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RÜSIE:
A JOURNAL OF CONTEMPORARY SCIENTIFIC, ACADEMIC AND SOCIAL ISSUES

KOHIMA SCIENCE COLLEGE
JOTSOMA

FROM THE DESK OF THE PRINCIPAL

I am happy that the research cell of Kohima Science College, Jotsoma has decided to bring out an Annual Research Journal entitled 'Rüsie: A Journal of Contemporary Scientific, Academic and Social Issues'.

Publication of Journal of such nature will give opportunities to teachers and researchers to share their research findings and observations on the subject of their interests. As the title of the journal 'Rüsie' means 'movement for a cause', it is hoped that it will also bring forth relevant social issues.

With great pleasure I forward the first Volume of the Journal. I wish the Editorial Board success.

(Dr. Vituo Belho)
Principal
Kohima Science College, Jotsoma
Nagaland

EDITORIAL

It is a privilege for Kohima Science College, Jotsoma to bring out the first issue of "*Rüsie: A Journal of Contemporary Scientific, Academic and Social Issues*". *Rüsie* is a Tenyidie word which means "A movement for a cause" and this name signifies the philosophy of the journal. This is a forum where the faculty of the college can speak their mind on various scientific, academics and social issues which are relevant to society. Though the domain of the articles is quite diverse the objective is the same: to provide a critical perspective of the identified issue. The first issue of the journal consists of 15 articles.

The editorial board takes this opportunity to extend its gratitude to Dr. Shürhozelie Liezietsu, President of Ura Academy and former Minister of Higher Education, Govt. of Nagaland, for suggesting the core name of the journal. We are overwhelmed by the positive response of the authors and thank all of them for their valuable and thought provoking contribution. Last, but not least, we thank the Principal and all the faculty members for their cooperation and encouragement in bringing out the journal in its present form.

The journal is just born and it will mature with time. We hope that the journal will serve its purpose by giving a right perspective to the relevant contemporary issues. Any feedback from any quarter will be an asset to us as it will help us improve the quality of the journal. Looking forward to a long inning. OMNIA VINCIT LABOUR.

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NEW-SENSE *SANS* NUISANCE: UNRAVEL THE POTENTIAL SECRETS OF ALGAE

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Abstract: Food, medicine, power, fuel, energy – these are the things that have driven mankind and society since the beginning of time. And whether we like it or not, the fact is- the politics and economics of all these issues are not so "green" yet influencing us daily in their trends of use, means of production and cost. But since they play a very critical role in our history and future on this planet, we are now faced with massive challenges relating to all these issues. Potential uses of algae-whether it is micro or macro- in the search for renewable energy have created a new sensation within the field of sustainable development. From food, fodder, medicine, bio-energy, CO2 capture, pollution control to even novel applications in textile and other industries; Our challenge right now is to bring the research and development a step further so that the practical use is established connecting basic research, commercial initiatives and ecological applications.

Keywords: algae, algae solutions, alternative energy, green revolution

A preview to our future with Algae

Algae are a diverse group of simple, non-vascular plants that come in varied shapes, sizes and colors- from micro-unicellular forms to macro forms, from red to yellow to brown to green and blue. Algae blooms in ponds, lakes, rivers, seas and neglected pools and in just about any viable environment that they can survive, so much so that even Jonah-the biblical prophet had to complain to God about these weedy plants covering his head when he was thrown into the mighty sea from the boat.

So while these slimy living, breathing organisms are considered a great nuisance by prophets and laymen alike, it is now high time to change that mindset and revere them as they are the one promising class of plant organism that could form the basis for a green and truly sustainable environment. Products obtained from algae prove to be promising and they are now considered as the ultimate natural solution that the world is facing today when it comes to economy, energy, food and climatic challenges. Not only that, algae holds the powers to even simultaneously recycle CO2, put fuel in our vehicles, provide nutrition and therapeutic solutions for humans and animals, and create jobs for hundreds and thousands of people.

Algae? Naturally.

Not even in our wildest dreams did we imagine that these slimy looking plants would one day be used as a source of food, fodder, fertilizer, medicine, color, light, power, and even music. Thanks to the numerous futuristic visionaries and scientists who are working for days, months and years and have come up with amazingly creative concepts that put these small, unassuming algae to such novel uses that is now capturing the attention of scientists, engineers and architects so much so that even multi-million dollar companies, investors and industrialists are willing to be a part of this new green-revolution.

If you are thinking just how algae can transform the world and the bio-marketplace, let us take a look at some of the innovative ways.

Algae Food Solution

Algae are the primary producers that form the foundation of the food web. And since time immemorial, green and red macro-algae have been used as a super food for thousands of years and much sought after for their ability to prolong life, prevent diseases and enhance life. Several dozen species of algae are used as a food staple in many Asian countries (Chapman and Chapman, 1980; Waaland, 1981). Algal diet requires lesser food for consumption as it is filling due to its rich carbohydrate content and contains all the essential micronutrients, plus vitamins, minerals, antioxidants and trace elements. Coupled with this is the fact that algae may contain over twice as much as the total

number of micronutrients as compared to terrestrial land crops with 2 to 5 times the nutrient density. Antioxidants, such as omega-3 fatty acids, are also often present in algae and this gives an edge over terrestrial crops as they are not found in terrestrial crops (FAO, 1987). Unlike algae, terrestrial plants have to survive in challenging environments whereby most of their cells are specialized for structure and typically lack the nutrient density that is necessary for food. Most often, only the seed (or fruit) offers the nutritive food value for land-based plants as they must invest about 90% of their total energy in the other non-food producing components such as stock, stem, roots, leaves and seed coverings. The nutrients from higher plants form a matrix with other cellulosic components, whereby the body must breakdown these nutrients through digestion and even still majority of the nutrients stay locked in the biomass and pass right through the body. Algae are unique in that there is a perfect balance of vitamins, minerals and trace elements in a natural synergistic design (Kanazawa, 1963; Yamamoto *et al*., 1979; FAO, 1987).

Algae Medical Solutions

Another fantastic fact is that algal medical products are proving to be much superior to many compounds that are sourced from higher plants, animals or synthetic compounds. Medical compounds obtained from algae are cheaper, easier, faster and of much higher quality and typically has no adverse effects unlike the traditionally available medicines (Hoppe, 1979; Hoppe and Levring, 1982). Since algae forms the bottom of the food chain for living organisms, food, fodder and medicines from algae are free from any genetically modified material, gluten, pesticides and allergens.

The diminutive stature and size of algae create a big advantage. Since algae can be so tiny – about 5µ (microns), and small is undoubtedly excellent for easy assimilation and absorption by the body, it allows the consumers to get the bioavailable nutrients immediately. To top it off, an algal cell comes packed with a full set of all the nutrients that are essential and easily digested as each algal cell reproduces and grows independently, creating a nutrient density that is significantly higher than terrestrial crops (Kanazawa, 1963; FAO,1987). As the earth's most productive and sustainable plants, microalgae can double their mass daily with growth rates up to 100 times greater than land plants which are used to make similar products.

Algae Power Solutions

We all know that algae capture most of the sun's energy and produce more oxygen than all plants combined (Fenical and Paul, 1984; Smit, 2004). Scientists have now worked around this idea and found out that tiny bits of electrical current can be extracted from algae during photosynthesis. The outcome is an incredible algae-powered lamp wherein the lamp is self-powered by the algae by capturing sunlight, CO2 from your breath and water to give a soft glow (Fig1). A small lithium battery stores the energy generated by the algae through the day.

Fig. 1: Algae powered lamp

Algae-Powered Car

It's no longer a pipe dream, but a reality. There is already a car that is powered by algae called "Algaeus."(Fig2) Amazing fact is that it can go from coast to coast on just 25 gallons of fuel. And if you are wondering about larger-scale public transportation, there is a company called 'Heliae' which is already working on it. The hydrocarbon content of algae, specifically its fatty acids and acyl glycerides have the potential to compensate for a future decline in crude oil production (Talebi *et* al., 2013). Perhaps it won't be long when all our cars can run on algae as fossil fuel is fast depleting.

Fig. 2: Algae powered car

Algae-powered Textiles

Why limit the limitless? Living, breathing algal specimens of various kinds are put in clear tubes and used as threads to weave designer clothes. The outcome is an incredible variety of colors as the algae capture the sun's energy and respond to its surroundings (Fig3).

Fig. 3: Algae powered textile threads

Algae-powered Buildings

Mechanical engineers and researchers envision a future where buildings are equipped with algae so that it can produce energy and also simultaneously suck the greenhouse gas CO2 out of the surrounding environment. Additionally, fitting containers of algal photo-bioreactors on existing buildings can produce biofuels (Fig4). In Los Angeles, this concept has already transformed a 1960s federal government building into a waste-water cleaning, clean energy-generating building of the future. This has turned the existing building into a power plant that can produce all the energy required using giant glass tubes that are full of algae fitted on the exterior walls.

Fig. 4: Algae powered building

Algae Solar Panels

When scientists and chemical engineers team up together, they can come up with a lot of products that are sustainable with real-life potential. A classic example is the solar panels that have living algae- called Biophotovoltaics, at the University of Cambridge.

Music-Making Algae

Though not the most practical, some fun-loving and creative students used the red algae agar-agar to make music by molding the gel into various geometric shapes and placing them on sensor boards. When touched, it creates music.

Algal Interactive Cyber Garden

Imagine a garden with no plants! But this is exactly what is like in this high-tech garden. Instead, it has hundreds of small plastic pouches that are full of different species of algae. These photo-bioreactors are hung from the ceiling and visitors exhale CO2 into the algal bags via tubes to feed the algae for growth (Fig5). And if you have a smart phone, you can scan the QR code from the bag that provides you the information regarding the algae's growth.

Fig. 5: Algae Cyber garden

Carbon-Absorbing, Algae-Powered Eco city

Another futuristic concept is an algae-powered city that absorbs CO2 from the air and release fresh oxygen. The city's buildings will have the exterior walls covered with photosynthetic algae that can produce enough and more fuel to power virtually everything inside the eco-city including lights, various appliances and even vehicles. This would involve creating algae farms for food and oil in giant towers near water bodies and also more algae will be grown in underwater farms.

Conclusion

Food and energy security are among the most serious concerns for every Government in the world. In other words, food and energy have to be sustainable, and this relies on achieving reliable resources. The continuing quest by mankind for alternative sources is undergoing many changes and has sparked numerous alternative options which seem odd and impractical just yet. But given a few more years, when the 'know-why' and 'know-how' is more clearly understood and worked out, it could become quite commonplace to let these so-called nuisance algae take over to give us all a new-sense and a very alternative source of food, fodder, medicine and energy to sustain our planet where everything seems to be in utter chaos at the moment!

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BEE – FRIEND OF FLOWERS

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Abstract: Insects are the chief pollinators and show various types of intimate relationship with flowers they visit. Of the various insects, bees are the main flower visitors. Bees visit flowers to collect food and in the process prove instrumental in bringing about pollination. They become effective pollinators only if successive visits are confined to the same floral type. Bees show curious behaviour, known as "floral fidelity". The communication techniques become progressively elaborate from physical guidance by scouts in primitive bees to dances in advance bees. Bees handle upto 80 percent of all pollination carried out by insects.

Keywords: Bees, pollination, flowers, pollen.

Social organization

Bees are wonderful social animals and they exhibit a great example of teamwork. They belong to Phylum – Arthropoda, Class – Insecta and Order – Hymenoptera. A bee colony consists of three distinct castes, viz, Queen, Workers and Drones. The drones are fertile males, which are produced during the breeding season. These short-lived males are to copulate with virgin queens and die soon after. The queen with a life span of about three years mate only once and store sperms in her spermathical sac; utilized for fertilizing billions of eggs laid during her life time. She can lay both fertilized and unfertilized eggs depending upon the needs of her colony. Unfertilized eggs develops into haploid drones, on the other hand, fertilized eggs develop into sterile females (workers). Occasionally, fertilized eggs may also develop into fertile females (queens) depending upon the chemical composition of the larval food provided.

