, de manera incesante, hacia ese lugar, esos paisajes, esa naturaleza, esos espacios, esos aromas, esas texturas, esas geografías cargadas de afectos, sensaciones y emociones a granel.

II. Diseño Metodológico

Para conseguir abordar las cuestiones del presente trabajo, se utilizó el método cualitativo. Esta elección se basó en la naturaleza de la investigación y por creer que este tipo de método favorece la recopilación de información haciendo hincapié en la subjetividad y sensibilidad del investigador. En este sentido, a su vez, un trabajo que sirvió de inspiración para pensar en una metodología fuera de los límites tradicionales fue el texto. de John Finn (2015), "Musicscapes of Heritage and Memory: Researching the Musical Construction of Place". Este texto posee la particularidad de pensar y reflexionar en nuevas metodologías para el mundo sonoro en lugar de "utilizar métodos visuales disfrazados para el mundo de los sonidos" (p.122), ya que redundan en aspectos representacionales provenientes del mundo visual y resultan limitados/ limitantes cuando se busca abordar aspectos sonoros. Por esto, propone metodologías auditivas variadas, tales como "la 'escucha' experimental (Smith, 2000, p. 626) y la "escucha participante" (Wood y Smith, 2004) mediante las cuales se considera a un grupo más amplio de participantes y se enfocan en las percepciones, impresiones, interpretaciones y comprensiones del investigador en el lugar. También menciona las audio-etnografías de la música en la performance (Smith, 2000), las cuales utilizan entrevistas y conversaciones con cualquier persona relacionada con una performance en particular, y la observación de las performances, ensayos u otras actividades relacionadas con la música. Y, por último, la "etnografía performática" (Morton, 2005) que se basa en el uso de diarios hablados para músicos, en los que los artistas registran sus pensamientos y experiencias antes, durante y después de las performances.

[3] El éxodo jujeño fue la retirada hacia Tucumán que, cumpliendo parcialmente la orden de evacuación hasta Córdoba impartida por el Primer Triunvirato de las Provincias Unidas del Río de la Plata, emprendió —el 23 de agosto de 1812— el Ejército del Norte, comandado por el general Manuel Belgrano, y la población de San Salvador de Jujuy —que abandonó completamente la ciudad y sus campos— como respuesta estratégica ante el avance del Ejército Realista proveniente desde el Alto Perú y cuya retaguardia fue protegida por el mayor general Eustoquio Díaz Vélez, resistiendo el acoso enemigo (Fuente Wikipedia)

[4] Información extraída del sitio oficial de turismo de la provincia de Salta: http://turismosalta.gov.ar/contenido/2325/campo-santo#:~:text=Pueblo%20de%20Campo%20Santo,frontera%20norte%20realizada%20por%20Belgrano

De esta manera, la metodología se compuso por la descripción sensorial de las melodías de las músicas a personas (en total 3) de diferentes lugares de Argentina pidiéndoles que se remitiesen a describirlas en sus imágenes, sensaciones, sentimientos, sabores, olores, texturas. Las 9 músicas se dividieron en 3 bloques, siendo '*Cité de la musique*', 'Introducción y milonga del ausente' y 'El río y el abuelo' para la primera persona; 'Zurdo', 'Romance' y '*Winter'* para la segunda; y '*How my hearts sings'*, 'Gorrión' y 'Coral para mi pequeño y lejano pueblo' para la tercera. Sus nombres se mantienen en anonimato ya que lo relevante es hacer hincapié en los aspectos espaciales de la música de Saluzzi a partir de la información proporcionada. Esta metodología se encuadra en una metodología auditiva no convencional ya que busca "capturar los aspectos más expresivos, no verbales . . . emotivos, [y] no cognitivos de la práctica y performance social" (Morton, 2005, p. 663 citado en Finn, 2015, p. 166, traducción del autor).

III. Marco Teórico

Desde principios del siglo XXI el denominado "giro afectivo" o "giro emocional" dentro de la Geografía (Anderson y Smith, 2001; Wood, 2002; McCormack, 2003; Thrift, 2004; Thien, 2005) busca incorporar lo que el pensamiento positivista y racionalista ignoraron o negligenciaron por tanto tiempo: las emociones y los sentimientos. Dentro de este contexto de geografías emergentes y diversas, este abordaje posee una tendencia distintiva e intencional hacia lo 'transhumano' o 'posthumano', entendido como el estado de ser o estar más allá de lo humano. Es decir, este pensamiento configura una geografía que incorpora lo no-humano (el agua, las plantas, los semáforos, las piedras, los cordones, los faroles, los glaciares, bicicletas, las motos, la luna, los colectivos, los autos, los ríos, los pájaros, las nubes, las esquinas, los árboles, las montañas, las selvas, el asfalto, las casas, los edificios) en la concepción de los territorios y en la conformación de sus identidades. De este modo, Deborah Thien señala que esta intención de buscar o ir más allá de lo humano representa un movimiento político ya que "colocar la emoción en el contexto de nuestras relaciones siempre intersubjetivas ofrece más promesas para las geografías políticamente relevantes y enfáticamente humanas" (2005, p. 450). Por otro lado, Giuliana Andreotti establece que desde esta perspectiva "las sensaciones y los sentimientos son tomados como norma o principio de análisis, considerando lo real como complejo perceptivo y fenomenológico" (*apud* Furlanetto, 2018, p. 203).

