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1. Morphological characteristics of pollen grains have been categorized into different groups: Pollen Units, Polarity, Symmetry, Shape, Size, Apertures , Sub-Divisions of the Pollen Surface , Sporoderm Stratification, Exine Ornamentation and. 'LO' Analysis.

The orientation of polarity is an important criterion in identification and description of pollen grains, as apertural position is of primary phylogenetic and functional significance. All pollen grains are in tetrad stage during development and the polarity is determined in this stage, prior to their separation. The part of the pollen grains which is nearest to the centre of the tetrad is the proximal pole and that towards the opposite side is the distal pole. The imaginary line between the proximal and distal pole of the grain is called the Polar Axis (PA) which passes through the centre of the spore to the centre of the tetrad. The plane perpendicular to the polar axis through the middle of the grain is the equatorial plane (equatorial diameter). Positions on the surface of the grain maybe determined by their latitude, comparing to the latitude on a regular sphere. Similarly, surface features in a pole to pole direction at right angles to the equatorial plane are called meridional. The pollen grains maybe either apolar or polar

The shape of the pollen grains varies from species to species. Shape of the grains is found to be useful in spore/pollen identification. However, the shape may vary considerably within one grain type or even within one species. Pollen grains and spores are often described by the shape (non-angular and angular) of their outline both in polar and equatorial views. The shape of the pollen/spores may be circular, elliptical, triangular, rectangular, quadrangular or in other geometrical shapes. G. Erdtman (1952) categorized eight shape classes based on the ratio of polar axis (PA) and equatorial diameter (ED). In the equatorial view, the ratio between the PA and ED, multiplying by 100 gives the indication of the shape.

Morphologically aperture is an opening or thinning of the exine where the in tine is usually thick; physiologically it is a germination zone or a harmomegathus (A mechanism accommodating changes in volume of the semirigid pollen exine) or both.

With regard to their position the apertures are polar, global or equatorial. The polar apertures are either monopolar (either in proximal or in distal pole) or bipolar (both in proximal and distal face). Global apertures are uniformly distributed over the pollen/spore surface. Equatorial apertures are meridionally arranged.

Some taxa have ‘atreme’ (trema, a Greek word means aperture) pollen/spore, i.e., they seem to have no special aperture, are termed as ‘inaperturate’ or non-aperturate. Majority of the pollen grains described as ‘inaperturate’ seem to be ‘omniaperturate’, that is, the entire pollen wall is made up of a thin exine and a thick intine or at least thick as the exine, for example Canna sp. of Cannaceae. There are two types of apertures known as Pores (Porus, p1. Pori) and furrows (Colpus, p1. Colpi. or Sulcus, p1. Sulci). In most cases the furrows act as harmomegathi.

Spore morphology is no more important in determining sedimentation rate in water than it is for spores dispersed in air. The high viscosity of water relative to air slows the sedimentation rate of spores from millimetres per second to millimetres per minute, but most experiments show that conidia with appendages fall through the water column at the same speed as more compact spores. Indeed, one experiment showed that intact spores of marine fungi settled faster than spores whose appendages had been disrupted by sonication. The unusual shapes of aquatic spores require an alternative explanation.The most compelling answer is that the broader span of spores with unusual shapes increases the probability that they will collide with submerged plant materials. The largest conidia produced by the Ingoldian Brachiosphaera tropicalis have an effective diameter of 0.4 mm (Figure 3.1f). A spherical spore of this diameter would weigh approximately 40 μg; the tetraradiate spore with a central hub and slender arms is 400 times lighter, producing a similar probability of hitting a leaf fragment yet saving a considerable investment in cytoplasm. This calculation is a little simplistic because the spherical spore might reduce its volume of active cytoplasm by expanding a large fluid-filled vacuole. Also, the surface area of the tetraradiate spore is only 30 times less than the surface of the sphere, which means that the economy in cell wall production is more modest than the potential reduction in cytoplasm. Nevertheless, the concept of the spore as a search vehicle probably explains the significance of the beautiful spore shapes in these fungi. The utility of the spore morphology with multiple appendages is evident from its convergent development in basidiospores of the marine wood-rotting basidiomycete Nia vibrissa. The extended shapes of these aquatic spores may confer other advantages. Experiments on tetraradiate conidia show that when one arm of a spore strikes a target, the spore pivots around this point of attachment allowing the fungus to make a stable three-point landing. Leaf colonization begins when the tips of the arms cement themselves to the surface and slender hyphae grow from the triangle of contacts. Enhanced dispersal in surface films is another possible benefit of this spore morphology and helps explain the concentration of spores in foam. It has been suggested that spores trapped in foam may become airborne as the bubbles collapse. This would explain how some of these aquatic fungi establish themselves as endophytes in plants growing above the water.