The workers have a normal life span of about 3-5 months. All the worker bees look alike but they perform different functions in groups such as feeding and nursing the broods (larvae), cleaning the colony, guarding the hive entrance, gathering nectars and pollen, scouting, etc.

The main function of scout bees is to survey the area within the foraging range around the colony. They locate the availability of floral nectars and pollen sources, judge relative merits of alternative floral types available at a time, decide the best floral type that has high nutritive value and palatability and return to the hive and communicate all these information to the other foraging workers.

Swarming

Each of the new queen, after fertilization, leave the parent colony with a group of worker bees to establish a new colony of her own. This process is known as swarming. In this way, the bee colonies multiply and flourish in nature.

Foraging behavior

The foraging workers go to the field for the collection of food based on the information communicated to them by the scout bees. The communication techniques become progressively elaborate from primitive to advance bees. In case of primitive bees, *Melipona* and *Trigona*, the scout bees physically guide the workers to the floral site. Further, in the process of evolution, the scout bees deposit the glandular aromatic secretion along the way and thus, providing an odour trail which the foraging bees can follow because of their highly developed olfactory reception.

In case of genus *Apis*, the scout bees communicate information about direction as well as distance of floral source by means of dances on the comb surface. In primitive diploid species *Apis florsa* (little bee) and *Apis dorsata* (rock bee) which make single comb exposed to light, the scout bees perform communication dances on the horizontal upper surface of the comb and while dancing, point their heads toward the floral site. While in advance tetraploid species *Apis indica* (Indian bee) and *Apis mellifera* (Italian bee) which build multiple combs enclosed in the dark, the scouts perform communication dances on the vertical comb surface.

Dances serve the same purpose as language for their inter-communication. Each dancing pattern has a specific meaning in terms of both direction and distance of the floral source. After the direction is conveyed, the distance between hive and floral source is indicated by means of rhythm of round or wag-tail dance which implies shorter or longer distance.

Floral fidelity

Bees visit flowers to collect nectars and pollen. A colony has different sets of workers that are conditioned as either nectar or pollen gatherers; although, some may collect both. The workers are conditioned to a specific floral source for collection of nectars and pollen, which is selected by scout bees. When there are a number of floral sources available at a time within the foraging range, bees fix their preference based on high sugar concentration in nectars, nutritive value and maximum palatability of pollen.

The entire foraging bees of a colony confine their visit to the flowers of the same species or the same variety (to which they are conditioned) as long as its blooming continue and they ignore the presence of other species or varieties that may be flowering at the same time within their foraging range. This curious behaviour of bees is known as “floral fidelity”.

If the floral source is not abundant, small groups or individual forager may visit different floral types at a time. It will thus, be seen that in any case, an individual foraging bee restricts its visit to a single floral type.

Conclusion

Bees visit flowers to collect food and in the process bring about pollination. It is said that bees handle upto 80 percent of all pollination carried out by insects. Amongst all the pollinating insects honey-bees show highest respect for the floral fidelity and therefore they are most effective pollinator. If a worker bee visits a *Citrus* flower and then change to a peach flower, it loses its utility as a pollinator. It can become an effective pollinator only if successive visits are confined to the same floral type.

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ACTINORHIZALS: A REVIEW

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Abstract: Nitrogen, the key element required by plants for synthesizing amino acids, nucleotides, etc is made available to the plants from its elemental form (dinitrogen) to a usable form such as ammonia by a process called Nitrogen fixation. The microsymbiont *Frankia* can infect plants belonging to a diverse group belonging to 8 families, called the actinorhizal plants. Actinorhizal plants act as pioneers in nitrogen poor soils and have been used extensively in land reclamation. Many of these actinorhizal plants bear edible fruits and hold medicinal importance and edible value.

Key words: Nitrogen fixation, Actinorhizal symbiosis, *Frankia*.

Introduction

The fact that elemental nitrogen constitutes approximately 79% of the total atmospheric gases fails to ensure its availability to plants *per se*. Plants cannot utilize nitrogen in its elemental form and, therefore it (Nitrogen) has to be first reduced to a usable form such as ammonium by a process known as nitrogen fixation. Plants assimilate this reduced nitrogen to synthesize molecules such as amino acids, nucleotides, etc. and improve their growth and mineral nutrition.

Nitrogen fixation is brought about by certain prokaryotes either in free living state or in symbiotic association with certain dicotyledonous plants by a process known as Biological Nitrogen Fixation (BNF). The free living prokaryote includes those of *Clostridium, Azobacter, Klebsiella*, etc. The symbiotic nitrogen fixers belong to the genera *Rhizobium* and the actinomycete *Frankia. Rhizobium* nodulates roots of plants belonging to the family of leguminosae and one member of the family ulmaceae *(Parasponia*).

Frankia nodulates roots (fig. 7) of plants on a diverse range spread across 8 families and 25 genera (see Table1). These plant families include Betulaceae, Casuarinaceae, Coriariaceae, Datiscaceae, Elaeagnaceae, Myricaceae, Rosaceae and Rhamnaceae.

The actinorhizals

About 194 different plant species (see Table 1) have been identified as symbiotic hosts for the actinomycete *Frankia* (Cronquist, 1981). Later, separate studies done by Bond (1983), Torrey and Berg (1988), Newcomb and Wood (1987), Baker and Schwintzer (1990) and Benson and Silvester (1993) reported about 288 species of dicotyledonous plants forming nitrogen fixing symbiotic association with *Frankia* (Misra, 2010). These groups of plants which form symbiotic association with the actinomycete *Frankia* are called actinorhizal trees. All the actinorhizal trees are perennial dicots and all, except *Datisca* which is herbaceous, are woody shrubs or trees (Tjepkema *et. al.*, 1986).

Actinorhizal plants are found all over the world except Antartica. Most of the actinorhizals are found in temperate zone. Some species of Myricaceae and Casuarinaceae are considered tropical. Countries like Scandinavia, Canada and New Zealand which are near to the pole are home to many of these trees. In the subcontinent India, the distribution of actinorhizal plants is confined to higher altitudes in Himachal Pradesh, Jammu and Kashmir, Arunachal Pradesh, Sikkim, West Bengal hills, Meghalaya, Nagaland and to some extent in the coastal regions and plains.

TABLE 1. LIST OF ACTINORHIZAL PLANT GENERA.
According to Cronquist (1981)

Subclass	Family	Genus	No. of species
Hamamelidae	Betulaceae	*Alnus*	47
Hamamelidae	Casuarinaceae	*Allocasuarina*	54
		Casuarina	16
		Ceuthostoma	2
		Gymnostoma	18
Hamamelidae	Myricaceae	*Comptonia*	1
		Myrica	28
Rosidae	Elaeagnaceae	*Elaeagnus*	38
		Hippophae	2
		Shepherdia	2
Rosidae	Rhamnaceae	*Caenothus*	31
		Colletia	4
		Discaria	5
		Kentrothamnus	1
		Retanilla	2
		Talguenea	1
		Trevoa	2
Rosidae	Rosaceae	*Cercocarpus*	4
		Chamaebatia	1
		Cowania	1
		Dryas	1
		Purshia	2
Magnoliidae	Coriariaceae	*Coriaria*	5
Dilleniidae	Datiscaceae	*Datisca*	2

Some of the genera commonly found in India are *Alnus*, *Casuarina*, *Coriaria*, *Elaeagnus*, *Hippophae* and *Myrica* (see fig. 1-6).

The actinomycete *Frankia*

The name *Frankia* was coined by J. Brunchorst in honour of his mentor, A. B. Frank in the year 1886. However, attempts to isolate pure culture of *Frankia* was not possible till 1978 when Callaham and co workers successfully isolated and cultured Frankia from root nodules of the actinorhizal genus *Comptonia*. Since then, numerous research have been conducted in respect to *Frankia* taxonomy, host specificity groupings, metabolism, biochemistry and genetics (Jeong *et. al.*, 2003).

Fig. 1: *Alnus nepalensis equisetifolia*

Fig. 2: *Casuarina*

Fig. 3: *Coriaria sp.*

Fig. 4: *Elaeagnus umbellate*

Fig. 5: *Hippophae rhamnoides*

Fig. 6: *Myrica nagi*

Fig. 7: *Frankia* infected root nodules in *Myrica*

The characteristic feature of *Frankia* is the development of vesicles (site of nitrogen fixation) that has evolved to protect the enzyme nitrogenase from oxygen. All known nitrogenase enzymes are oxygen sensitive iron(Fe)-sulphur(S) proteins. Improvement of the isolation methods of *Frankia* involve the investigations of resistance to antibiotics and to heavy metals of *Frankia* strains to use them as genetic markers (Richards *et. al.,* 2002; Tisa *et. al.,* 1999).

Actinorhizal plant Uses

Actinorhizal plants are pioneers on nitrogen poor soils including sandy and gravelly sites, shores of streams and lakes, wetlands and exposed raw mineral soils. These plants find economical use as timber, fuel wood, in land reclamation, biomass production and in forestry (Chauhan, 2000).

In Western Europe actinorhizal plants are used primarily for reclamation of industrial wastelands and for land stabilization. Actinorhizal trees such as *Alnus* have been used in the reclamation of mine spoils in Britian (Schwintzer and Tjepkema, 1990) and *Alnus, Elaeagnus* and *Hippophae* have been widely used for land stabilization. In Eastern Europe and China, *Hippophae rhamnoides* is cultivated for its fruits for human consumption.

Several actinorhizal trees like *Alnus* and *Casuarina* are used as timber and fuel wood. They are also planted extensively as windbreaks and to stabilize dunes against wind erosion. Actinorhizal trees are also valuable for reclamation of mine spoils and rehabilitation of wastelands.

Fruits of *Myrica* species are used to make jams, syrups and juices and also its bark is used as fish poison in Meghalaya, India (Yanthan *et. al*., 2013). The bark of *Myrica* tree has been known to have many medicinal values especially in the treatment of diarrhea, headache, stomachache, earache, etc. and has also been used as a carminative and astringent (Dhyani & Dhar, 1994). Juice extracted from the fruit of *Elaeagnus* has been used as health tonic. Some actinorhizal species have adapted well to inundated lands, warm arid and semiarid regions, and areas of devastation (e.g. rock slides).

Actinorhizal plants have been used in soil restoration, as fuel wood, in wood production and derivatives, in agroforesty, in coastal restoration, and in the prevention of desertification (Wall, 2000). Several workers have excellently reviewed the application of actinorhizal plants (Benoit and Berry 1990; Dawson 1986; Diem and Dommergues 1990; Sprent and Parsons 2000).

Actinorhizal research status

There has been an increase in research on the actinorhizal plants in the recent years especially in regard to its phylogeny, nitrogen fixing biochemistry, host-symbiont interactions, nucleotide sequencing, molecular markers, etc.

Work on recent developments in actinorhizal symbiosis in the context of molecular approaches has been reviewed by Misra *et al*. (2004), with special emphasis on the molecular approaches to identification of the actinomycete *Frankia* using the *nif* genes and 16S rRNA. Studies done by Torrey (1978) revealed that the estimated amounts of nitrogen fixed by actinorhizal plants (40-350 kg N/ha/yr) are similar to that of legumes (~580 kg/ha/yr).

Based on the basis of *rbc*L, ITS and morphological data the monophyletic origin of Betulaceae with Casuarinaceae as its sister group was established (Chen *et. al.*, 1999). Navarro *et al*. (2003) studied the molecular phylogeny of 19 species of *Alnus* inferred from the ITS region of the nuclear ribosomal DNA. A similar study by Savard *et al*. (1993) proposed a monophyletic origin of *Alnus* and *Betula* based on the results obtained from ITS sequences.

Taxonomical dispute regarding the nomenclature of *Myrica* species was investigated utilising rRNA nucleotide sequences, Amplicon Restriction Patterns (ARP's) and 5.8S rRNA secondary folding by Yanthan *et. al*., 2011. Their study led to the proposal of treating *Myrica nagi* and *Myrica esculenta* as two separate species.