Al considerar, por un lado, que las emociones y los sentimientos poseen un rol geográfico porque "conectan a los hombres a sus espacios de vida e influencian las relaciones geopolíticas y los proyectos de planeamiento compartido" (Persi, [2010] 2014, p. 200) y, por otro, que la música es un lenguaje que se basa en lo emocional y afectivo, y por eso a partir del arte musical es posible erigir y fijar nuestro ser en el mundo mediante la música (Furlanetto, 2018), entendida de manera amplia, es decir, constituida por sonidos, ruidos, melodías, ritmos, armonías, silencios, timbres. Siguiendo con esta idea, la música, los sonidos, las melodías, los ruidos, las voces y "todos los elementos sonoros, los sonidos del medio ambiente y los sonidos de los hombres o por ellos creados, pueden funcionar como mediadores de las relaciones emotivas de los hombres entre sí y con los lugares" (*Ibidem*, p. 204). Por lo cual, en este proyecto, al reconocer que el ser humano no es el principal actor sino que es uno más tanto en el contexto urbano como en el natural y que, por lo tanto, forma parte del mundo real en una relación basada en la interactividad y posicionalidad (Hayles, 1995), entendemos que la música también puede funcionar como mediadora no solo entre lo humano entre sí y con los lugares, sino entre lo humano y lo no-humano.

Una contribución fundamental en la relación entre los sonidos ambientales y la percepción humana, fue realizada por el músico e investigador canadiense Raymond Murray Schafer que rastreó cómo los paisajes sonoros fueron transformándose en el mundo occidental a lo largo de la historia y en particular, cómo esto impactó en el comportamiento humano. Con la publicación en 1977 de su trabajo más importante, *The tuning of the world*, Schafer inició un movimiento que buscaba percibir el medio ambiente sonoro en el cual el ser humano se inserta, haciéndolo responsable también por la composición sonora de los paisajes. Así, el autor creó el término 'paisaje sonoro' para denominar el conjunto de sonidos provenientes de un espacio determinado, en estrecha relación con el entorno social en el cual se producen revelando el grado de evolución del grupo social y del espacio que ocupa. Lo más interesante de este trabajo fue que demostró la manera en la cual los sonidos son responsables por una caracterización peculiar de determinados ambientes acústicos y, en consecuencia, por la impregnación de sonidos del lugar. Esta demostración trae implícita una cuestión muy relevante para este proyecto: los sonidos de los espacios cambian, se transforman, mutan a lo largo de los años. De esta manera, Schafer establece que el paisaje sonoro está compuesto por tres elementos: sonidos claves (*keynote sounds*), señales (*signals*) y marcas sonoras (*sound marks*). En relación con los sonidos claves, estos son creados por la geografía y el clima, y entre ellos se encuentran los sonidos que crean el agua, el viento, los bosques, las llanuras, las aves, los insectos y los animales. Su relevancia radica en que "ayudan a delinear el carácter de los seres que viven entre ellos" (1994, p. 9). Las señales, por su parte, "a menudo pueden organizarse

en elaborados códigos que permiten mensajes de considerable complejidad transmitidos a quienes pueden interpretarlos" (*Ibidem*, p. 10). De esta forma, las señales sonoras tienen la particularidad de constituir dispositivos de advertencia acústica, entre los que podemos mencionar las campanas, los silbidos, las bocinas y las sirenas. En tercer y último lugar, las marcas sonoras son aquellos sonidos que "hacen que la vida acústica de una comunidad sea única" (*Idem*). A este respecto, Cárdenas-Soler y Martínez-Chaparro agregan que estas marcas "se refieren a los sonidos (con valor simbólico y afectivo) que describen con mayor fidelidad las cualidades socioculturales de una comunidad" (2015, p. 132).

De la concepción de Schafer lo que deseamos rescatar es que el ser humano es también responsable por la composición sonora de los paisajes y son estos sonidos que componen determinado espacio los que ayudan a delinear el carácter de los seres humanos. Y a su vez, así como los sonidos de los espacios cambian a medida que el tiempo avanza, también hace lo propio la percepción que los seres humanos obtienen de estos sonidos espaciales. En este punto, hacemos nuestras las palabras de Beatriz Furlanetto cuando dice que "la música despierta una interpretación poética, artística, onírica, imaginética, moldeadora del mundo, expandiendo los modos de ser y de sentir la realidad" y nos inspiramos para situar nuestra contribución al presentir que "el mundo puede ser percibido como una partitura musical, una grafía que se lee con los oídos y no apenas con los ojos, una escucha de los sonidos y silencios que siembran horizontes en nuestras fronteras" (2018, p. 208).

IV. Resultados Encontrados

El álbum[5] inicia con la música homónima con un aire evocativo muy profundo. En esta canción Saluzzi despliega toda su nostalgia contenida en los botones de su bandoneón. Hay una impronta particular en la música de Saluzzi, y en este disco en especial, que es la nostalgia hacia su pueblo natal y su provincia en la Argentina. Vale la pena mencionar que el bandoneonista salteño alrededor de los 20 años dejó su ciudad para realizar su carrera musical en Buenos Aires y luego, a finales de la década de 1970, se embarcó hacia Europa, cuando el pianista, organista, teclista y compositor suizo George Gruntz (1932-2013) lo invitó a trabajar en Alemania, Francia, Suiza y Dinamarca, por citar algunos países (Mannarino, 2020). A partir de ahí y, gracias al productor musical alemán Manfred Eicher, fundador en 1969 del prestigioso sello discográfico *Editions of Contemporary Music* (ECM), con quien grabó alrededor de una veintena de discos, Saluzzi empieza a tener éxito y reconocimiento no solo en Alemania sino en toda Europa. Volviendo a la música, el diálogo entre la guitarra acústica (de la mano de su hijo, José María Saluzzi) y el bandoneón le otorgan un aire de melancolía que remite sobre todo a Campo Santo, pero también a todas aquellas ciudades musicales por las cuales Saluzzi anduvo, ya que los climas del tango, jazz, folclore ora se aceleran, ora se lentifican, con una sutileza y emoción extremas.

