INTRODUCTION OF PALYNOLOGY

Palynology is a branch of science concerned with the study of spore and pollen study whether living or fossil. The term palynology was first of all introduced by Hyde & Williams in 1944. The term palynology is derived from the Greek word "Palyenin" means to scatter or to sprinkle as many pollen grains or spore are easily dispersed or carried away. Although this study has been very old, gone through prehistoric times. With the invention of compound microscope, the spore and pollen have been identified as morphological entity. Later on with the invention of scanning electron microscope (SEM) and transmission electron microscope (TEM) have given a new dimension to the field of palynology.

Apart from this all the organisms or part of organisms, variety of microorganisms or particularly fossil flora that fall within the general spore - pollen size range have also come under the study of palynology.

Spore - pollen size range

A large number of these are algal elements---example Coccolithophorids -- one celled microscopic marine alga

Dinoflagellates - one celled microscopic marine alga, usually solitary flagellated organism resembling both plant -- photosynthesis and animal – motility.

Diatoms & Desmids -- single celled green alga.

Occurrence : Regarding its occurrence, the pollen grains are omnipresent in the air, over the poles where there are no vegetations. They are more widely distributed in time and space than any other object in the plant kingdom.

Definition of pollen and spore:

The term pollen was introduced by Swedish botanist Linnaeus in 1760 and it is derived from the Latin word "Pollinis" whose meaning is fine flour due to its granular nature. Pollen is haploid male reproductive body produced as a result of meiosis in pollen mother cells containing male gametophyte of angiosperm

& Gymnosperm. While the spore is a independent, resting & dispersal phase of independent gametophytic generation. It is loosely applied to the various reproductive body in cryptogams formed by sexual and asexual methods. Spore is a cell which becomes free and direct development into new life.

Among Algae the asexually produced reproductive bodies are akinetes, endospores, tetraspores, ascospores, zoospores, heterosis etc. Among Fungi there are uredospores, teleutospores, ascospores, basidiospores, conidiospores, chiamydospores etc.Then comes the sexually produced spores of Bryophytes, Pteridophytes & Gymnosperms. The spore is immediate product of meiosis of SMC, germinate and give rise tohaploid gametophytic generations which produces male &

female sex organs. In pteridophytes they are isospores, microspores and megaspores.

Isospores --- Homosporous plant producing only one type spores, germinate to form prothallus with antheridia & archegonia on the same prothallus.

Microspore --- Smaller spores produced by heterosporous plants which produces male gametophyte (haploid) developing male sex organ antheridia.

Megaspore --- Larger spores produced by heterosporous plants which produces female gametophyte (haploid) developing female sex organ archegonia.

MIOSPORES

In palaeopalynology, the term miospore is arbitrarly defined for fossil spores and pollen grains <200 µm in diameter regardless of their biological function. Thus miospores are used in orderto categorize the spores of relatively smaller size and to differentiate them from macrospores or larger spores including homosporous microspores, small megaspores, prepollen etc.

PALYNOMORPH

Microscopic resistant walled organic bodies found in palynological maceration is called as palynomorph.

PREPOLLEN

The earliest pollen grains were not at all morphologically different from the spores. Chaloner (1970) defined prepollen as any

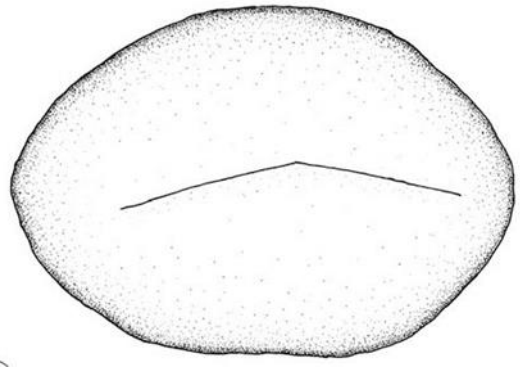
microspore belonging to seed plant group, i.e., angiosperm that germinate from the proximal side of the pollen. Thus prepollen is the functional pollen grains having trilete mark on the proximal side like spores and also germinate proximally. In contrast to modern pollen which have aperture on the distal side that's why have distal germination. These prepollen are important intermediate evolutionary stage. This trasitional stage between the spore and pollen is present in fossil spores of primitive Palaeozoic gymnosperm.

Example: Potoniea, Crossotheca and Lyginopteris have prepollen of trilete type, Dolerotheca, Feraxotheca and Schopfipollenites have prepollen of monolete type. During evolution of prepollen, there was a schift in the area of germination from proximal trilete

aperture or monelete aperture to a more precise distal position in the development of furrow or colpus as seen in the Cordaitales, Bennettitales and Pentoxylales.