PCR/RFLP study of the ITS region of the nuclear 18S-28S ribosomal DNA of some *Alnus nepalensis* population using primers AnpITS1 (Chauhan and Misra, 2002) and ITSC26A (Wen and Zimmer, 1996) revealed that restriction digestion of the amplicon with *Scr*F1 separated the genus into nine different groups. Comparative analysis using the PCR/RFLP data with that of the nitrogenase activitiy of *Alnus nepalensis* resulted in generating molecular markers that could be used to eliminate genotypes with low nitrogenase activity (Chauhan and Misra, 2002).

Conclusion

Nitrogen is a limiting factor for the growth of plants. This is because of the continual loss of nitrogen from soil reserves by processes such as microbial denitrification, soil erosion, leaching, chemical volatilization and removal of nitrogen-containing crop residues from the land. This loss of nitrogen reserve of the agricultural soils must, therefore, be replenished periodically in order to maintain an adequate (non-growth limiting) level for crop production. This is achieved by either adding nitrogen containing chemical fertilizers directly in the soil or by the activity of Biological Nitrogen Fixation (BNF) systems.

Actinorhizal plants have potential to establish itself as pioneers in degraded and nitrogen poor soils. The ability of actinorhizal trees to form symbioses with the actinomycete *Frankia* to affect nitrogen fixation not only benefits the host plants but also enriches the surrounding soil that support the growth of other plants as well.

Reestablished forest helps in checking soil erosion and landslide while establishing itself as a natural basin for conserving water. Documentation of naturally growing actinorhizal trees and the study of its distribution pattern may help identify degraded areas where these plants can be introduced in order to enhance the soil nitrogen content. Edible fruits borne by these actinorhizal trees (e.g. *Elaeagnus*, *Hippophae*, *Myrica*, etc.) may supplement as income generating source.

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TRACE ELEMENT GEOCHEMISTRY OF DISANG SHALES: A CASE STUDY FROM KOHIMA, NAGALAND

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Abstract: Trace element geochemistry of fine grained sediments like shales has been used in many studies to determine provenance. Geochemically distinct rock types such as the ultramafic rocks, which have very high concentration of Cr and Na can produce elevated concentrations of some trace elements in sediments derived from a source or region that contains these geochemically unique markers.

Key words: Disang Shale, Eocene Age, trace elements, provenance.

Introduction

The area of Investigation including Kohima town and its surroundings, it is approximately 80 sq.kms. This area exposes two groups of rocks; one belonging to the Disang and other to Barail group. Geologically the Disang group of rocks are older than the Barials. The Disangs were first describes as monotonous sequence of Splintery Shales in Upper Assam by Mallet (1876) who called them Disang Shales, which was later redesignated as the Disang formation. The given work is confined to the geochemical study of the shales of the Disang Group exposed in and around Kohima in terms of trace elements Geochemistry.

The area of investigation in top sheet no 83 K/$_2$ of the Survey of India, and is bounded by North parallel 25^{o}38’00’’ & 25^o 42 ‘30’’ and east meridians 94^o 05’ 00” and 94^O 07’ 30”. It is approximately 80 sq.km area and falls within the territorial boundary of Nagaland.

In this area rocks of the Disang and Barail groups are exposed. The Disang sediments, a flysch facies of upper Cretaceous-Eocene age, is made up of abundant splintery shale intercalated with very hard, fine grained flaggy sandstones and silt stones. The Dissang Shales are highly fissle and readily split into semi-flexible thin sheets. The Shales of this area are mostly fawn to reddish brown coloured at very old exposures whereas in fresh surfaces they are commonly dark grey to brown color.

Materials & methods

Eleven Shale Samples, (Surface Samples) were collected from the study area. The Sample is prepared using the palletizing technique. This involves placing the sample in a vibrating disc-type grinder to grind the sample for a pre-determined length of time. Than a 40mm pellet is made from the ground material in a hydraulic compression machine so as to fill into the sample holder. The trace elements are determined quantitatively by XRF method. These include Pb, V, Cr Co, Ni Cu, Zn, Ga, Rb, Sr, Nb, Cs and Ba. Hf, Ta, Th, U and Sc have been analysed by the ICP-MS (Balaram and Rao, 2003) technique. B was analysed by the AAS method. The XRF technique is a non-destructive analytical method used to identify or measure this concentrations of elements present in solid, powder and liquid material.

Result & Discussion

The trace element composition of the eleven surface samples out of S1 –S19 were analyzed in ppm are shown below.

In the surface samples these elements range from Pb (27-42), V (56-92), Cr (101-194), Co (13 to 29), Ni (30-101), Cu (35-41), Zn (45-128), Ge (21-35), Rb (22-50), Sr(105-127), Zr (93-150), Nb (12-17), Cs (5-10), B (10-38), Ba (219-376), Hf (2.21- 4.5), Ta (0.94-1.36), Th (8.99-15.32), U (1.02- 1.55) and Sc (8.72-10.26) ppm respectively.

While studying the trace element distribution it is important to understand the distribution of organic matter and certain major elements like Fe, Al, etc. because their hydroxides and carbonates adsorb certain trace elements in the aquatic medium. Biogenic debris settling through the water column delivers minor elements such as Cd, Cu, Cr, Mo, Ni, V & Zn to the sea floor. Its contribution to the sediments, however is not easily established owing to a very wide variation in the result of minor element analysis of Plankton (Piper and Isaacs, 1995).

Several studies have used Cr and Ni concentrations of Phanerozoic Shale as a provenance indicator of ultramafic rocks. Most of the studies indicate that the high correlation coefficient between Cr & Ni is a result of their presence in clay mineral and ultimately their derivation from ultramafic rocks. (Garver and Scott, 1995) suggest that where Cr & Ni concentrations are high, a Cr/Ni ratio about 1.2 to 1.6 should be expected from mafic volcanic rocks such as Basalts. The Disang values agree with these rocks Table (1). This support a basaltic origin for these sediments. The low Ni/Co ratio (table 1) is an indication of high oxidation potential (Dykpiv, 1975). This may be the reason for the low occurrence of Cu in these sediments (Average shale ratio is 45, whereas in Disang Shale the ratio is 38.4 only). Well-formed pyrite in sediments supports reducing conditions is the depositional environment (Rothwell, 1989), Pyrite is fairly common in the Disang Sediments but its distribution is sporadic.

Plots of Th/ScVs Cr/Th (Table 1, Fig. 1) following Totten *et. al.* (2000) indicate a mixed source of rocks ranging in composition from granite to basalt. TiO2 in these samples range from 0.02 to 0.7% in the samples. Zr is plotted against TiO_2 following Sugatini *et. al.* (1996) in a binary diagram (fig 2). These plots indicate that the source rocks have been derived from granitoids & mafic rocks.

Several factors control the presence of trace elements in sediments and these include Pressure, Temperature, the physical & chemical properties of the elements and the chemical environment (Taylor, 1965). The presence of certain trace elements in sedimentary rocks is indicative of mode of formation and environment of deposition of the sediments (Majumder *et. al.*, 1980). Cr/V ratios are calculated for determination of condition of ventilations in the deposition environment while Ni/Co rations are calculated for Eh conditions in the depositional basin and provenance of the shale (Dykpiv, 1979), these values suggest moderate ventilation and low oxidizing conditions. The Correlation coefficient ratio are calculated using Karl Pearson formula:

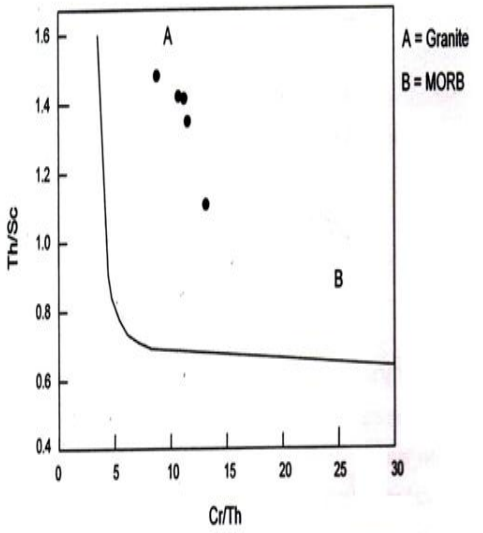
$$r = \frac{\sum dxdy}{(\sqrt{\sum dx^2 x dy^2})}$$

Positive correlation is observed for organic carbon against trace elements such as Pb, Ni, Co, Cu & Cr.
OC Vs Pb = +0.405,
O.C Vs Ni = +0.840
O.C Vs Co = +0.057
O.C Vs Cu = +0.206 and
O.C Vs Cr = +0.319

Such values suggest that organic carbon act as a scavenger of these trace elements.

Conclusion

From the above findings it is concluded that the Disangflysch are elastic sediments derived from very complex sources. Sedimentation takes place in a lagoonal environment where reducing conditions prevailed. Organic carbon is a scavenger of certain trace elements in aquatic medium.



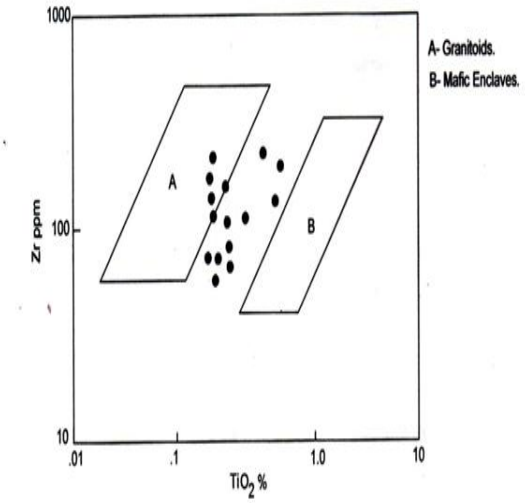
Provenance of Disang shales (after Totten et al, 2000)

Fig - 1

TABLE :1

Ratios of some trace elements of the surface samples of the Disang shale

Sample No	Ga : B : Rb	Cr/Ni	Ni/Co	Cr/V	Th/Sc	Cr/Th
S 1	29.41 : 29.41 : 41.18	4.85	2.22	2.25	-	-
S 3	29.12 : 36.89 : 33.98	5.10	1.25	1.70	1.36	12.90
S 4	26.73 : 34.65 : 38.61	4.25	2.22	2.13	-	-
S 5	37.34 : 12.04 : 50.60	5.78	2.29	2.37	-	-
S 6	-	1.63	3.10	1.77	1.04	11.20
S 9	26.58 : 36.71 : 36.71	1.34	7.77	2.41	0.88	14.96
S 11	-	5.06	1.50	2.07	-	-
S 12	-	1.73	3.20	1.31	1.10	11.25
S 13	-	1.88	3.62	1.88	1.01	13.19
S 14	-	2.21	2.79	2.21	-	-
S 19	-	2.03	3.29	2.03	-	-



Provenance of Disang shales (after Sugitani et al, 1996)

Fig - 2

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ASSESSMENT OF SURFACE WATER QUALITY IN NAGALAND, INDIA

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Abstract: In this study, the physicochemical characteristics of surface water of Nagaland, India viz, temperature, pH, conductivity, TDS , total hardness, dissolved oxygen, BOD and COD were determined for the purpose while the level of essential trace elements namely iron, copper, zinc, nickel, manganese and non-essential trace elements namely lead, cadmium, silver and arsenic were estimated by atomic absorption spectroscopy. Comparing these results with the ISI and WHO recommendation for the domestic water revealed that the concentration of lead, iron and manganese in some samples under investigation were within the elevated values. These finding demonstrate that pollutant have been passed into the surface water by various anthropogenic activities as well as natural processes.

Key words: physiochemical parameters, essential and non essential trace elements, surface water, pollutant, Nagaland.

Introduction

Nagaland is the sixteenth state of Indian Union and lies between $25^0 6'$ and $27^0 4'$ latitude North of Equator and between the longitudinal lines $93^0 20'$ and $95^0 15'$East having an area of 16,579 sq km. The total population of Nagaland as per 2011 census is 19.8 lakhs with a population density of 119 per sq km (Statistical handbook of Nagaland, 2011). The state of Nagaland has no dearth of water resource, the predominant sources of water is surface water in rivers, streams, ponds and natural springs and subsurface water occurring as ground water. The annual average rainfall of Nagaland is about 2500 mm (Statistical handbook of Nagaland, 2011; Basic Facts of Nagaland, 2010).