La persona que escuchó las 3 primeras músicas manifestó que esta nostalgia está muy presente en este primer bloque de manera tajante. Empezando por los títulos de las 3 músicas, es imposible soslayar que están conectadas por el mismo sentimiento. En la primera, '*Cité de la musique*', hace pensar en el lugar donde Saluzzi aprendió a tocar el bandoneón con solo 7 años de edad y también, los demás sitios por dónde paseó junto con su instrumento –nos comenta la persona que también es bandoneonista. El sentimiento de nostalgia está llevado hacia una connotación más de tristeza en la segunda música por la cuestión de la ausencia. En este sentido, y siguiendo con lo aportado por la escuchadora, la primera y la tercera podría decirse que están enmarcadas por un aura más de melancolia positiva y la segunda, por una más negativa. A pesar de esto, le parece que las 3 melodías son cálidas y poseen un aroma de familia, de un dulzor peculiar, un dulzor bastante intenso que resulta agradable por ya ser conocido. El derrotero que traza el bandoneón en 'Introducción y milonga del ausente' le trajo momentos de intimidad (esto no quiere decir que estos momentos estén exentos de tensión) en los cuales no suceden muchas cosas y en donde reina el silencio mientras los integrantes de la familia están en sus cosas. Y, por último, en 'El río y el abuelo' la percusión que abre la música, realizada parece con la madera del bandoneón, acompañado con el bajo de Marc Johnson, le da un clima de cierta ternura y/o contención, que le remite a paisajes rurales, con temperaturas agradables y el olor a mates recién iniciados. A su vez, esta música también la hace pensar en caminatas, charlas entre los bosques, praderas y animales, como pueden ser vacas, pájaros, canchos y caballos. En resumen, un paisaje muy bucólico y alejado de la ciudad, del ruido y el tránsito. Una mención aparte le merece el fragmento que se extiende desde el minuto 4:10 al 4:43, en donde la guitarra acústica sobresale y trae aires que evocan al sur de España, en particular a Andalucía y el flamenco.

El segundo bloque de músicas está compuesto por 'Zurdo', 'Romance' y 'Winter'. De entrada, lo que llama la atención es lo sucinto de los títulos de las músicas en relación a las 3 anteriores, que eran más narrativas e invitaban a imaginar historias a partir de la información contenida en ellos. 'Zurdo' empieza como agazapado, de una forma tímida pero segura la respiración del bandoneón va entretejiendo un clima de

[5] De las 9 músicas que componen el disco, 8 están compuestas por Dino Saluzzi. '*How my heart sings*' está compuesta por Earl Zindars (1927-2005) compositor norteamericano y percusionista de jazz.

delicadeza y al mismo tiempo, misterio. Esta es la palabra elegida por el escuchador para intentar definir la melodía de esta música. Es que en los 3 minutos iniciales es un aura de misterio mezclado con suspenso el cual va llevando a quien escucha a no saber bien el rumbo que puede llegar a tomar. A partir de ahí, empieza a estructurarse la canción guiada por el bandoneón en un diálogo con la guitarra acústica y el bajo que, sin acaparar la atención, está bien presente. La persona comentó que encontraba cierto vínculo entre la melodía y la foto que está en la tapa del disco. El fotógrafo argentino Juan Hitters es el responsable de esta imagen. En ella hay una superposición de imagénes de exterior e interior. Pero lo que le otorga a la fotografía el misterio es esa luz que entra por la ventana que parece un reflejo suspendido entre medio de estas dos imágenes. Otra cosa que le llamó a atención es la melodía que realiza el bandoneón entre los minutos 3:45 y 5:02, y luego de una breve conversación con el bajo le da paso a la guitarra que curiosamente la melodía que toca le remitió al flamenco español. En la segunda música, 'Romance', ese arranque con la guitarra evoca un aire de lejanía, de distancia entre quien extraña y el objeto que provoca este sentimiento, que por un fragmento del documental 'Saluzzi, ensayo para bandoneón y tres hermanos' (Rosenfeld, 2001), puede llegar a ser Campo Santo o Salta: "[…] y extraño cosas, ya si me voy de Salta, por ejemplo. Pensábamos irnos nosotros, todos los días pensábamos irnos y a la misma vez, todos los días pensábamos regresar. Es una locura". Esta contradicción, entre ese vaivén de querer irse pero necesitar quedarse, creo que resume, de alguna forma, esta música. En la siguiente, '*Winter*', tenemos la música más tanguera del disco. La aparición de la guitarra jazzeada no llega a modificar ese matiz de tango, todo lo contrario, lo refuerza. A partir del minuto 3:30, la guitarra entra unos segundos para dar con la cadencia del tango y luego desaparece para dejarle paso al bandoneón que, ahora sí, de forma explícita, saca todo el tango que tiene dentro. Tal vez sea justamente por eso que el escuchador sienta el frío de los inviernos europeos o más específicamente, el de los alemanes. A esto le atribuye la cadencia lenta de la melodía y no cree que sea casualidad que esta sea la música más larga del disco, con 8:39 minutos. Y volviendo a la dialéctica interior-exterior, el escuchador manifiesta que el frío es extremo, se percibe y se sabe, pero la melodía también le transmite el confort y calidez de una casa con el hogar encendido y de una familia reunida alrededor del calor.

