

## **Pollen Classifynder/AutoStage – a view from Bergen Norway**

John Birks (June 2011)

A small group comprising myself and two of my colleagues (Anne Bjune and Arild Breistøl) from the Palaeoecology Laboratory in the Department of Biology, University of Bergen had the pleasure of attending a two-day workshop in early March 2011 at Massey University to learn how to use Pollen Classifynder, previously called AutoStage. We came to the workshop because our Laboratory has purchased three Pollen Classifynders from Massey University. Two of these will be based in Bergen and one will be in Kathy Willis's Long-term Ecology Laboratory at the University of Oxford.

Why did we decide to purchase three machines? The answer is very simple – we believe that Pollen Classifynder opens up very many new and exciting possibilities in pollen analysis and other microfossil analytical techniques (e.g. diatoms, phytoliths, etc.) in palaeoecology and may well revolutionise Quaternary pollen analysis.

I have known John Flenley, one of the Pollen Classifynder team, since about 1964 and from about 1968 John has worked on trying to automate pollen identification and counting. Thanks to Bob Hodgson and his outstanding team at Massey University, John Flenley's dream is now becoming reality and the Bergen group is keen to be able to take advantage of this major development in palaeoecology.

Bergen has had a long and distinguished role in Quaternary pollen analysis, starting in about 1930 with Knut Fægri, one of the great pioneers of the subject who published in 1950 with his Danish friend and colleague Johs Iversen their 'Textbook on Modern Pollen Analysis'. Fægri and Iversen produced a second edition in 1964, and Fægri with colleagues in Bergen produced the third (1975) and fourth editions (1989). Bergen has maintained an active palaeoecological research group that today includes Peter Emil Kaland, Aage Paus, Kari Hjelle, Hilary Birks, Richard Telford, Gaute Velle, Anne Bjune, Arild Breistøl, Jan Berge, Lene Halvorsen, and myself.

Turning to Pollen Classifynder, its potential in revolutionising pollen analysis is immense. Now it will be possible to count **all** the pollen on a microscope slide, not only a potentially biased sample of 500-750 pollen grains on the slide, to replicate pollen counts, to do high-resolution stratigraphical studies involving 500-600 samples instead of the conventional 50-100 samples, to construct rapidly a 'pilot' pollen stratigraphy to help guide further sampling and analysis, and to test the abilities of Pollen Classifynder and its pattern recognition and image-processing procedures to discriminate pollen types that with conventional light microscopy appear to be indistinguishable (e.g. grass, heather, etc.).

Of course there is a lot to do before we can exploit Pollen Classifynder's full potential. For example, we have to build up a representative training-set of modern Norwegian pollen types before Pollen Classifynder can be trained to identify these types in fossil material. We have to consider how to simplify our sample preparation procedures so that sample preparation is not the limiting factor in Pollen Classifynder's work, and we have to re-think several of the current working practices in pollen analysis.

Pollen analysts have been using basically the same techniques since Fægri and Iversen's (1950) textbook appeared. One is reminded of Abraham H. Maslow's famous saying "I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail". With only one tool from 1950, there has been a tendency to treat research questions in pollen analysis as Maslow's nails because pollen analysts only have Maslow's hammer as their tool.

My colleagues Anne Bjune (pollen analyst), Arild Breistøl (computer expert), and Kathy Willis (pollen analyst) and I are very excited by now having a new and very powerful tool to investigate and decipher the 'secrets of the past' and to exploit in greater detail the remarkable palaeoecological record preserved in lakes and bogs as a long-term ecological laboratory.

We are immensely impressed not only by Pollen Classifynder but also by the highly professional team at Massey University who have produced the machine and its software and who are giving us much help in setting up and running Pollen Classifynder. This multidisciplinary team includes Bob Hodgson, John Flenley, Kat Holt, Ken Mercer, Colin Plaw, Gary Allen, and Jamie MacDuff.

The long journey from Bergen to Palmerston North for the workshop in March was most certainly worth it and we look forward to using Pollen Classifynder in the coming months and years.

John Birks (Update June 2013)

Our Pollen Laboratory in Bergan (now called the Palaeoecology Laboratory) is one of the oldest pollen-analytical centres in the world. It started in the early 1930s with Knut Fægri (1909–2001) and has continued as an active and productive research centre with Ulf Hafsten, Peter Emil Kaland, Dagfinn Moe, Hilary Birks, John Birks, Kari Hjelle, Jan Berge, Anne Bjune, and Arild Breistøl.

In its 80+ years of activity, the Laboratory has witnessed and embraced many technological and methodological developments – improved optical microscopes, oil-immersion objectives, phase-contrast microscopy, scanning-electron microscopy, numerical methods, and improved pollen identifications.

The Laboratory is naturally involved in training and using the two Classifynder machines it purchased in 2011. Arild Breistøl is in charge of this work. It has involved preparing new high-quality modern pollen reference material and we have incorporated an alternative statistical-learning technique—random forests—into the training phase.

The work is not complete but many exciting results have emerged, for example, Classifynder's ability to separate different species of sedge (Cyperaceae) pollen, a separation that is impossible using conventional microscope systems. Classifynder is providing many challenges to the pollen analyst's classical modus operandi and the Laboratory is trying to respond to these challenges.

Classifynder is, without doubt, changing how pollen analysis will be done in the 21st century.