Exploring the Diversity of Pollen Fossils: Eight Iconic Types

A Visual and Scientific Journey Through Ancient Botanical Fossils

Pollen grains are microscopic entities that are produced and released annually by all flowering plants. They are a vital part of the reproduction cycle of plants and the creation of seeds and fruits. They are also an important food source for pollinators such as bees and play a key role in biodiversity. Some of the pollen released into the atmosphere becomes fossilised in lakes, bogs and soils where it can remain for millennia. As peat and lake sediments accumulate year on year these robust, microscopic plant fossils become preserved and stratified with records in Ireland stretching back to the end of the last Ice Age c. 15, 000 years ago.

By isolating and studying fossil pollen in sediments, palaeobotanists can get a glimpse into the past and use these fossils to reconstruct climate change, track the arrival and spread of woodlands and the development of the first bogs in Ireland and even the arrival of the first farmers in the country.

What follows are examples of eight distinct, unique and beautiful pollen grains from plants that form part of the Irish flora. The photos, which are of 3D printed images of microscopic scans of modern pollen, demonstrate the diversity and intricate detail found on pollen grains most of which are less than 0.035mm (35µm) in size!

Although small in size, fossil pollen are a powerful tool for the reconstruction of past environments and the role people have played in shaping our landscape since earliest times.

1. *Pinus* (Pine)

Description: A large pollen grain of c. 100µm, pine pollen consist of an ovoid shaped body onto which 2 distinct air sacs, or "bladders" are attached giving the grain a ‘Mickey Mouse’ type appearance, making it highly recognisable. Pine pollen are adapted to be dispersed on the wind and the presence of the air bladders facilitate the grains becoming air borne and getting into the high atmosphere where they can travel distances of up to

1000km. These pollen grains, typically golden-yellow in living specimens, are robust and well preserved in the fossil record due to their thick walls.

Significance: The presence *Pinus* pollen in the fossil record gives us a glimpse into past woodlands of Ireland in which pine played a significant role at different times.

2. *Salix* (willow)

Description: Willow pollen grains are small (c. 20µm) ovoid grains with a textured, reticulate (net-like) surface pattern and three longitudinal germination slits or furrows. They have a robust outer wall structure that allows them to be preserved for thousands of years.
Significance: Willow is a pioneer species that grows in cold and temperate climates. It is also a tree that can grow in wet soil conditions. Insect pollinated, the presence of *Salix* pollen can give an insight into developing woodlands and local conditions.

3. *Betula* (Birch)

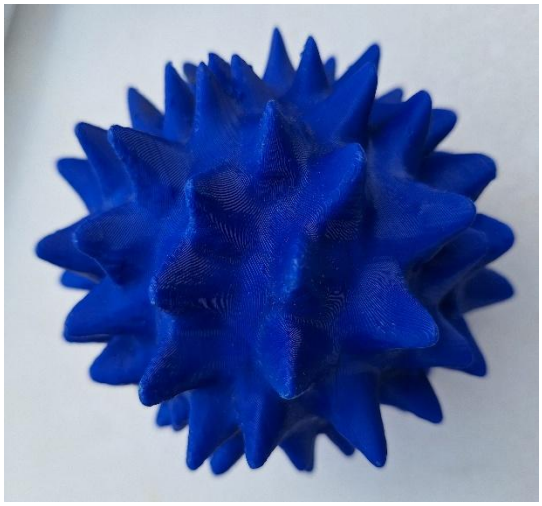
Description: Birch pollen is small (c.25µm), rounded-triangular in outline with three distinct pores and a smooth surface. It is produced in vast quantities on dangling flowers (catkins) in spring and can be allergenic causing 'hay fever' type symptoms.
Significance: Fossilized *Betula* pollen is used to track post-glacial recolonization of trees into Ireland after the ice retreated and temperatures rapidly increased.

4. *Hedera* (Ivy)

Description: Ivy is pollinated by a variety of insects. It produces a spheroidal pollen grain up 50µm in size with a thick outer wall. The pollen structure is complex with a combination of three furrows with a pore in the middle of each and a textured reticulate surface.
Significance: Fossilised *Hedera* pollen gives insight into woodland and woodland edge composition and history.

5. *Ranunculus* (Buttercup)

Description: Buttercup pollen is a robust spheroidal grain with three furrows c. 35µm. The surface structure of this insect dispersed pollen is rough or granulate with a medium sandpaper type texture.
Significance: Buttercups are plants of disturbed landscapes including rough pastures. The appearance of *Ranunculus* pollen along with pollen of other herbs such as that of grass, dandelions etc. in a fossil pollen record marks the rise of grasslands in Ireland.



6. Asteraceae (Daisy-type)

Description: Daisy pollen grains are small c. 25µm, spheroidal with three furrows and three pores. The distinctive feature however, is the spiny (echinate) texture of the grains which allows the grains to attach to the legs of insects when they visit plants helping in the dispersal of pollen from plant to plant.
Significance: Like *Ranunculus* pollen, Asteraceae pollen are indicative of open environments often reflecting grasslands.

7. *Plantago lanceolata* (Ribwort plantain)

Description: Ribwort plantain, a weed of disturbed habitats (roadsides, pastures etc.), produces small (c.25µm), round, rough textured pollen grains that are multi-porate with pores distributed all around the grain. **Significance**: The presence of *Plantago* pollen in a fossil pollen record is highly significant. This plant is strongly associated with people. The fossil *Plantago* pollen helps unlock secrets about the clearance of woodlands and the beginning of farming in prehistoric Ireland.

8. Liguliflorae (Dandelion-type)

Description: Dandelion-type pollen are striking. The grains are roughly circular (c. 25µm) with a distinct surface texture of spiny ridges and 'windows'. The wall is thick allowing for easy preservation in sediments. The spines or echinae allow the pollen to become attached to the hairs on the legs of bees and thus are moved from plant to plant. **Significance**: Along with the pollen of herbs listed above the presence of even occasional fossil grains of dandelions are key in the reconstruction of the role of pre-historic people in shaping the Irish landscape.