El tercer y último bloque de músicas comienza con la única que no fue compuesta por el propio Saluzzi, '*How my heart sings*'. Este estandar de jazz pertenece a Earl Zindars, compositor norteamericano de jazz y música clásica. Los arreglos que introduce Saluzzi le otorgan a la música el aire más introspectivo del álbum. Aunque mantiene una estructura de jazz, en lo que se refiere a los solos de los instrumentos, los dos momentos marcantes del bandoneón, el primero entre el minuto 1:08 y 2:43, y el segundo, desde 4:12 hasta el final, le brindan a la música un anclaje folclórico. Es decir, le imprime matices que se sitúan en el límite entre el tango y el folclore, una huella muy saluzziana.

La segunda música de este bloque corresponde a 'Gorrión' y está dedicada al director de cine Jean-Luc Godard (1930-2022), el cual utilizó músicas de Saluzzi para algunas de sus películas, como por ejemplo '*Histoire(s) du cinéma*' (1989), '*Nouvelle vague*' (1990) y '*The old place*' (1999), esta última codirigida con Anne-Marie Miéville. Esta música llama especialmente la atención porque es la única en el disco que está tocada, de principio a fin, únicamente con el bandoneón. A su vez, es la música más corta del álbum, con 3:18 minutos, y a la escuchadora la remitió a lo urbano, al movimiento incesante de las grandes ciudades, al despertar de un día de semana lleno de bullicio, bocinas, tránsito intenso, alta humedad y cielos plomizos con probabilidad de lluvia. Todo esto que le sugirió la música, aclara la escuchadora, no es por asociación sino más bien por contraste. Y para finalizar el álbum, Saluzzi nos entrega 'Coral para mi pequeño y lejano pueblo', que de alguna forma parece funcionar como contrapunto con la primera, '*Cité de la musique*'. Según nos dice el periodista musical Tyran Grillo (2012) esta música está dedicada a un amigo de la infancia del cual Saluzzi no revela su nombre. Digo que funciona como contrapunto porque mientras la primera pareciera abrirnos al mundo sonoro que existe en todas las ciudades, la última pareciera hacer el camino inverso. Es decir, vuelve sobre sus pasos hasta el pueblo de origen, al lugar donde todo comenzó. En este sentido, Saluzzi parece ofrecernos un álbum redondo, con un cierre no solo musical sino también un recorrido por sus geografías afectivas que termina en el inicio, un repertorio nutrido de paisajes afectivos que logran activar en los/as escuchadores/as resonancias, ecos, mensajes "en que el paisaje activa en el individuo (yo agregaría el plural, para integrar a quienes escuchan y a quienes componen e interpretan) una fuerte evocación, y éste a su vez consigue 'hacer hablar al paisaje'" (Lozano, 2012, s/p). O como le gustaba decir a Atahualpa Yupanqui sobre los cantores: "El cantor traduce lo que la tierra le dicta, el cantor no elabora, sino que traduce, es un mensajero de voces que le llegan. Él traduce lo que la tierra le dicta, lo que le va dictando la tierra" (Hassan, 1985). Porque, en definitiva, siendo cantores o no, siendo músicos o no, siendo humanos o no-humanos, lo relevante es que como seres tenemos la capacidad de conectarnos con los paisajes, los espacios y los lugares, ya que como define Paloma Puente Lozano "los 'paisajes afectivos' son la expresión geográfica y la concreción material y simbólica de nuestras querencias; es decir, aquellos

parajes a los que, con la imaginación, el cuerpo o la memoria, siempre volvemos". Y esto es lo que queda resonando en los cuerpos de quienes escuchan este álbum de Dino Saluzzi.

V. La Geografía Sentimental en la Música de Dino Saluzzi

Parece que Dino Saluzzi en este disco plasma lo que Beatriz Furlanetto manifiesta cuando señala que a través de la música los seres humanos nos conectamos con el mundo, con el espacio geográfico, con nuestro pueblo natal y nuestros lugares de residencia/pertenencia. Todo este caleidoscopio geográfico que se despliega en este disco, en donde cada música parece regresarnos una y otra vez a los infinitos Campos Santos que existen dentro de Saluzzi. Es que una ciudad, pueblo o localidad nunca es la misma. Es que los espacios nunca se mantienen estancos, siempre fluyen en un devenir constante. Por este motivo, Doreen Massey (2005) establece tres principios o proposiciones a partir de los cuales concebir el espacio: "primero, se entiende el espacio como producto de interrelaciones… por lo cual las identidades no son algo ya constituido, sino que se basan en la construcción relacional de cosas". En segundo lugar, "se imagina el espacio como la esfera de la posibilidad de la existencia de la multiplicidad, esfera en la cual distintas trayectorias coexisten. Por lo cual, sin espacio no hay multiplicidad; y sin multiplicidad no hay espacio". Y como tercera y última proposición, "se reconoce el espacio como estando siempre en construcción. Precisamente porque el espacio, en esta interpretación, es un producto de relaciones que están embutidas en prácticas materiales que deben ser efectivadas, él está siempre en proceso de hacerse". En este sentido, "tal vez pudiésemos imaginar el espacio como una simultaneidad de historias hasta ahora" (Massey, 2005, pp. 10-12). Esto último, de imaginar el espacio como un conjunto de historias hasta ahora y que éstas pueden ser evidenciadas a través de la música, creo que encaja en las 9 historias musicales que Saluzzi nos narra en este álbum. Y, sobre todo, porque estas 9 historias se van resignificando y reinterpretando cada vez que como escuchadores/as nos disponemos a oír el disco.