In the North Eastern region of India including Nagaland most of the potable water is harnessed from surface water, rivers, ponds and natural springs. However, many of these water sources are reportedly becoming polluted. That 28,181 water sources located in Assam have been contaminated with inorganic materials, followed by 2931 in Tripura, 566 in Arunachal Pradesh, 124 in Meghalaya, 76 in Sikkim, 37 in Manipur and 26 in Mizoram. In Nagaland alone, 136 water sources under studies were reported to be contaminated with excess inorganic materials and reported that the arsenic levels in Assam, Manipur, Tripura and Arunachal Pradesh were above 300 ppb (NERIWALM, 2007; Singh, 2006).

Surface water is one of the most exposable to pollution due to their easy accessibility for disposal of waste water and effluents. Various natural and human activities, like industrial, domestic, agricultural activities and others are creating water pollution. And all these anthropogenic activities as well as natural processes degrade surface waters and damage their use for drinking, industrial, agricultural, reaction or other purposes.

In the state of Nagaland, there is no proper drainage system, besides there is no system for recycling the sewage and solid waste management. The municipal and domestic wastes from urban and rural areas are directly discharged into natural water bodies. Hence, the surface water can get contaminated with inorganic and organic load (NPCB, 2004; Jamir & Singh, 2010; Jamir *et al*, 2011).

Therefore, it was thought that a preliminary study on some dimensions of surface water quality would be of value to develop the management strategies for maintaining potable water quality for healthy and well being of the inhabitant of the state.

Experimental

In this study, the physiochemical characteristics such as temperature, PH, conductivity, TDS, total hardness, dissolved oxygen, BOD and COD were determined for the purpose. Analysis of pH, conductivity, temperature, TDS, DO was done using water analysis kit (Eutech cyperscan, Singapore) on the spot. Dissolved Oxygen, BOD, COD, Total hardness, calcium hardness was determined following mainly the standards methods (Welcher, 2006; De, 2005).

While the level of essential trace elements namely iron, copper, zinc, nickel, manganese and toxic elements namely lead, cadmium, silver and arsenic have been estimated using Atomic Absorption Spectrophotometer (Perkin Elmer 3110) of corresponding analytical wavelengths and slit width (Singh, 2006; De, 2005).

The water samples were collected seasonally (pre-monsoon and monsoon) for three continuous years. Samples were collected from 15-25 locations each from different districts/Sub division viz; Kohima, Dimapur, Mokokchung, Wokha, Tuensang, Lumami, Tseminyu and Ungma covering mainly the urban populated area. Samples were collected using analytical grade (AR) 1 litre polyethylene container and was insured that the representative samples reflect the main body of water (Manivasakam, 2008 ; De, 2005).

Results and discussions

The physiochemical characteristics of water samples of different districts of Nagaland have the pH in the ranges 6.02-7.23. Few representative samples from Kohima *(K-8, 9, 11)* and Mokokchung *(M-3,5,9)* were slightly acidic in the range of 5.56-5.61 and 5.64-5.80 respectively. While some sources under Ungma, Mokokchung & Lumami found to be slightly alkaline in the ranges of 7.89-8.14.

The electrical conductivity of the samples under study was found to be in the range of 70-670 μ mhos cm^{-1} and that the values of total dissolved solid (TDS) was in the ranges 43-387 ppm, however few representative samples of Dimapur *(D-17,19,20*) showed above the permissible limit in the range of 1.30 ppt. (2.62 ms -1,30 ppt). It was also observed that the water samples collected from Tseminyu area showed the lowest electrical conductivity. The water temperature of all the samples ranges from 14-24^{0}C (winter & summer).

Analysis of Dissolved Oxygen DO showed in the ranges, 10-23 mg/L while the biological oxygen demand BOD was in the ranges 2.1-3.7mg/L. It observed that few samples from Ungma, Mokokchung and Tseminyu showed BOD contents above the permissible limit though within the tolerable limit. Nevertheless the analysis of DO, BOD and Chemical Oxygen demand (COD) of almost all the samples adhere to ISI and WHO guidelines values.

As regard to the samples collected in different seasons, it was concluded that the value of dissolved oxygen marginally decreases in summer than in winter and the values of biological oxygen demand and chemical oxygen demand increases during summer season than in winter. This may be due to the reasons that during summer the monsoon brings all the organic and inorganic load into the water bodies thereby increases the number of oxygen demanding microorganisms leading to the reduction of oxygen contents thereby decreases the dissolved oxygen and increases the values of biological and chemical oxygen demand.

Analysis of water samples further revealed the high presence of Calcium and Magnesium (43.4-120.3 mg/L total Hardness) especially in Dimapur district. The increased in concentration of Calcium and Magnesium is one of the reasons for the cause of hardness of water. However in other districts of Nagaland, the total hardness of water was all within the permissible limits.

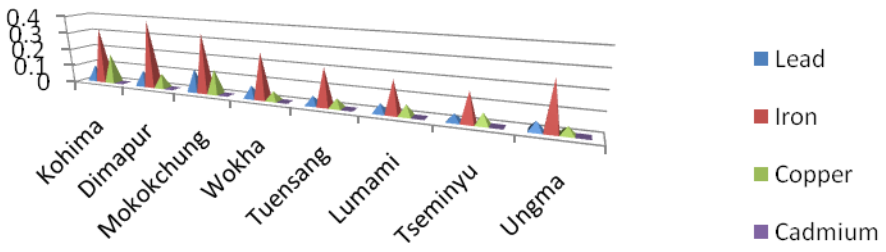
The trace elemental analysis of water samples showed the concentration of As, Ag, Ca, Cd, Cu, Mg, and Zn within the permissible limit. However the concentration of lead, Iron and manganese in some water

sources under examination were found to be above the prescribed maximum permissible limit (WHO, 2004).

The concentration of lead in some water sources under Mokokchung *(M-2,3,15 &16)* and Kohima *(K-5, 7, 21)* were slightly above the permissible limit in the ranges of 0.14-0.19 mg/L ; Wokha *(W-1, 2)* in the ranges of 0.14mg/L (maximum permissible limit is 0.1mg/L). This relatively higher concentration of lead in some water sources confirms that many surface water sources are unprotected from domestic and municipal sewage, human and industrial effluents as most of the heavy metals and in particular the lead metal is generated from street dust. The concentrations of iron in many water samples from Dimapur were above the permissible limits in the ranges of 0.34-0.68 mg/L. Higher concentration of Iron was also found in few sources of Kohima, Tseminyu, Ungma, and Wokha in the ranges 0.33-0.51 mg/L. Similarly higher concentration of manganese was observed in Dimapur, few sources in Mokokchung and Lumami in the ranges 0.13-2.1 mg/L (WHO, 2004).

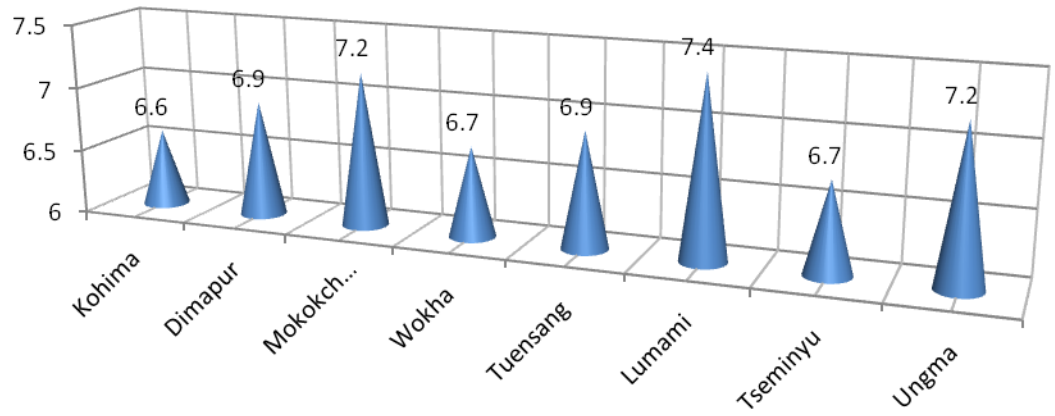
Conclusion

Surface water is one of the main sources for drinking water in Nagaland and therefore keeping in view the deteriorating quality of surface water, a long term environmental planning and management of surface water quality maintenance is essential to blunt the danger from pollution and that with effective management safe drinking water could be provided for the health and well being of the inhabitant of the state.

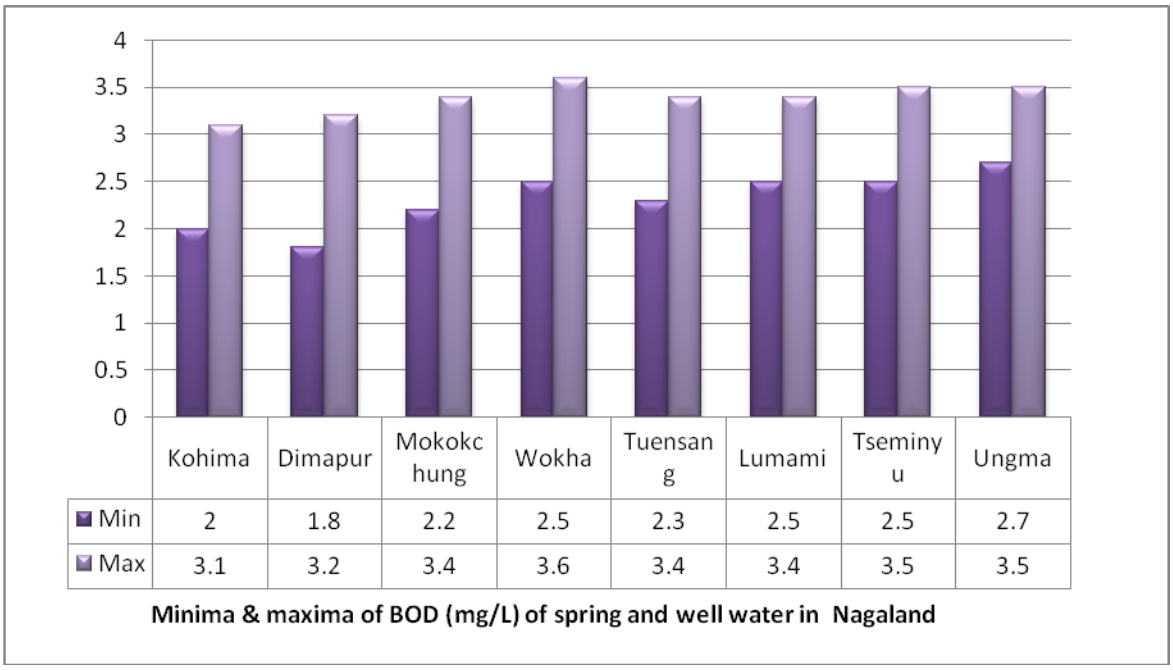


	Kohima	Dimapur	Mokokchung	Wokha	Tuensang	Lumami	Tseminyu	Ungma
Lead	0.09	0.09	0.13	0.07	0.05	0.05	0.04	0.05
Iron	0.32	0.39	0.34	0.26	0.21	0.18	0.16	0.26
Copper	0.17	0.08	0.14	0.05	0.05	0.06	0.06	0.04
Cadmium	0.01	0.01	0.01	0	0	0	0	0

Average Conc. of trace elements (ppm) in Spring and well water of different district in Nagaland



District wise comparision of Average PH of spring and well water in Nagaland



	Kohima	Dimapur	Mokokchung	Wokha	Tuensang	Lumami	Tseminyu	Ungma
Min	2	1.8	2.2	2.5	2.3	2.5	2.5	2.7
Max	3.1	3.2	3.4	3.6	3.4	3.4	3.5	3.5

Minima & maxima of BOD (mg/L) of spring and well water in Nagaland

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FUTURE OF ENGLISH IN NAGALAND

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Abstract: This article is the abridged form of a previously published paper. It briefly presents some modes of English language teaching and learning available today vis-a-vis the Nagaland ELT scenario. It makes suggestions regarding the need to 'adapt' or 'catch-up' with various electronic resources available through which language can be taught more effectively. Information regarding the local scenario are sourced from questionnaires given to UG students of Arts, Commerce, and Science from all the districts of Nagaland, interviews of English teachers and the author's own experience as an English teacher. At the time of this study the CCE and semester system were not yet introduced in Nagaland.

