Determination of spore concentration with an electronic particle counter

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Stockmarr, Jens: Determination of spore concentration with an electronic particle counter. *Danm. geol. Unders., Årbog 1972,* pp. 87–89. København, 5. december 1973.

In a new portion of tablets for absolute pollen analysis the spore content was determined with an electronic counter.

The use of tablets containing a known amount of *Lycopodium clavatum* spores for determination of the absolute pollen content of sediment samples was mentioned in Stockmarr 1971. One or more tablets are added to a fossil sample prior to preparation in the laboratory. During the analysis the modern spores are counted together with the fossil spores and pollen grains, and afterwards the total number of fossil spores and pollen grains in the sample, can be calculated from the equation:

$$\text{total fossil grains} = \frac{\text{added } \textit{Lycopodium} \text{ spores}}{\text{counted } \textit{Lycopodium} \text{ spores}} \cdot \text{counted fossil grains}$$

It was decided to make a large batch of tablets for distribution to other laboratories for pollen analysis.

The new tablets

The new tablets are smaller than those dealt with in the former article. The *Lycopodium* spores were given a dark colour by acetolysis prior to incorporation in the tablets. In this manner the added spores can be distinguished from fossil *Lycopodium* spores because the modern spores will become darker than the fossil ones after further acetolysis.

Spore concentrations was determined with an electronic particle counter, and afterwards a few microscope counts were made according to the method of Sv. Jörgensen (1967). A *Coulter Counter* model Zs kindly placed at my disposal by *Bie & Berntsen,* Copenhagen was used in the former case. In this counter the number and size of particles suspended in an electrically conductive liquid can be determined. The suspension and electric current flow through a small aperture having an immersed electrode on either side. Concentration is such that the particles traverse the aperture

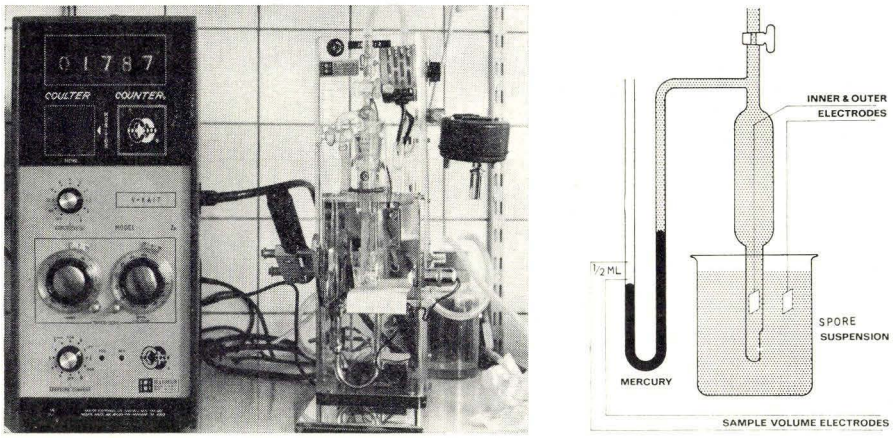


Fig. 1. The counter in the laboratory and a model demonstrating the principle.

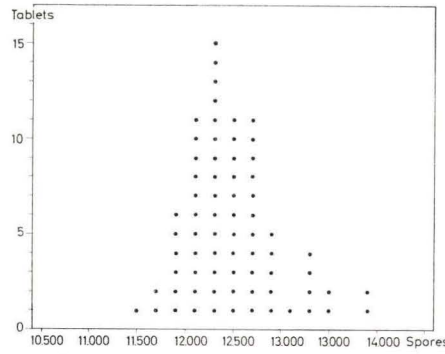
substantially one at a time. Momentary changes in the impedance caused by displacement of electrolyte within the aperture by each succesive particle produce a series of voltage pulses of an amplitude proportional to particle volume. The resultant series of pluses is electronically amplified, scaled and counted.

The tube on top of the model in fig. 1 leads to a vacuum pump. When the tap is open the suspension is drawn through the aperture and the mercury string is drawn away from the sample volume electrodes (the situation i fig. 1). When the tap is closed the mercury string slowly returns to the initial position drawing the suspension through the aperture. When the string reaches the first sample volume electrode the counting begins, and when it reaches the second, about 10 seconds later, it stops again. The aperture used was 140 μ, and the volume measured was half a milliliter. The spore suspension was stirred between the counts to keep a constant concentration.

71 tablets taken from different places in the batch were placed in 25 milliliter beakers, one in each, Sufficient HCl was added to dissolve the tablets. A little alcohol was added to keep the foam away and the beakers were filled up with a 0.15 molar NaCl solution. After stirring the beakers were placed in the counter. 15–20 counts each of half a milliliter were made on each tablet. In this manner more than one third of the spores in each tablet was counted.

From the counts the spore content in the tablets could be calculated. No error has been calculated on the single tablets but it is small as a large proportion of the total was counted.

Fig. 2. Number of spores in the tablets. Class intervals of 200 spores.
$\overline{X}$ = 12.488
$\hat{\sigma}$ = ± 499
V = ± 4.0 %



The arithmetic mean, $\overline{X}$, the standard deviation, $\hat{\sigma}$, and the coefficient of variation, V, of all the tablet calculations were found.

From fig. 2 it is seen that the distribution might be slightly skewed, but the skewness is so small that the material has been treated as normally distributed.

To control the method four tablets were prepared for microscope counting. From each tablet two slides were counted containing about one half of the material, with the following result:

1. tablet: 12.830
2. tablet: 12.611
3. tablet: 12.287
4. tablet: 12.418

$\overline{X}$: 12.537
$\hat{\sigma}$: ± 237
V: ± 1.9 %

Conclusion

The two methods gave almost identical results: 12.500 spores per tablet with a coefficient of variation not exceeding 4 %.

While the microscope determination lasted for three days, the electronic method was completed in one day and the certainty was much higher, since 71 samples were determined instead of only 4 in the former case.

Literature

Jørgensen, Sv. (1967): A method of absolute pollen counting. The New Phytologist 66, p. 489–493.

Stockmarr, J. (1971): Tablets with spores used in absolute pollen analysis. Pollen et Spores. Vol. 13, No. 4, p. 615–621.