Si entendemos que el/los paisaje/s, los espacios y lugares pueden ser descifrados mediante las melodías, ritmos, armonías, ruidos, silencios y timbres (Arosteguy, 2021) y si coincidimos con Atahualpa Yupanqui (2008) cuando nos avisa que los paisajes son plausibles de perseguirnos y dejarnos marcas, huellas, signos en la cara, el cuerpo, y hasta en el alma, creo que esto mismo le sucede a Dino Saluzzi en todas y cada una de las canciones que aquí abordamos. Es que hay una fuerte evocación que se transmite tanto en los solos de los instrumentos y cuando se juntan y entretejen melodías infinitas. Por lo tanto, resulta imposible agotarlas porque como nos advierte Silvio Ferraz, hablando de Vivaldi y Debussy, los compositores son "atraídos por un efecto, por una fuerza casi que sin nombre, la cual tiene la potencia de volver sonora la temperatura, de volver sonoro el movimiento, de volver sonora la fuerza de la tempestad y de volver sonora una situación no sonora como la tristeza" (2005, p. 17, traducción del autor). Creo que esto mismo lo podríamos hacer extensivo a la música que Saluzzi nos presenta en *Cité de la musique*, al hacer que evoquemos incesantemente los sabores, colores, sentimientos, olores, temperaturas, movimientos de los componentes humanos y no humanos, recordados o imaginados, reales o inventados, de su Campo Santo natal.

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Effect of Corona Epidemic on Every Aspect Related to Economic and Intellectual Development of the Country

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Abstract- The covid-19 virus which has become a matter of fear for the whole world today is a dangerous virus. Corona is not actually the name of a virus but the name of an entire virus family and covid-19 is a member of that family. Due to its structure, it has been named corona, the word corona is derived from the English word crown and the external shape of this virus looks like a crown. On the basis of their own research by the scientists of the world behind the origin of covid-19, almost all scientists are unanimous that this virus originated from a market selling sea creatures in the Chinese city of Wuhan. The market which is known for illegal trade of wild animals like snakes, rats, bats etc. According to the Youth Center for Disease Control and Prevention (CDC), the corona virus is a group of coronaviruses that are commonly found in animals. This virus affects the body by reaching the human body by living with animals or by eating animal flesh. After spreading in the city of Wuhan, this virus has shown its effect in 210 countries all over the world. In view of its magnitude, Corona was declared a global pandemic on 11 March 2020 by the World Health Organization.

Keywords: *contract tracing, social distancing, prevention and social distancing.*

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Effect of Corona Epidemic on Every Aspect Related to Economic and Intellectual Development of the Country

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As of 30 March 2020, the number of corona positive cases in the world was more than 7 lakhs and about 364050 people had recovered. While the recovery rate was very good.

Keywords: contract tracing, social distancing, prevention and social distancing.

I. Study Area

In this research paper, work has been done by me in the context of India. While I have taken various things in this paper, examples are such which are based on the events happening at the world level. Whereas during the corona call, the problems that occurred in the country and the state were shown by the administration to the people through various channels. In this research paper, I have described the situation of whole India during the corona period.

II. Objective

- From which country did the corona pandemic originate?
- Which countries were mainly affected by the corona epidemic?
- What was the effect of the corona epidemic on the economic, social and religious activities of the common man?

III. Methodology

While writing this research paper, I have made national and state level magazines, newspapers published at national and state level, and research papers related to the Corona epidemic published at national and international level and various channels of broadcasting as its basis. In this paper, from 23 March 2020 to 30 January 2022, three times the lockdown in our country, during this situation, I have heard the problems of the people by going to the ground level, following the instructions of the government. All these methods are based on my observation.

IV. Changing Nature of Coronavirus

Scientists have already been familiar with other members of the Coronavirus family, the coronavirus, which is also called SARS corona (Severe Acute Respiratory) virus and Mers coronavirus (MERS & Cov.)). Scientists have studied about this in the past, the recently arrived covid-19 is part of this family and the fact is very popular that coronavirus infection occurs in animals like bats, cats, rats and monkeys etc. Even if it does infect a human, it will be limited to just similar cold and flu-like symptoms. But the new virus which is known as covid-19 is affecting humans very badly and its infection is proving fatal for human life in many places. After infection with this virus, symptoms like cold, fever, sore throat, difficulty in breathing are appearing in the patient and gradually taking a severe form, this fever also converts into pneumonia and the lungs are affected so badly. It affects the person till death. This virus reaches the person sitting nearby through respiratory droplets, due to which it keeps on affecting from one person to another. If the droplets of sneeze fall on any surface, then it infects all the person who comes in contact with the surface.

a) Nature of corona epidemic disaster in India

India declared COVID-19 as a nationally notified disaster on 14 March 2020. To prevent this, advisory was also issued thrice by the Ministry of Health and in view of the increasing impact of the epidemic, Hon'ble Prime Minister Shri Narendra Modi addressed all Indians on 21 March and sensitized people about the corona crisis and on 22 March. On 2020 (Sunday), it was asked

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to impose a complete Janata Curfew of 1 day and we found that the call of Modi ji was followed well in the whole country. To create such resonance in the atmosphere by playing thali, clapping, bell and other melodious sounds for 5 minutes to honor the doctors, policemen, drivers and other brave warriors serving during the corona pandemic by the Prime Minister on 22 March 2020 Called so that the chain of bacteria / germs spreading corona infection stops.