Keywords: Strategopedia, communicative, ESP, language laboratory.

Introduction

English is a pre-eminent language of wider communication at the international level. Even countries like China, Japan, and Russia which lagged behind in English language learning and teaching, are now making great efforts towards English language education. In fact, since the 1990s "English language education has been a subject of paramount importance in China, and proficiency in English has been widely regarded as a national as well as a personal asset," according to Guangwei Hu (2005: 5). Today we see that even a very conservative country like Japan, that resisted English for more than half a century, thought it fit at the dawn of the new millennium to adopt English as its official language" (Kumaradadivelu 2002: 48). Japan now thinks, according to Yuko Butler and Iino, that its people "must be equipped with better communicative skills in English and that raising the ability to communicate with foreigners is a key remedial measure to boost Japan's position in the international economic and political arena" (2005: 25-26). One knows fully well that in this world of international market, knowledge explosion, and Information Technology only familiarity with this language can carry an individual and a country far.

English enjoys the status of State language of Nagaland. While it is taught as a subject and is also the main medium of instruction at the primary school level, it becomes the sole medium of instruction for all the students from the middle school onwards. However, despite increasing literacy and spread of education, English is not exactly the language of the masses. Nevertheless, this language does enjoy mass attitudinal support, and is seen as a tool for promoting unity and gaining prestige. The ability to speak English especially without any trace of regional accent is prized by students, educators, parents and employers here. It is also the gelling language of Nagaland, and to borrow from Roy, English "still remains the least volatile option for managing diversity" (1993: 57).

The Future Prospect of English in Nagaland

Teaching English language in Nagaland can be made much more interesting than it actually is. The college graduate should be more fluent in English and should be able to communicate with ease. At present most of them are inhibited, and though they have a decent grounding in grammar they are not able to translate that into very effective interactive communication. They need to use English in their daily lives as a lingua franca and not just as a library language. For this the students should be armed with a basic knowledge of phonology of English too. Exercises in accent, rhythm and intonation can be used to reinforce the student's knowledge of grammar and develop the spontaneity of utterance. No student should be handicapped by ignorance of the

language as this language could ultimately determine the career the student chooses or gets. English should continue to have an important position in the curriculum of the Under Graduate course. The students should be able to express themselves in simple and correct English. They should be armed with the power of comprehension as this language is a potential resource for group affinity and solidarity. In Nagaland because of the absence of a common language, English language can go a long way in developing the State's personality.

Nagaland should also implement the new trend in language teaching which is now available in the form of Distance Education. Distance Education was born out of urgent social compulsions, new cultures and new objective of the learners. Distance Education is a revolutionary break from the traditional, aged-old face-to-face teaching system leading to the development of an innovative as well as effective multi-media teaching system. Today, correspondence courses enable one to have a self-paced study separating the students from the teachers: it has made the learners autonomous and helped shift the focus from 'teaching' to 'learning.' The stress is now on 'what should be taught' than 'how things should be presented in the classroom situation.'

Another area that needs to be looked into is the evaluation system. In Nagaland we follow the summative evaluation system whereby the total achievement of the student is assessed at the end of the year through one examination. However, this system is not the best tool to judge the ability of the students as it encourages the student to study only selected portions from the syllabus, and also cram just before the examination. Therefore, one system that would be more valid and reliable for both the language learners and the teachers is the Formative Evaluation. According to this, periodical tests which supply feed back to both the learners and teachers are administered. As language learning follows the two phases of learning the forms and application of the forms or learning to use them, only constant monitoring will ensure that the learners are progressing the way they should be.

As English is the only medium that can meet the specialized needs of business, commerce, education, law, politics, science and technology, the principles of ESP (English for Specific Purpose) may be taken into consideration while framing the ELT course design at the college level in Nagaland. It is time we made more serious efforts for developing courses to teach special English to meet the specific needs of the students in certain disciplines. With globalization and the emerging market economy the demand for this language is ever increasing. The university can introduce short-term English language courses to facilitate students who wish to learn the language efficiently in the shortest possible time for a specific purpose. For example, with the mushrooming of call centres all over the country, we can have course that specifically cater to the demand of call centres. Another area where these courses can help is to help those students who wish to go abroad to take the TOEFL (Test of English as Foreign Language).

There are concerns that govern our ELT courses. The main concern for us language teachers is how the language system is put to use for communication purposes. As far as higher education in Nagaland is concerned, English is taught for two purposes: to enable the students to have an easy access to knowledge by giving them the benefit of another medium and, secondly, to prepare them to operate successfully in the professional world after their graduation. It would be helpful to introduce courses like TEST (Teaching English for Science and Technology) and TEBC (Teaching of English for Business and Commerce).

English as a Communicative Task

A communicative task is "a piece of classroom work which involves learners in comprehending, manipulating, producing or interacting in the target language while their attention is principally focused on meaning

rather than form' (Carter & Nunan 2001: 173). Language in a communicative task brings about a result through exchange of meanings. Therefore, it is important to see that it is designed to provide the students with stimulating and challenging material. The teacher's task is to make sure that a sequence of communicative tasks is carried out in the target language. Only than will serious learning take place. Since English is mainly learnt as a tool of acquiring communicative ability relevant for real-life situations, ESP courses should be designed using the above mentioned insights. That way the courses would cater to the needs of the various professions into which our graduates enter.

If Communicative Language Teaching (CLT) can be introduced in our language classroom it will make language learning pleasant and effective. (Especially in Nagaland where English is taught mostly by traditional methods). CLT involves communication in the classroom. This approach which entails communicating with one another in class in pair or small groups is popular in Britain and Australia. According to Senior of Curtin University, Perth 'its (CLT) strength is that it is a general teaching approach rather than a specific teaching method. It can be used in any course. It can be adapted for classes at any level, ranging from beginners to advanced. It is particularly suitable for classes comprising students from different linguistic backgrounds and various level of proficiency. In effect, CLT gives teachers a high degree of freedom to organise their classes in the ways they want, and to select from the widest possible range of learning activities" (2006:17).

Another method that could work well here is the *Strategopedia methodology* wherein the students are taught the strategies they need so that they can learn on their own. This methodology has been advocated by Holec who claims that "to teach the learner to learn, that is to enable him to carry out the various steps which make up the learning process, is considered the best way of ensuring that learning takes place" (1995: 265). At the basic level strategies can include memory tricks, and at the higher levels cognitive strategies for learning, thinking, planning and self-monitoring. When strategies are taught to language learners, they can apply these strategies in language learning tasks.

Role Technology can Play

One factor that brought about a radical change in the modes and strategies of imparting knowledge in the 1990s was the emergence of the Information Technology. The language teachers too need to be 'computerates' and 'netizens' so as to retain their relevance. Technology-enhanced language learning is an aspect of language learning that can be used to supplement conventional language learning. Encouraging signs from students using technology are seen in the foreign language classroom. Beauvois reports that "technology encouraged the development of the independent learning characteristics in the students of the foreign language" (1994: 171). Computers in the language classrooms can play the dual roles of tutor and tool: as a tutor the computer evaluates the user's input and respond to it, while as a tool, the computer is employed by the user to enhance his or her own learning or communication. It will do the ELT scenario in Nagaland a world of good if the policy makers

realize the indispensability of IT in the language classroom today.

The Language Lab is another aspect that needs serious consideration. At the moment the language lab is conspicuous by its absence in almost all the colleges of Nagaland. Due to the growth of ICT multiple media resources like CD-ROMs, video conferencing, broadcasting and internet can now be incorporated in the language lab systems. This will give a new look as it will expand beyond its historical focus on audio, and in turn have a number of educational implications. This view is corroborated by Damodar who says "apart from having the usual formats for testing tutorials and practice, [ICT tools] also stimulate situations for effective teaching and learning of English" (2005: 278). This researcher believes that language learning can be enhanced though adopting of technology. The proficiency, fluency, and competency of the language would be greatly improved if the 'know-how' of the latest information technology including CALL (Computer-Aided Language Learning) is adopted by the language teacher. This will not only make teaching-learning more challenging and effective but also exciting.

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UNDERSTANDING THE PSYCHOLOGY OF CHILDREN IN LATE CHILDHOOD

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Abstract: A child's world is as a child sees it- a world of innocence, far removed from the corrupt, experienced world of adults. To understand the world in which a child operates, one needs to understand its psyche. With this in focus, this paper aims to highlight the emotional and cognitive processes during late childhood or the elementary school years.

Keywords: Children, Development, Psychology, Late Childhood

Introduction

Late childhood extends from 6 years to 12 years. It is a very crucial period when children need a lot of understanding from people around them. They are exposed to many new situations and experiences. From the security of the home, they move to a larger and a more hostile environment. Therefore, adults need to understand their psyche and help them cope with the changes. The onset of this period brings about a lot of emotional and cognitive developments in the child which must be properly channelized.

As this period is accompanied by immense psychological challenges, an attempt to understand children from a psychological perspective is being made, so as to enlighten parents, teachers and adults to create an atmosphere conducive to the child's psychological growth.

Psychological development in late childhood

Comprehension of some general psychological developments during late childhood will equip adults to understand children better. Late childhood is the period when children are caught between two worlds- the confined world of early childhood and the independent world of adolescence. As they emerge from their cocoons, they need maximum adult supervision and empathy. Following are some general psychological developments that take place during late childhood.

Emotional development

Emotionally, children of this age group are relatively calm. Emotions are less violently expressed compared to younger children. According to Elizabeth Hurlock, there are three reasons responsible for this relative calmness. One reason is their awareness of how people feel about violent emotional outbursts. Another is their constant engagement in group activities like games and sports, through which their pent-up emotional energy is released. The third reason is the improvement potency in different skills, which enables them to face less frustration in accomplishing various task (Hurlock, 1978: 194). However, emotions can be heightened by changes or disturbances in their routined established lives. For instance, a young boy who befriends a newcomer will go through an emotional shock when he is suddenly shunned or ignored by his school friends. This initial shock will be followed by a surge of emotional and mental agony because he feels betrayed by his friends. However, for children, such repeated emotional shocks can prove to be the 'emotional catharsis' or the release of repressed emotions. Hurlock states that emotional catharsis can be obtained through crying, laughing, strenuous play, confiding in others or even running away. Through all these, children learn what reaction

is socially acceptable. They discover more by 'trial and error than by guidance' and also the value of 'mental catharsis' which when combined with 'physical catharsis' enable them to express their emotions in socially approved ways with minimum physical and emotional stress (Hurlock, 1978:211).

Psychoanalysis affirms that aggression is a reactive phenomenon, conditioned by unconscious mechanisms. It can be interpreted as a defensive behaviour of children who feel frustrated, insecure, inferior and inadequate but not fully conscious of these feelings. As a reaction against such feelings, the child may put on an aggressive front. This false defensive front of the child is to attract others interest and to show that it is strong and confident. M. Kapur in a study on the mental health of Indian children states that in responding to distress, boys target the environment. They show more of aggression related symptoms called 'externalising disorders' which may result in conduct disorders and delinquency (Kapur, 1995: 167-215). Take the case of a boy with very imposing or indifferent parents. Very likely, he may turn out to be a bully at school. His aggression and threats are attempts to attain status and importance which he doesn't get at home. He creates a make-believe situation where he appears big and powerful. Such imaginary stature gives psychological satisfaction and soothes the hurt ego of frustrated children.

Fear is also a specific emotion in later childhood. Bright children are likely to be more fearful. This could be due to their greater power of imagination and sensitivity to perceive threats around them. They may possess little self-control with over-active minds. The dull child may often fail to sense the potential threats to his safety, which may make him self -composed and fearless (Morgan, 1986:449). Among older children, "fears are concentrated on fanciful, supernatural or remote dangers; on the dark or imaginary creatures associated with the dark..." (Hurlock, 1978:198). This indicates that children can mentally project a repressed fear which can be psychologically disturbing due to its propensity to distort the object of that specific emotion.