Prepollen are similar to pollen in having capacity to penetrate ovule but differ from the pollen in the fact that they do not germinate by means of pollen tube. The reduced microprothallus remains within the spore wall and dissolved away as a liquid in which male sperm or antherozoid swim. These antherozoids released either by rupture alon the trilete slit or by dissolution of the spore wall as in case of microspores of pteridophytes.

lyginopteris prepollen



Dolerotheca monolete prepollen

Subdivisions of palynology

Palynology is considered as interdisciplinary science, broadly subdivided into:-

I. **Fundamental or basic palynology** -- deals with the spore and pollen morphology. It also deals with dispersal of pollen and spores by means of air and water and its content in sediments and peats.

II. **Applied palynology** -- deals with the applied aspects of palynology.

There are various branches: ---

Paleopalynology -- concerned with the study of fossil spores and pollen. This branch is used to reconstruct past vegetation and paieoclimatic conditions.

Geopalynolgy -- pollen analytical investigation of quaternary deposits.

Palynotaxonomy-- Morphology of spores and pollen have the specific structure including the structure and ornamentation in case of spores and the number and position of aperture and ornamentation in case of pollen. The constant spore and pollen characters to the particular species is extremely helpful in the taxonomic identification of genus even at the species level.

Aeropalynology-- Concerned with the study of spores and pollen present in the air. The spore and pollen present in the air show variation from:

i.one place to another place -- place to place variations

ii. one season to another season -- season to season variations.

Melittopalynology or Melissopalynolgy -- study of pollen grains present in honey type A honey & type B ---- collected from two different places -----variations in plants flora may be observed after morphological study of spores and pollen.

Iatropalynology --Concerned with the study of pollen grains and spores, which causes allergy like eczema, asthama, allergic lung disease, bronchitis, hay fever etc in susceptible humans.

Pharmacopalynology -- Study of pollen and spores present in drugs and tablets.

Forensic palynology -- helpful in criminology. It is used as an aid in crime detection. Forensic palynology is an important tool for obtaining trace evidence from vicitims, suspects, items related with a crime scene, or for determining the location of a sample.

Palynology involves the identification of pollen, spores and fungal spores. It is important for its ability to provide information about pollen and spores trapped in cloth or other items which may be helpful in resolving crimimnal cases.

Copropalynology -- Concerned with the study of pollen grains and spores present in external and waste products.

Biogenic palynology or pollen biology -- includes pollen stigma interaction, pollen viability/ germination, pollen storage, production of haploid plants and also in the plant breeding programs which may be utilized in hybridization.

Biostratigraphy & Geochronology -- To correlate strata and to determine the relative age of a given bed, horizon, formation or stratigraphical sequences.

Pollen preparations

How the pollen and spores are prepared for their morphological studies. There are two methods :

1. **Wodehouse method** :

   This method is given by Wodehouse (1935). The pollen grains and spores are first treated with absolute alcohol, then stained in methyl green or safranin and mounted in gylcerine

jelly. By this method , oily content of the exine is removed but the size of pollen grains and spores remains same.

2.Erdtman ‘s acetolysis method:

This method is given by Erdtman (1952). By this method protoplasmic contents are removed. Pollen grains and spores become very clear and the morphology can be studied very easily.

Acetolysis is a method in which pollen grains and spores are treated with acetolysis mixture consisting of 9 part acetytic anhydride and 1 part conc. sulphuric acid. There are following steps in this method:

1. Dry specimens are kept in 70% alcohol for one week.

2. For the study of pollen grains anthers and for the study of spores sporophyll have been.
3. The materials have been transferred into centrifuge tubes and pour glacial acetic acids. Materials have been crushed with glass rod just to release pollen grains from the anther and spores from sporangia.
4. After that centrifuge for 5 minutes, then decant the acid and acetolysis mixture 9: acetic anhydride & 1: conc. sulpuric acid, crush again with glass rod. Do carefully as reaction is exothermic.
5. After this, centrifuge tube on a water bath (80 c) temperature, crush the material with glass rod and centrifuge it.

6. Decant the the mixture and wash the residue first with 70% alcohol, the 2 or 3 times with water just to remove acid.
7. The final part is divided into two parts:

Part 1 : directly mounted in safranin gylcerine jelly.

Part 2 : Some spores are very dark for them bleaching is necessary , saturated the residue of pollen grains and spores with Kclo3 or Naclo3 and 1 or 2 drops of conc. Hcl. This will bleach the pollen grains and spores, centrifuge and decant the mixture, wash the residue with 2 or 3 times with water, finally mounted in safranin gylcerine jelly.

The important point is that every steps is followed by centrifugation.

To observe the colour of spores or pollen grains, plane gylcerine jelly(without safranin) has been used.

Preparation of glycerine jelly

Distal water + Zelatin ----- zelatin dissovle in distal water, kept in oven, add gylcerine and a pinch of safranin powder.