Due to the increasing effect of Corona, on 23 March 2020, the Prime Minister, while addressing the countrymen, announced a complete lockdown of 1 week till 30 March evening. If we talk about our country, till 30 March 2020, the number of corona infected here was not in a dire situation and it seemed that the situation was under control. On 30 March, about 1400 Muslim people from all over the world gathered for the religious program in Tabligi Jamaat in Nizamuddin area of Delhi, some of these people were found positive, which was presented to the public by giving communal and religious color by the media and the people. One thing got printed in the hearts and minds that Muslim people are running a campaign to spread corona. After that, to avoid the crisis of Corona, it was announced to impose a lockdown in the country from April 1 to April 15. Due to this lock down, all the industries, business, all services including business transport were closed to maintain social distance so that the epidemic does not spread much. In this way, this disaster took a formidable form and the period of lockdown was also increased by the government accordingly.

All the expenses of the house were being met by the one who had some accumulated capital. The government put its point before the public to help the suffering people. On the call of the government, many organisations came forward to help the poor people to maintain humanity. But it is my belief that the greatest impact was on those people who had become dependent on the kindness of the people for the food and drink of the working class people who earn daily wages.

The pandemic has given new life as well as new meaning to some old words and already existing words. For example, till now the use of lockdown was heard only for strike or dharna etc. but today it is being used in social context. Social distancing till now used to refer to those people who were isolated from the society, but now social distancing has come before us in a positive context, people who sit and walk keeping a proper distance from each other to keep themselves safe. Similarly, the word Quarantine was somewhat unheard of for Indians, but time prevailed in our country like smallpox, tuberculosis, leprosy and sitting alone for a few days after death. But such words are rarely used in such abundance. A new word related to this came in front of us which was named isolation which was once used in a negative context but now it seems that the person who is in isolation is doing a great favour to the society. Because he was stopping the spread of the epidemic by isolating himself, who was looking after his health in the health of the people.

Impact on human community as a result of corona pandemic

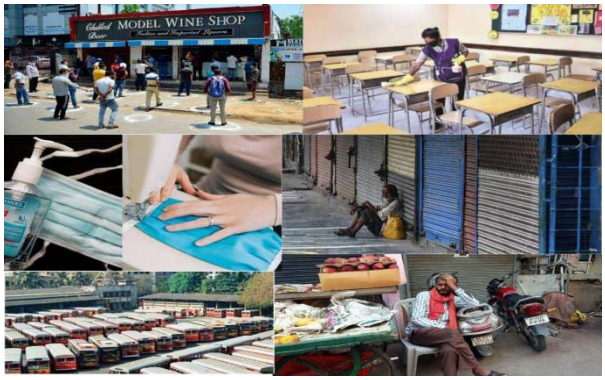
- Impact on Tourism

India has an amazing ability to attract tourists due to its diversity in its geographical, cultural and architectural arts. Presently, the tourism industry has become a strong business for every country, which is a better source of employment and foreign exchange. In the Travel and Tourism Competitiveness Report 2019, India has registered a major improvement, down from 40 in 2017 to 34th position in 2019. But in March 2020, during the Corona epidemic by the Government of India, the gathering of people at all public, philosophical and religious places was completely stopped and a lockdown was announced in the entire country. Due to which the tourists who came to visit from abroad had to return home empty handed. In this way, the process of this lockdown was seen smoothly in our country till January 2022. Whose effect came in front of us in the form of billions of rupees in the economy of our country.

- Unemployment problem

During the first Lockdown of this epidemic, from big industries to small handloom industries were all closed. Due to which lakhs of people of the country came in the grip of unemployment. During this

epidemic, the big textile industry was closed, but those who ran industries like masks on a small scale for the prevention of corona on a small scale, they earned a large margin.



- Social Impact

During this epidemic, this message was given by the government to all the people that if no one can go to anyone, then stay at your home. Maintain social distance (3 feet) from each other and by doing this you will be able to avoid the effects of the epidemic. In this bad time, the neighbours and relatives also stopped coming to the house of the people who died due to this epidemic. The time of this epidemic was also getting the right and bad person to be identified in this critical situation and on the other hand, to save the human species, the human being not going to the house of the victim's family was also giving the message of the supremacy of the human species.