In late childhood, jealousy can stem from feelings of insecurity in a relationship with a close friend and the fear of losing status in that person's affection (Hurlock, 1978:203). This implies that children begin to recognize threats to their security and obstructions to their wishes. They may express their annoyance and jealousy by being rude and cynical which provide them relief. This is seen in a child who may be jealous of someone who threatens its status. In such a situation, the child may sarcastically belittle the one who threatens his security. Outwardly it may appear powerful but in reality, it is an outgrowth of jealousy.

Poor parental relationship can psychologically strain the child. According to Karen Horney, in such an environment, the child becomes anxious because it cannot express its hostility directly to the parents. Feelings are repressed, which only increases anxiety (Horney, 1986:587). Children in such situations can sense the tense atmosphere and catch all the insinuations in the air, yet feel helpless which make them insecure and emotional and may lead to psychological disorder.

Cognitive development

Intellectually, this period of development is termed as the stage of 'concrete operation' because the child's mental ability is confined only to concrete objects and events (Morgan, 1986:450). The child cannot understand broad abstract concepts which indicate that his 'secondary ego' is not well developed. Children of this stage find everything confusing when things are not explained in plain language. This is so because the secondary mental processes or reasoning which govern the mastery of the outer world is still weak at this stage. They continue to relate objects and events to themselves and fail to understand things not related to them.

On the achievement front, Hurlock advocates the view that independent and initiative taking children score higher in the

achievement drive than those who are dependent and lack initiation. Late childhood is a critical period in the achievement drive- a time when children form the habit of being achievers, underachievers and overachievers. This development even affects other areas of the child's life (Hurlock, 1978:442-44). Academically, overachievers score high marks and can solve problems quickly; achievers are average scorers and underachievers are least bothered about their studies and may even bully others. This variance in academic performances can also reflect the upbringing and family ambience of the children. Top achievers usually have parents who prove to be strong support systems for their children's achievement drive. Underachievers are usually from family environments which are not conducive to intellectual development.

Mental development

Mentally, these children are very vulnerable to their teachers' reactions and attitude. Therefore, teachers ought to understand their psychology and deal with them accordingly. Instead of giving constructive criticisms, which make children guilt conscious, they may make them shame conscious. According to Fraser Watts, shame is an emotion that is similar to guilt but subtly differs from it. Guilt is a thought laden emotion but shame is more immediate and physical. Excessive shame is a very destructive emotion, and can lead to various forms of self-abuse. It can also isolate people from others (Watts, 2002:12). This implies that the guilty child may not necessarily display that he is guilty, but the child who is shamed will spontaneously show the emotion. Guilt oriented teachers make the child say that it is sorry and extract a promise not to repeat the act. Shame oriented teachers ridicule the child that it may not be able to hold up its head. Such teachers resort to harsh scolding and physical punishment instead of correcting the child. Guilt oriented teachers can help a child to develop a conscience whereas a shame oriented teacher can push him to rebellion and resentment. Ken Heyman asserts, "Our self-image develops on the basis of information about the way we are and the way others see us" (Heyman, 1986:598). This denotes that a healthy self concept in childhood depends a lot on the social ambience of the child. Children see themselves as their friends, teachers and parents see them.

Along with guilt consciousness is also the gradual development of conscience. Eysenck defines conscience as an internal standard that controls the individual's behaviour. It is not inborn but is learned through the passage of time. Guilt is a special kind of negative self evaluation, which occurs when an individual acknowledges that his behaviour is at variance with a given moral value to which he feels obligated to conform (Eysenck, 1960:11). This moral development takes root in late childhood. Though conscience is already at work in the child's mind, it is at its initial stage, thus telling lies for varied reasons continue to be a part of late childhood. Hurlock avers that in most cases children lie due to fear of punishment, disapproval or ridicule (Hurlock, 1978:410). A child may feign sickness and refuses to attend school when it fails to do its homework. This indicates that conscience is not deep rooted nor properly developed in late childhood.

Conclusion

Children who have no adult figures to guide them during late childhood may resign themselves to their fate. They fail to develop a healthy self concept because their potentials are not evaluated or exploited. They enjoy no sense of fulfilment as they lack feedback which can be obtained from the observations and comments of their parents or other adults. Such children fall behind as they are deprived of an unbiased perception and judgement of people around them, which is the very foundation on which they form their self-perception. Thus, it is important that adults understand the emotional and cognitive developments of children during this period and help them to achieve psychological equilibrium.

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RECREATING DINOSAUR DAYS

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Abstract: Since 1850 the Earth's climatic temperature has been gradually rising. During the last ten years there has been a decline in the Sun's heat but unlike during the Little Ice Age (1850 – 1550) caused by solar minimum, this has not caused any cooling effect. The global climate warming caused by accumulation of green house gases in the atmosphere by burning oil, gas and coal seems to have greatly surpassed the effect of solar minimum. This is an alarming indicator of very hot days ahead. We are recreating through our modern day activities a situation very much like the Cretaceous Period which saw gradual increase of the Earth's climatic temperature caused by huge volumes of green house gases that spewed out from the innumerable volcanoes. The effect of increase in Earth's climatic temperature will have the greatest impact on the sea level. The melted snow and ice will inundate large areas of the continents similar to Cretaceous times. The intolerably hot climate and the acid rains falling from a severely polluted sky can also prove fatal to all living things. The acid rain generated from a volcanically polluted atmosphere during the end of the Cretaceous was one of the major causes of mass extinction of marine planktonic life. Mass extinction and severe decline of plants and animals have occurred from time to time owing to extreme climatic situations. They bear testimony to the fact that climate and life are inexorably linked.

Keywords: Climate change, cretaceous, Permian, mass extinction

Recreating Dinosaur Days

The Dinosaurs, the largest animals known to have ever walked the face of the Earth lived under climatic conditions that changed from extremely hot and dry during Triassic Period (248 mya to 208 mya) to extremely hot and humid during Cretaceous Period(144 mya to 65 mya). These animals thrived in an environment that was gradually growing hotter by the day and their progeny managed to spread out to all the continents. Species such as the *Brachiosaurus, Tyrannosaurus* and the *Diplodocus* grew to astounding sizes and length. These giants who lorded over the Earth for more than 160 million years (modern humans have existed for just 125,000 years) suddenly and completely disappeared about 65 million years ago due to abrupt climate change from very hot and humid to very cold.

Causes of climate change

The Earth has gone through a series of climate changes during its four and a half billion years of existence. This phenomenon of periods of warmth and cold ranging from decades to millions of years, in a region or worldwide, is known as climate change. Climatic changes are controlled by the following factors:

1. Variation in pattern of Earth's orbit and rotation causes fluctuations in solar radiation falling on Earth. This was formulated by Scottish scientist James Croll and firmly established by Serbian mathematician Milutin Milankovitch.
2. Variation in amount of cosmic radiation (solar maximum and solar minimum caused by increase or decrease of solar flares and eruptions) reaching the Earth's surface. During solar maximum Earth receives extra solar radiation from the Sun.
3. Other causes (Release of green house gases to the atmosphere through volcanic eruptions and burning of fossil fuels, asteroid hits, etc).

Change in the Earth's climate due to greenhouse effect was first described by the Swedish scientist Svante Arrhenius during the early part of the 20th century. The first

conference on world climate was organized by the World Meteorological Organization at Geneva in 1979.

Climate changes in Earth's history

There have been alternate periods of intensely hot and cold climatic conditions. After each glacial period there were periods of global warming. Some glacial times were much colder and some interglacial times a lot warmer. Changes from hot to cold were very slow while changes from cold to hot were comparatively very fast.

The Pleistocene times (10,000 years ago to 2 million years ago) experienced a remarkable number of climate changes. Based on oxygen isotope studies it has been determined that the world underwent 26 climatic changes since 10,000 ya to 1 mya. And between 1 mya to 2 mya there were similar fluctuations.

Some other notable periods of global warming and glaciations are mentioned below.

Global Glaciations

1. Early Proterozoic: 2500 mya (million years ago) to1600 mya
2. Late Proterozoic: 900 mya to 550 mya
3. Cambrian: 550 mya to 505 mya
4. Pleistocene: 2 mya to10, 000 ya
5. Little Ice Age: 1850 AD to1550 A.D. Coldest during 1700 A.D. The Little Ice Age was caused by solar minimum.

Global Warming

1. Carboniferous Period (360 mya-286 mya)
2. Permian Period (286 mya- 248 mya)
3. Triassic Period (248 mya-208 mya)
4. Jurassic Period (208 mya-144 mya)
5. Cretaceous Period (144 mya-65 mya).

The Carboniferous period was hot and steamy and helped the plant kingdom and aquatic life forms to flourish. During the end of the Permian the climate became very hot and dry leading to the largest mass extinction of animals and plants. This severe hot and dry climate continued up to Triassic times. The last global warming peaked around 5000 years ago.

Some significant climate changes due to other causes:

1. Global Warming during Cretaceous Period (65mya to 144mya):

   This came about due to large scale volcanic eruptions on land and under the sea in most parts of the world. The huge amount of water vapour and carbon dioxide along with other gases emitted during these eruptions caused severe green house effect on Earth. The world climate underwent gradual increase of temperature from Early Cretaceous up to late Cretaceous Period. Snows and glaciers melted except for those on the summits of the highest mountains. Sea level rose continuously and covered most parts of the world. The chalk and clay deposits (formed only on the sea bed) of this age covering large parts of continents are evidences.

2. Global Cooling during end of Cretaceous Period (about 65 mya):

   There are two theories that could have caused global cooling at the end of the Cretaceous Period**.** The first being about a giant asteroid that slammed into the present day Yucatan peninsula in Mexico causing a colossal cataclysmic explosion. The other theory is about a very powerful volcanic eruption. Evidence of both these causes

comes from the thin but very widespread layer of clay containing unusually rich amounts of Iridium metal in all late Cretaceous rocks all over the world. This metal is present in the core of the Earth and in asteroids. The extensive dust generated by the explosion of either or both of these causes blocked out sunlight and caused extreme cooling of the Earth for years. This led to mass extinction of life forms on land and sea. To name a few, remarkable animals like the Dinosaurs, Pterosaurs, marine reptiles and other animals such as the giant Ammonites became extinct. 85 % of planktonic life species were completely wiped out.

3. The present day Global Warming:

Since 1850 the Earth is gradually warming. Sea level is rising, glaciers are retreating, oceans are getting warmer and ice sheets are shrinking. During the last ten years there has been a decline in the Sun's heat but unlike during the Little Ice Age (1850 – 1550) caused by solar minimum, this has not caused cooling of the Earth's climate. The green house effect caused by accumulation of green house gases in the atmosphere has greatly surpassed the effect of solar minimum.

Causes

The major factor contributing to the present day global warming are emission of green house gases (GHG) through burning of oil, gas and coal. These gases are carbon dioxide, methane, nitrous oxide etc. Among all these gases, carbon dioxide is the main cause of green house heating. Countries responsible for the highest amount of carbon dioxide emissions are the United States of America, China, Germany, Japan, United Kingdom, India and Canada. The United States takes the lead with emission level almost three times more than China. 80 percent of the global pollution is being caused by the developed countries.

Annual worldwide emission of GHG

Carbon dioxide- 30 billion tons
Methane- 350 to 500 million tons. Methane traps 20 times more heat than carbon dioxide.
Nitrous oxide- 13 million tons.

Deforestation

Trees take in harmful carbon dioxide for their photosynthesis and produce oxygen which is needed by all life forms. The large scale deforestation worldwide is severely upsetting this exchange.

Conclusion

We are recreating through our modern day activities a situation very much like the Cretaceous Period which saw gradual increase of the Earth's climatic temperature. The extreme warming during the Cretaceous was caused by huge volumes of green house gases that spewed out from the innumerable volcanoes, while now, similar amounts of these gases are being sent out to the atmosphere by burning oil, gas and coal. If this continues it will melt all the glaciers and snows on the north and south poles and even those on the high mountains. This will drastically raise sea level and drown large parts of all the continents. The intolerably hot climate and the acid rains falling from a severely polluted sky will also prove fatal to all living things. The acid rain generated from a volcanically polluted atmosphere during the end of the Cretaceous period was one of the major causes of mass extinction of marine planktonic life. The extremely hot and dry climate during the Permian caused the largest extinction of animals and plants, so also, the sudden change from hot and moist to cold at the close of the Cretaceous times led to the total annihilation of the Dinosaurs and other life forms on land and sea. These disastrous events in Earth's history are outstanding examples of the effects of climate on life forms.