A different adaptation is observed in aeroaquatic conidia that form at the air–water interface in stagnant ponds. These spores develop by helical growth of hyphae to form barrels with an air bubble trapped in the centre. Dispersal occurs by floating on the surface of the water and these fungi colonize leaves and decaying wood. Many other fungi that grow on plant debris in aquatic environments do not show any obvious morphological adaptations to their habitats.Pollen and spores are used in:

2. The role of palynology in the exploration for oil is essentially comparable to that of any other branch of paleontology. Advantages and limitations of spores, pollen, algae, miscellaneous protistans of uncertain or known affinity, and other similar-sized microfossils utilized in palynology as stratigraphic and paleoecologic indicators are briefly reviewed. The economic value of this relatively modern scientific field to the petroleum industry may be increased and hastened by avoiding some of the pitfalls which plagued micropaleontology in its earlier years of application. Information should be developed simultaneously on the biology, ecology and stratigraphy of these organisms.

- In oil exploration; Palynologists now being trained should be encouraged to develop their knowledge of both geologic and biologic fundamentals. Research in this field should be sponsored by industry, as well as by universities and government agencies, in both its own research laboratories and in private or university labs. The areas of this research should include: studies of the distribution and preservation of palynomorphs in modern sediments; relative significance of living assemblages or transported entities to other types of organisms with which they are found; development of methods and programs for mechanical classification of these micro-fossils and analysis, evaluation, storage and retrieval of data concerning them; improvement of techniques for separating these fossils from the rocks; development of environmental information by the study of types and conditions of preservation, origin and significance of reworked fossils, relative percentages of spores and pollen to other organisms, and characteristics of their role in sedimentation.

    - and climate change. Palynology can be used to reconstruct past vegetation (land plants) and marine and Freshwater phytoplankton communities, and so infer past environmental (palaeoenvironmental) and palaeoclimatic conditions in an area thousands or millions of years ago, a fundamental part of research into climate change.

- Organic palynofacies studies, which examine the preservation of the particulate organic matter and palynomorphs provides information on the depositional environment of sediments and depositional palaeoenvironments of sedimentary rocks.
- Geothermal alteration studies examine the colour of palynomorphs extracted from rocks to give the thermal alteration and maturation of sedimentary sequences, which provides estimates of maximum palaeotemperatures.
- Limnology studies. Freshwater palynomorphs and animal and plant fragments, including the prasinophytes and desmids (green algae) can be used to study past lake levels and long term climate change.
- Taxonomy and evolutionary studies. Involving the use of pollen morphological characters as source of taxonomic data to delimit plant species under same family or genus. Pollen apertural status is frequently used for differential sorting or finding similarities between species of the same taxa. This is also called Palynotaxonomy.
- Forensic palynology: the study of pollen and other palynomorphs for evidence at a crime scene.
- Allergy studies. Studies of the geographic distribution and seasonal production of pollen, can help sufferers of allergies such hay fever
- Archaeological palynology examines human uses of plants in the past. This can help determine seasonality of site occupation, presence or absence of agricultural practices or products, and 'plant-related activity areas' within an archaeological context. Bonfire Shelter is one such example of this application.