- Communal Influence

Negative influence and hateful influence shown by media towards 1400 Muslims found in Jamaat in Nizamuddin area of Delhi (30 March 2020) during corona period. Such videos and photos of Muslim people were made viral on Facebook, WhatsApp, news channel etc. through public media, in which people felt that these people were promoting corona like sneezing or spitting on vegetables in the market., are selling such products in the villages. I also saw that an announcement was made in the villages or small towns that you should keep a watch on the water tank, chairs and such places where there is a lot of movement of people in your public places and no Muslim should be allowed to enter there. Because such a message was shown and narrated to the general public by the mass media that Muslims want to spread the corona epidemic, their effort is to end the Hindu society here. Such bad thoughts lead to hatred among different communities through the means of communication. Whereas during this corona period, the media did not see the effect of the epidemic at all due to the crowd of lakhs of Hindus on the foundation day (5 August 2020) of Shri Ram temple in Ayodhya city of Uttar Pradesh. Thus we can say it was vote bank politics. Where the community which has the majority, then politics is also in their favour.

- Political Aspect

We saw that in the elections held in 2021, on the one hand the situation of complete lockdown in different parts of the country was created by the government while on the other hand road shows were banned by the Election Commission in the state of West Bengal. National level parties were openly taking out road shows by holding rallies. Which was like inviting the corona epidemic. During that time the government did not realize at all how many people could have lost their lives by doing this by you. But here one thing became clear where the government can ignore even a hundred diseases like epidemics to win its party, what is to be done for them. Because they have to see the future of their party, not even humanity.

- Obstruction to the Movement of People

During the Corona period, we saw that the working class who are working in any company, industry or factory could not be reached home with the help of bus or train. But we found that the politicians running our country did not do such work for the development of the country or should I say they did not think that those people should be sent to their homes in such bad times. If transported, then only and only the children of rich people were sent to a place like Kota by sending special buns for the children studying medical and engineering or their loved ones from abroad were brought by plane. Whereas the people of the working class came to their homes after walking hundreds of kilometres. Many of them lost their lives on the road due to hunger, thirst, delivery etc. during these scorching summer days. It is a matter of great shame that our country has made such a development. Today it has been almost 70 years since we got independence and even today the facility of transport has not been available for the citizens in our country. The real face of the progress of our country has come to the public.

- Religious aspect

The contractors of some religions, during this epidemic to run their livelihood, thought in the minds of people in such a way that God would finally solve this epidemic and he has found the solution "Who saved from the epidemic by doing charity service in temples." Will remain, the one who makes offerings in temples, his family will remain happy and healthy. But it also came to be seen that in the temples the priests of those religions even said that our deities have also suffered from corona. To avoid the corona epidemic, they put masks on the idols of gods and goddesses in the temples, which was a sign of our superstition, great stupidity. Those who were the contractors of religion were saying that these gods and goddesses will take us out of the epidemic like corona, will they eventually have corona.

- Scientific aspect

During this epidemic, big doctors and psychologists of most countries were making various efforts to solve the mystery of this epidemic in their labs or observatories. All types of doctors were working in different ways and seeing whether some medicine, perhaps ayurvedic, homeopathic or allopathic, would be the solution to this epidemic. Which was being seen by applying on different creatures in different ways. Whereas in other parts of the country, the priests of some religions have said that only corona Mata has the cure for this epidemic, who will give us a healthy life by the method of asking trees. The one who comes to corona Mata's court will go away healthy. In this way people were being misled that the corona epidemic can be treated well by exorcism.

- Impact of Digital Technology in Education

But due to this technology, the curiosity of giving knowledge and taking knowledge in the teacher and learners became a part of a formality for the form of an academic record. Both sides had a profound effect on the eyesight and moreover it had a big impact financially on the poor families whose three or four children were studying in schools. All the school work was done through mobiles, as a result of which providing mobile and recharge for each child by a poor parent was like shaking the financial condition of the family.

- Impact on the quality of education in online mode

Even during the online examination, the marks of the children whose examinations were conducted on the online mode were given so much that this covid batch is the most promising among all the children studying so far. In this way, the marks of the students who will appear in offline mode before the pandemic and in future will never be equal to the children who passed in the pandemic. Because during this time such children have got hundred percent marks who found it difficult even to pass (33%) in their class. Now the question comes in our mind that how these children get so many marks, so here my psychological thought is that when a teacher is unable to check the answer book by heart in the form of hardcopy, then how can we assume that due to epidemic During this, all the examinations were taken by the students sitting at home through online mode and after that the answer sheet was to be uploaded on the e-mail of the university or board by making PDF of their choice. Here we think that the children must have kept their answer book ready by looking at the books or already uploaded it by making a PDF. Now after the PDF is uploaded, the university or board teachers have checked that PDF by getting it taken out as a hard copy. In this process as far as I am concerned a teacher will not show so much interest in checking the answer sheet because he thinks that if we give less marks to this same child then he will get the rechecking done again, his marks will naturally increase. Because he has written all his answers well after seeing them in the answer book. Due to which the marks of children passed in the epidemic are mainly seen between 90% to 100% or completely in hundred percent. Which has proved to be akin to the quality of education of the children who passed away during this pandemic.

Positive aspect during epidemic

- Increasing trend of cleanliness in homes

During this epidemic, the common man understood that "where there is cleanliness, there is goodness of our life" this proverb taught people to live; After touching the outside, after coming back, the people cleans himself with soap, dettol or sanitizer etc., while going out with a mask on his mouth so that the coronavirus left by the corona victim does not affect the general public.

- Special effect of sanitizer in life

During this epidemic, people have done many small things like sanitizing the house from time to time to keep themselves healthy, family members, washing hands frequently with soap or Dettol as soon as they come from outside, and changing clothes. He was taught to keep things in mind. Which should be applied by a person in life in general. The Corona epidemic has taught the common man to implement such things strictly.