We have cleverly invented so many devices for our ease, comfort and welfare but we are now beginning to see that these very things are endangering our lives and also all life forms on Earth as well. It is now time to use this cleverness coupled with some wisdom to undo the damage.

What we can do

1. Reduce green house gas emissions by resorting to other forms of energy
2. Plant more trees

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X-RAY ASTRONOMY: AN INSIGHT INTO X-RAY UNIVERSE

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Abstract: In the past few decades, observational astronomy has expanded from the relatively narrow wavelength band of visible light to the entire electromagnetic spectrum. There are wide varieties of systems in our galaxy e.g. rapidly rotating neutron star, accreting x-ray binaries, pulsars etc., which emit x-rays. X-ray astronomy deals with the study of x-ray emission from these celestial objects. The emitted x-rays carry fundamental information about their nature and origin. It also provides information about structure and evolution of the universe. With the advancement of technology and with the launching of new astronomy satellites, astronomy in general offers wide variety of research and carrier opportunity.

Key words: X-ray, satellites, spectrum.

Introduction

From prehistorical times astronomical objects has always fascinated human beings. To the nomad peoples, the knowledge of constellations helped them in directions. The most familiar constellation in the northern hemisphere is, the Big Dipper. The Big Dipper is a part of an astronomical constellation called Ursa Major. The pointer stars of the Big Dipper helps in finding the pole star and the pole star indicates the direction north. When the nomad people turned to farming, the constellations helped them in keeping track of time and in turn, the seasons.

To most people, astronomy means stars; stars means constellations and constellations means astrology. In the beginning there was little difference between astronomy and astrology. In fact, some of the famous astronomers of the past earned their livelihood by casting horoscopes for kings and queens. The major divergence between astronomy and astrology came with the work of Copernicus in the sixteenth century. Copernicus could explain the motion of planets in terms of the stationary sun about which revolved the Mercury, Venus, Earth, Mars, Jupiter and Saturn. A great part of the universe which was invisible till the early 20^{th} century, but with the advent of astronomical telescopes, the x-rays, gamma rays, ultraviolet light and parts of the infra-red spectrum were all opened to astronomers. From here, astronomy has taken a great leap forward and modern astronomy has grown into a very broad subject. Among all these, x-ray astronomy has itself become a branch of modern observational astronomy.

The x-rays were discovered in 1895 by Wilhelm Röntgen. X-rays are a form of light, but much more energetic than the light detected by our eyes. X-rays are electromagnetic radiation with a typical energy range from less than one keV to few hundred keV. Unlike the optical photons, the x-ray photons from the celestial bodies get absorbed and transformed into secondary radiation of degraded energies after series of interaction in the thick atmosphere of the earth. This makes primary x-ray observations of cosmic sources impossible from the earth.

Hence, the best way to observe the primary cosmic x-rays is to go above the earth's atmosphere, and that is possible only through balloon borne, rocket borne or satellite based experiment. Out of these, satellites are the most preferred way of x-ray observation because it can collect data for longer duration and covers the full range of x-ray spectrum.

X-ray Observatories

In the past three decades, observational astronomy has expanded from the relatively narrow wavelength band of visible light to the entire electromagnetic spectrum. X-ray astronomy is a relatively new branch of astronomy as it needed satellites to record the observations, and the satellites have only been around since the 1950. X-ray astronomy deals with the study of x-ray emission from celestial objects. This branch is one of the most exciting fields in the astronomy, as it covers a wide band of photon energies from 0.1 keV to 500 keV.

There are a variety of different kinds of astronomical sources which emit electromagnetic radiation in the x-ray region. These include: Active Galaxies, Binary Star Systems, Black Holes, Neutron Stars, Pulsars, The Sun, Supernovae and their Remnants, White Dwarfs and x-ray Transients. In particular, the phenomena which occur at the end of stellar life times are observable in the x-ray sky. The emission of x-rays results from cosmic objects under extreme conditions.

Unfortunately, the earth's atmosphere absorbs the x-ray coming from the astronomical objects. So, to observe x-rays from the sky, the detectors must be flown above most of the earth's atmosphere. Detectors are placed on a satellite which is taken up to an orbit well above the earth's atmosphere. Instruments on these satellites are able to observe the full range of the x-ray spectrum. They can collect data for as long as the instruments continue to operate, except for earth occultation or in the high background region. So, there are the distinct advantages in operating a satellite for x-ray observational purposes.

At present, there are many multi wavelength operational satellites/observatories observing the astronomical bodies in the x-ray range like – X-ray Multi-Mirror Mission-Newton (XMM-Newton), Chandra, Suzaku, Rossi X-ray Timing Explorer (RXTE), Advanced Satellite for Cosmology and Astrophysics (ASCA), BeppoSAX, Rontgen Satellite (ROSAT) etc. A typical x-ray satellite carries detectors like Photo-Multiplier tubes, Charge-Coupled Devices (CCD's), Calorimeters/ Bolometers, spectrometers, imaging spectrometers, x-ray telescopes, UV-Optical telescope etc. The on board instruments work in different ways and are good at telling different things about the source.

XMM-NEWTON is a European Space Agency mission and was launched on an Ariane V rocket from French Guiana on December 10, 1999. This satellite is designed to perform high quality and high sensitivity x-ray spectroscopy. This satellite carries instruments like Reflection Grating Spectrometers, UV-Optical telescope, x-ray cameras etc.

CHANDRA is an important *NASA* mission and was launched on the Space Shuttle Columbia on 23rd July 1999. It is named after an Indian-American astrophysicist, Subrahmanyan Chandrasekhar. It was designed to provide high resolution imaging of x-ray sources; as opposed to *XMM-NEWTON* which has better spectral resolution. Chandra carries four science instruments - two imaging detectors (High Resolution Camera, HRC and the Advanced CCD Imaging Spectrometer, ACIS) and two spectrometers (figure 1).

The detectors are kept at very low temperatures (-120 ^{o}C), so that they are sufficiently sensitive and can record the energy of the incoming photon, when it hit the detector.

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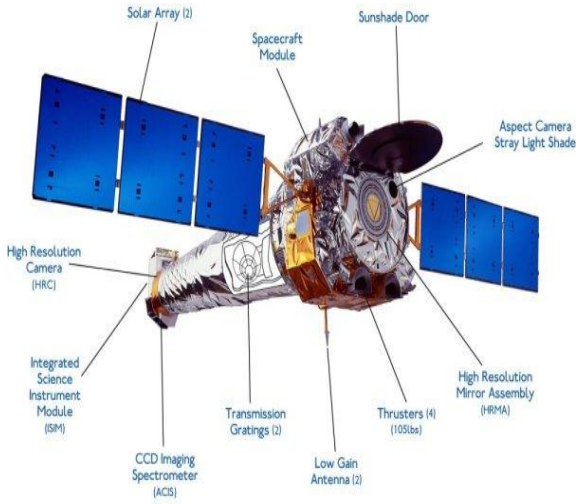

Figure 1: The *CHANDRA* X-ray Observatory and its instruments. (Image courtesy *CHANDRA*).

ASTROSAT: India is also going to join the elite club of nations, by launching a multi-wavelength astronomy satellite in 2014, named as Astrosat. It will carry five astronomy payloads for simultaneous multi-band observations- two units of Ultraviolet Imaging Telescopes (UVIT) covering Far-UV to optical bands, three units of Large Area Xenon Proportional Counters (LAXPC) covering medium energy x-rays from 3 to 80 keV, a Cadmium-Zinc-Telluride coded-mask imager (CZTI), covering hard x-rays from 10 to 150 keV, a Soft x-ray Telescope (SXT) and a Scanning Sky Monitor (SSM) consisting of proportional counters. ASTROSAT will be a general purpose observatory, with main scientific focus on broadband spectroscopic studies of x-ray binaries, AGN, SNRs, clusters of galaxies and stellar coronae. It will also monitor the x-ray sky for new transients sand broadband spectroscopic studies of x-ray binaries, AGN, SNRs, clusters of galaxies and stellar coronae.

X-ray Data

Raw data as such cannot reveal the facts and hidden secrets of celestial objects, but requires appropriate data reduction. X-ray missions produce a wide range of data in many forms. The first one is in the form of image. The image is a photo of sources taken from an on board camera. Image can be in optical, x-ray, UV or in radio band. The constellation of Orion in optical and x-ray region is shown in figure 2.

The data can also be used for generating spectra of the source. Spectra are formed when the light is split into different wavelengths or energies- a rainbow is a spectrum. The spectra provide information like how many x-rays are coming from the object at a particular energy. There are also some electron transitions which have lines in the "soft" (low-energy) x-ray band. If these lines are missing then, one can conclude that there is very little (or even no) cool x-ray gas in Clusters of galaxies.

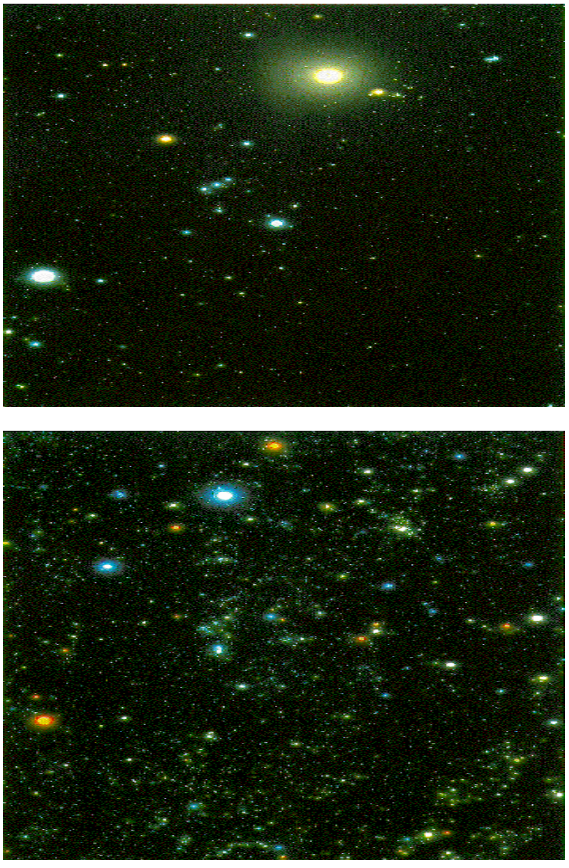

Figure 2: The constellation of Orion as seen in Optical Light and the same region in x-ray.

Also, one can combine image and spectra and can build up a detailed model of what the conditions are inside a cluster of galaxies or close to a black hole, by matching what we see to the model. The x-ray missions also provide data as time-series, as the detectors can tell when each photon hit, one can see if a source's emission is varying in time. For example, in the case of a stellar x-ray source, an x-ray binary for example, or the emission from an Active Galactic Nucleus (AGN), shows some kind of periodicity. From this one can calculate the orbital period of the source (or part of it). However, some x-ray sources show no periodic patterns.

Data analysis

Data analysis and reduction is the process of filtering, applying some selections and extracting the light curves or images from the raw data. One has to reduce raw data for two basic studies; timing and spectral analysis. The software for the data reduction and analysis are provided by respective missions. A light curve is the starting point of timing analysis. A light curve is the plot between intensity of the source and the time (figure 3). The change in the intensity can be periodic, quasi periodic or sometimes totally periodic. Sometimes just looking at the light curve can provide the clue about the periodicity. But most of the time one has to use other methods.