- Clean the Environment

As a result of this epidemic, many factories and brick industry etc. were all closed in the lockdown. Due to which we found that the air quality was returning to purity in these 4 months. As a result of which different types of birds are migrating from one area to another, a different enthusiasm has come in the trees, plants and birds. We never thought that the industries running in the thousands of lakhs would be completely closed as a result of the guidelines of the administration and the government. As a result, the hole caused by pollution in the ozone layer is filling up during this time. Which was a huge change for our environment.

- Emphasis on digital technology

As a result of this pandemic, in order to maintain education during the lockdown in our country, on the lines of Digital India, lectures were taken by the teachers sitting at home through applications like Google Meet with the help of mobiles, tabs, laptops etc. Through this technique we believe that education continues smoothly. During this pandemic we saw that this online education had taken such a huge form that examination and submission from primary education to PhD were done on online mode.

- Saving on unnecessary expenses

During this epidemic, the common man also realized that people who spend unnecessarily for appearances at parties, weddings and any other occasion, are all in vain. If we have to spend any money, then we should do it in order to improve our health, education and the environment around us. I saw in this bad time that a poor family was getting married and I saw that her financial condition is such that even if 30-40 persons come in her daughter's procession then she will be buried under the expenditure of 2-3 lakhs. But during this epidemic, you will not leave the house according to the rules of the police or administration. This ideology increased the number of marriages taking place at this time so much that many poor parents were saved from extravagant expenses. The procession, which used to be of 200-300 people, was reduced to 2 to 5 people. In this way the poor families on both sides were saved

from unnecessary debt. In this way, this corona proved to be beneficial for a poor family in this situation.

V. Conclusion

So far, there is no specific technique available to root out the infection of coronavirus. Because various types of injection doses have been administered by India and other countries for the prevention of covid. Even after getting the vaccination done, many people were found to be corona positive and they died. Some people also came in front of us who did not get any kind of injection or vaccination during the corona period, only kept themselves healthy through their diet and yoga and their negative report came every time.

But some doctors and physical teachers believed that this epidemic is nothing but only a fear, a fear-making disease in the hearts and minds of people globally. The symptoms of this corona epidemic are like a common cough, fever. In such situation, to fight this disease, doctors are using the necessary medicines according to their earlier information. As the virus is new, research is still going on. Ultimately, there is a lack of proven information about it. In such a situation, each country is engaged in treatment in its own way. After the outbreak of corona in India, hydroxychloroquine tablets were used here for the treatment of corona patients on a large scale and this drug proved to be somewhat better than other drugs. Hydroxychloroquine tablets are originally used in India for the treatment of malaria. Seventy percent of Hydroxychloroquine tablets used in the world are produced in India. As soon as the fact came to the fore that this drug can be used powerfully in fighting corona, its demand at the international level increased a lot. On receiving special requests from countries like America, Brazil, France, Indian exported it on a large scale and showed charity. On the other hand, the ever-changing attitudes of this virus surprised the doctors because the corona test in patients was repeatedly coming from negative to positive and positive to negative. Thus, there was confusion among all the doctors regarding the treatment of this disease. Health department officials and doctors were very confused about the new form of corona infection. After that, prevention of corona in different countries

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Associates are authorized to organize symposium/seminar/conference on behalf of Global Journal Incorporation (USA). They can also participate in the same organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent. Additionally, they get free research conferences (and others) alerts.

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Associate	Fellow	Research Group	Basic
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Preferred Author Guidelines

We accept the manuscript submissions in any standard (generic) format.

We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

Alternatively, you can download our basic template from https://globaljournals.org/Template.zip

Authors should submit their complete paper/article, including text illustrations, graphics, conclusions, artwork, and tables. Authors who are not able to submit manuscript using the form above can email the manuscript department at submit@globaljournals.org or get in touch with chiefeditor@globaljournals.org if they wish to send the abstract before submission.

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Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

1. Authors must go through the complete author guideline and understand and *agree to Global Journals' ethics and code of conduct,* along with author responsibilities.
2. Authors must accept the privacy policy, terms, and conditions of Global Journals.
3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s') names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
5. Authors should submit paper in a ZIP archive if any supplementary files are required along with the paper.
6. Proper permissions must be acquired for the use of any copyrighted material.
7. Manuscript submitted *must not have been submitted or published elsewhere* and all authors must be aware of the submission.

Declaration of Conflicts of Interest

It is required for authors to declare all financial, institutional, and personal relationships with other individuals and organizations that could influence (bias) their research.

Policy on Plagiarism

Plagiarism is not acceptable in Global Journals submissions at all.

Plagiarized content will not be considered for publication. We reserve the right to inform authors' institutions about plagiarism detected either before or after publication. If plagiarism is identified, we will follow COPE guidelines:

Authors are solely responsible for all the plagiarism that is found. The author must not fabricate, falsify or plagiarize existing research data. The following, if copied, will be considered plagiarism:

- Words (language)
- Ideas
- Findings
- Writings
- Diagrams
- Graphs
- Illustrations
- Lectures

- Printed material
- Graphic representations
- Computer programs
- Electronic material
- Any other original work

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2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

Changes in Authorship

The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

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Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

Declaration of funding sources

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Preparing your Manuscript

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for writing a good quality Social Science Research Paper

Techniques for writing a good quality homan social science research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of homan social science then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.
Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

19. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

20. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

21. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

22. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

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Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

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