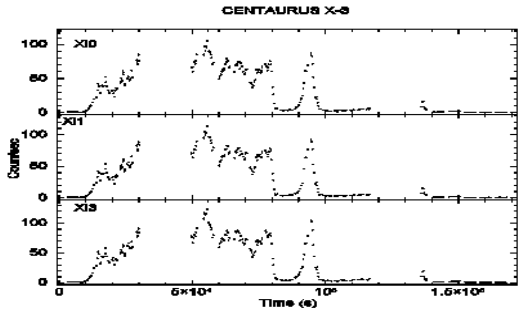

Figure 3: The figure shows the light curve of HMXB Cen X-3, observed from 08-10, Dec, 2008, with the Suzaku satellite

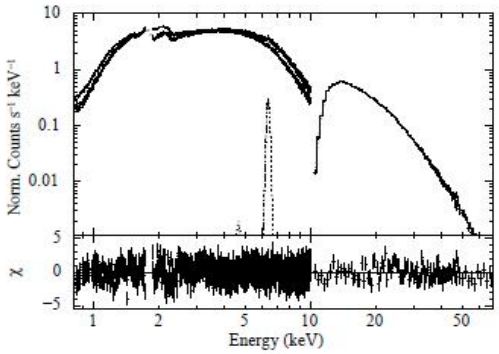

Figure 4: Energy spectrum of x-ray pulsar (HMXB) GRO J1008

X-ray spectrum is the starting point of spectral analysis. The x-ray spectrum is the graph between the intensity of source and its energy. The main purpose of spectral analysis is to understand the variation of intensity with energy. There are many different mechanisms by which an object can produce x-rays. Each mechanism has a characteristic spectrum either in the form of line emission or continuum emission and generally the observed spectrum is the result of more than one mechanism. The x-ray line emission is produced by the characteristic x-rays of different elements where as the continuum emission is produced by process such as black body radiation, thermal bremsstrahlung, synchrotron radiation, inverse Compton scattering etc. A typical energy spectrum of x-ray binary is shown in the figure. 4

Areas of research

There are many areas of research which are using x-ray data and there are some which are almost exclusively x-ray based. The thrust areas in x-ray research are-

All Sky Surveys

X-ray telescopes usually perform "pointings," where the telescope is pointed at some astrophysical object of interest. This of

course means that only sources which already look interesting for other reasons or known to be so from a previous observation are observed. All sky surveys are useful for discovering the unexpected as they scan the entire sky over a large range in energy.

Galactic Survey

Surveys of the galaxy in x-rays are designed to help to pin down the structure of the hot gas in our galaxy. It also provides information about the interactions occurring at the centre, close to the massive black hole at the Milky Way's core. Large scale surveys help in determining the demographics of some of the x-ray stellar objects, e.g. binaries and cataclysmic variables. Galactic survey also, includes the study of normal stars, like our Sun or active stars, like- O and Wolf-Rayet type's early stars.

The x-ray data are also used in study of x-ray binaries, Ultra Luminous x-ray Sources, Clusters, Radio & x-ray interactions, Evolution & Substructure, AGN, AGN & Black Holes, AGN & Jets etc. These days x-ray observations made by various satellites of astronomical objects are available at an archive which is maintained by NASA's High Energy Astrophysics Science Archive Research Center (HEASARC). The data received from the satellite are highly instrument specific format. The mission operation center converts the data into FITS (Flexible Image Transport system) format. After doing the preliminary analysis to check the goodness and integrity of the data, it is archived. These data can be accessed through the internet and can be used for the scientific purpose.

Conclusion

Celestial bodies and celestial environment provide natural laboratories for studying physical phenomena in extreme conditions which are hardly realized in our terrestrial environment. The discussions and interpretation of observations employs the use of mathematical analysis, often of the most advanced type. Physical and mathematical theories are thus stretched to the limit to provide explanations for the celestial phenomena that one observe. Modern astronomy requires the use of most modern and advanced technologies, e.g. in fabrication of modern telescopes, in building imaging and spectroscopic equipment to observe and analyse radiation received from the celestial objects. It also needs fast computers, state-of-the-art software to handle data and process images. So, it requires contribution from almost all branches of science be it engineering, mathematics, physics, biology, geology, chemistry, computer science etc. Thus, it offers a wide range of opportunities. With the launch of new satellites like Astrosat, Constellation X(ConX), Xeus and others, the focus of scientific study will be towards broadband spectroscopic studies of x-ray binaries, AGN, clusters of galaxies and stellar coronae etc. and that will give a new insight into x-ray universe in particular and astronomy in general.

Astronomy is still subject to a major constraint, it is inherently an observational rather than an experimental science. Almost all measurements must be performed at great distances from the objects of interest, with no control over quantities such as their temperature, pressure, or chemical composition. There are a few exceptions to this limitation—namely, meteorites, rock and soil samples brought back from the Moon, samples of comet dust returned by robotic spacecraft, and interplanetary dust particles collected in or above the stratosphere. In the future, space missions may return surface materials from Mars, asteroids, or other objects, but much of astronomy still appears to confined to Earth-based observations or by observations from orbiting satellites and long-range space probes and supplemented by theory.

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PREVALENCE OF CHRONIC NON-COMMUNICABLE DISEASES IN KOHIMA AND DIMAPUR TOWN

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Abstract: This study assesses and evaluates the influence of various socio-economic, demographic and cultural factors as well as some risk behaviours on prevalence of chronic diseases among a representative sample of urban population of Kohima and Dimapur towns of Nagaland.

Keywords: Chronic disease, logistic regression, non-communicable, prevalence.

Introduction

Chronic non-communicable diseases are the leading causes of both disability and death worldwide and they strike hardest at the world's low- and middle – income populations. In Indian context, several studies have documented that the deaths due to communicable diseases have drastically gone down during the last few decades, where as deaths from chronic non-communicable diseases like cardiovascular diseases, cancer and diabetes are alarmingly increasing.

Various hypotheses have been put forward to explain the rising trend of chronic diseases, and consequence of urbanization is one of them. Though biological factors might have influences on chronic diseases, a majority of chronic diseases are due to lifestyle behaviours [1]. On the basis of this, we hypothesise the prevalence of chronic diseases in urban areas of Nagaland.

The health indices of Nagaland seem to be better than the national average with infant mortality rate (IMR) as low as 23 infant deaths per 1000 live births (Registrar general, 2011) (IMR, India = 47), and life expectancy at birth 67.33(67.94) years for males (females) (Choudhury *et. al.*, 2013). If life expectancy at birth is more than 55 years, then death due to chronic non-communicable disease like cardiovascular diseases, cancer and diabetes become more prevalent and frequent (Preston, 1976). As such, there is every possibility of prevalence of different chronic diseases in urban areas of Nagaland.

Objective

The objective of this paper is to study the existence of a relationship between various socio-economic, demographic and cultural factors and other risk behaviours on prevalence of chronic diseases among a sample of urban population of Kohima and Dimapur town of Nagaland.

Materials and Methods

The data used in this study is a primary one collected through a household survey conducted in Kohima and Dimapur town of Nagaland during May – August 2010. Altogether 4640 respondents were interviewed from both towns comprising 958 households. Identification of the chronic disease afflicted persons was based upon the information provided by the respondent or elder family members of the household but not clinically tested.

The independent variable is divided into three categories viz. socio-economic, cultural and demographic. From socio-economic characteristic, we have included annual family income and education. From demographic characteristic, variable like age and gender are included. Regarding cultural factors, we have considered religion, tribe and food habits. Some other risk behaviors like chewing tobacco, addiction towards smoking and consumption of alcohol, physical exercise and body mass index are also being included for the analysis. The logistic regression

analysis is used to examine the strength of association between each covariates and the dependent variate (presence of chronic disease).

Observations

It is observed from our data that out of the entire sample of size 4640, a very few case of chronic disease has been reported under age 25 years. Therefore, for the analysis, we have considered only those respondents who have attained age 25 years at the time of interview. Accordingly, the logistic regression analysis is carried out on 2328 respondents. In the reduced sample, 15.55% respondent are found afflicted with chronic diseases.

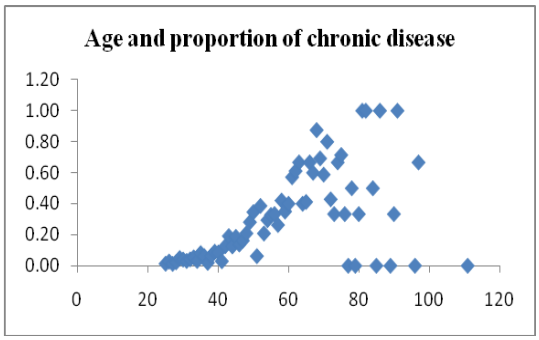

Fig. 1: Scatter Diagram Showing Age and Proportion of Persons Affected by Chronic Diseases.

Results and Discussion

For our analysis, we have categorized age into two categories viz. 25-50 years and above 50 years. This categorization is done, as out of total chronic diseases reported in the reduced sample, 62.71% of chronic diseases is found in persons aged 50 years and above. From the analysis, it is seen that persons in the age group 25-50 years are approximately 4 times less likely (odd ratio = 0.270) to have chronic diseases compared to those above 50 years of age.

It is also been observed that there is a weak association (p-value = 0.071) between gender and prevalence of chronic disease.

We have classified the per capita annual income into three categories viz., less than Rs.10000, Rs. 10000 to Rs. 40000 and above Rs. 40000. This classification has been done in accordance to the classification of the Organization for Economic Co-operation and Development (2003), which classifies India in the per capita annual income < $745 (approx. Rs.40000) group. Considering per capita annual income of more than Rs. 40000 as the reference category, it is observed that persons with per capita income less than Rs. 10000 are one and half times less likely (odd ratio = 0.623) to have chronic disease. If per capita annual income is between Rs 10000 to Rs 40000, the chance of having chronic disease is reduced approximately by 30% (odd ratio = 0.695) as compared to the reference category.

It has been observed that variable like education, religion, food habit, tribe etc. have no significant effect on prevalence of chronic diseases.

For the variable physical exercise, it has been observed that persons who does regular exercise are three and half times less likely (odd ratio = 0.280) to have chronic disease compared to persons do no physical exercise. There is evidence that regular physical exercise increases the high-density lipoprotein and decreases both body weight and blood pressure which are beneficial to cardiovascular health (Park, 2005). As per as the risk factors are concerned, physical activity can interact in various ways that influence the risk of several chronic diseases (WHO, 2010).

It has been observed that, persons who consume tobacco regularly are one and half times at high risk of having chronic diseases (odd ratio = 1.572) compared to persons not consuming it. For the variable smoking we have considered persons who smoke cigarette daily or at least twice a week as smokers and others as non smokers. Taking non smokers as reference category it is observed that smokers are approximately one and half times (odd ratio = 1.418) at high risk of acquiring chronic disease compared to non smokers. This fact is widely acknowledged as smoking has been identified as a major coronary heart disease risk factor (Park, 2005). For the variable

consumption of alcohol, we have considered those persons who consume alcohol regularly or at least once a week as alcoholic and others as non alcoholic. It is clear from the analysis that alcoholic persons are more than two and half times (odd ratio = 2.440) at high risk of having chronic disease compared to non alcoholic persons. High alcohol intake (75g or more) per day is an independent risk factor for hypertension and all cardiovascular diseases (Harrison, 2004).

For the characteristics body mass index (BMI), we have considered three categories viz. underweight (BMI<18), normal (BMI = 18-25) and overweight (BMI>25). If we take overweight as reference category then persons with BMI<18 (underweight) are two and half times less likely (odd ratio = 0.373) to have chronic diseases compared to overweight persons. Further, persons with normal weight are 50% less likely (odd ratio = 0.501) to have chronic disease compared to overweight or obese persons. Obesity may be mediated by other cardiovascular disease risk factors, including hypertension, diabetes mellitus, and lipid profile imbalances (Harrison, 2004).

Conclusions

Chronic disease is primarily a mass disease. The strategy should therefore be based on mass approach focusing mainly on the control of underlying causes in whole populations, not merely in individuals. A small change in risk factor levels in total population can achieve the biggest reduction in chronic disease mortality. As there is a large proportion of chronic diseases cases observed in urban areas of Nagaland, the overall burden of the occurrence of these potentially fatal diseases risk factors should be lowered through population-wide public health measures, such as community level campaigns against cigarette smoking, unhealthy diets, and physical inactivity etc.

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