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# DATRAN: analysing radiocarbon dates

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### 9.1 Description of the program

The DATRAN program provides a set of procedures designed to help in the analysis of radiocarbon determinations. The user inputs uncalibrated radiocarbon determinations (bp, bc or ad), and the results are expressed in calibrated years BC/AD.

The program has been written in BBC BASIC, by the author for use by students of archaeology, in conjunction with the university's Aeneas Project for introducing students to 'the new technology'. The program is suitable for BBC 'B' or Master 128 machines.

To run the program, the user boots the disc (using SHIFT-BREAK), and chooses an option from a set of menus displayed on the screen. The menus and prompts are intended to be sufficiently user-friendly for any one who has a modest understanding of radiocarbon dating.

After selecting a procedure, the user first decides what calibration to use, then loads the file which contains the data for that calibration. After that, the user is prompted to key in the determination, then its error term (or standard deviation). The program does not alter the error term which is keyed in: if the user wishes to alter the error term to allow for the latest 'corrections', this must be done before it is keyed in.

DATRAN offers the following facilities:

1. Calculation of any 'probable range' based on one determination. The user specifies the probability desired (as a per cent), and the program calculates and calibrates the start and end dates of the appropriate range. For example, the ' $\pm$  two standard deviation range' would be the '95% probable range'.
2. Calculation of the effect of having more than one determination to analyse, to help in choosing an appropriate probability level.
3. Calculation and plotting of probable ranges as 'equal area' or 'battle-ship' curves; output may be on screen or as hard copy. The Gaussian probability distribution of uncalibrated results produces 'battle-ship' curves (Fig. 9.1); the non-normal probability distribution of calibrated results produces some unusual patterns (Fig. 9.2). If this option is chosen, you may see an explanation before using the procedures.
4. Combination of one or more determinations to calculate 'probable limits'. If this option is chosen, you may see an explanation before using the procedures. The program will calculate the Earliest Limit, Early Limit, Late Limit and Latest Limit for a set of determinations.

5. Recording of the results of calculations as files on the DATRAN disc, which may then be printed out on a printer.
6. Preparation of a data file for a new calibration, using data keyed in by the user. The DATRAN disc already has a number of calibrations supplied ready for use, in files which are prefixed 'X.'. These are as follows
  - (a) **X.5568** produces results uncalibrated in 'radiocarbon years bp' (back to 10000 bc).
  - (b) **X.Agreed** is the currently recommended calibration curve, agreed jointly by Pearson & Stuiver 1986, p. 821 and p. 851 (by combining their two lists, back to 2026 bc)
  - (c) **X.Irish** is the longer curve, based on Irish oaks, presented by Pearson *et al.* 1986, p. 930 (back to 4200 bc).
  - (d) **X.Pacific** is the curve based on Californian trees presented by Stuiver & Becker 1986, p. 876, which has closer measurements and an error term based not simply on counting error but on a 'reproducibility' error (back to 2000 bc).
  - (e) **X.5730** produces results in 'radiocarbon years bp', but calibrated into the 5730-year half-life (back to 10000 bc).
  - (f) **X.WD71** is after Wendland & Donley 1971 (back to 6000 bc).

## 9.2 Technical details

The program is available as one double-sided 80-track disc, in BBC DFS format, suitable for use with any BBC 'B' or Master 128 computer which has one suitable disc drive and a monochrome screen. The screen graphics are in Mode 0, for which the printer routines are a screen dump written for Epson dot matrix printers. For higher quality graphics output, routines are included to drive a Hewlett Packard HP-7475A plotter. Ranges are calculated by the methods proposed by Pearson & Stuiver 1986, p. 823 and 853, adding the variances of the determination and of the calibration curve. Intermediate values are obtained by linear interpolation.

Copies of the Datran disc may be obtained from Michael Avery, Department of Archaeology, Queen's University, Belfast, Northern Ireland BT7 1NN, together with further documentation. It is hoped that a version in Pascal will be available in the near future.

## References

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- STUIVER, M. & B. BECKER 1986. 'High precision decadal calibration of the radiocarbon time scale, AD 1950–2500 BC', *Radiocarbon*, 28, pp. 863–910.
- WENDLAND, W. M. & D. L. DONLEY 1971. 'Radiocarbon-calendar age relationship', *Earth and Planetary Science Letters*, 11, pp. 135–139.

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Statistical Analysis of Particle Sizes and Sediments

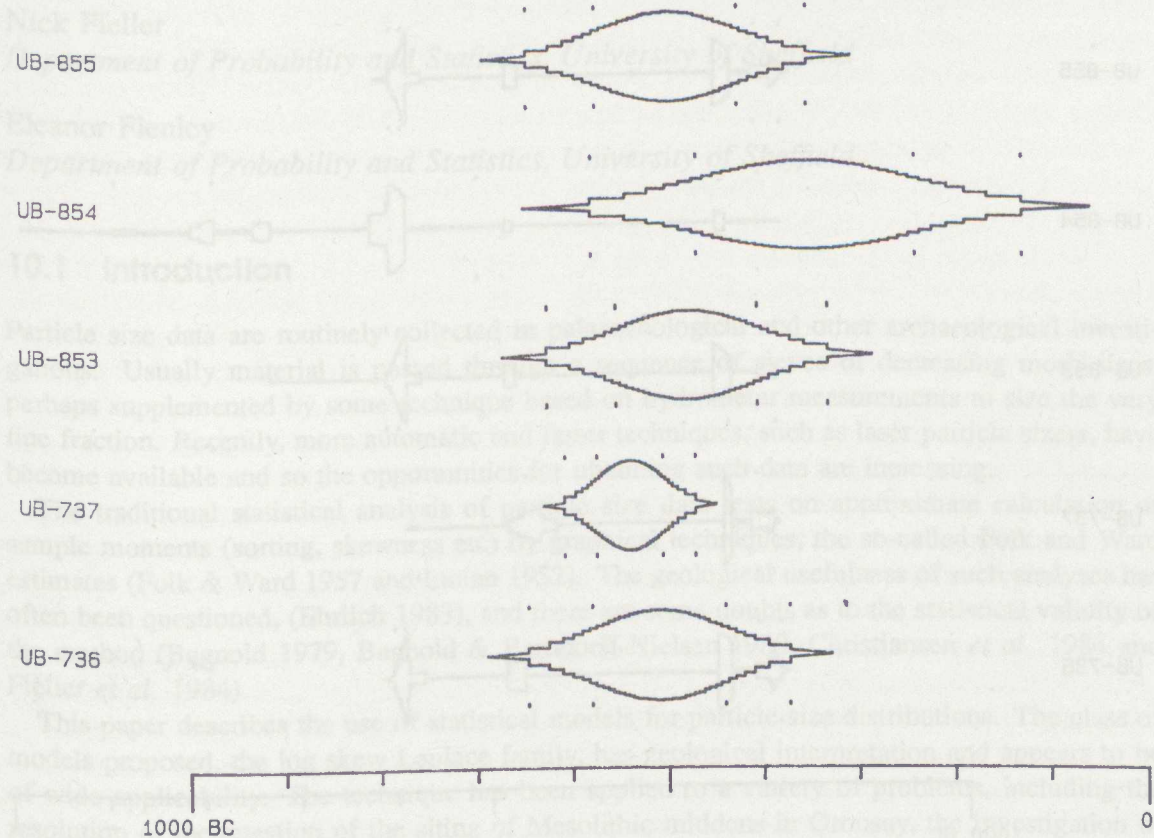


Fig. 9.1: Sample DATRAN output: Gaussian probability distribution of uncalibrated results

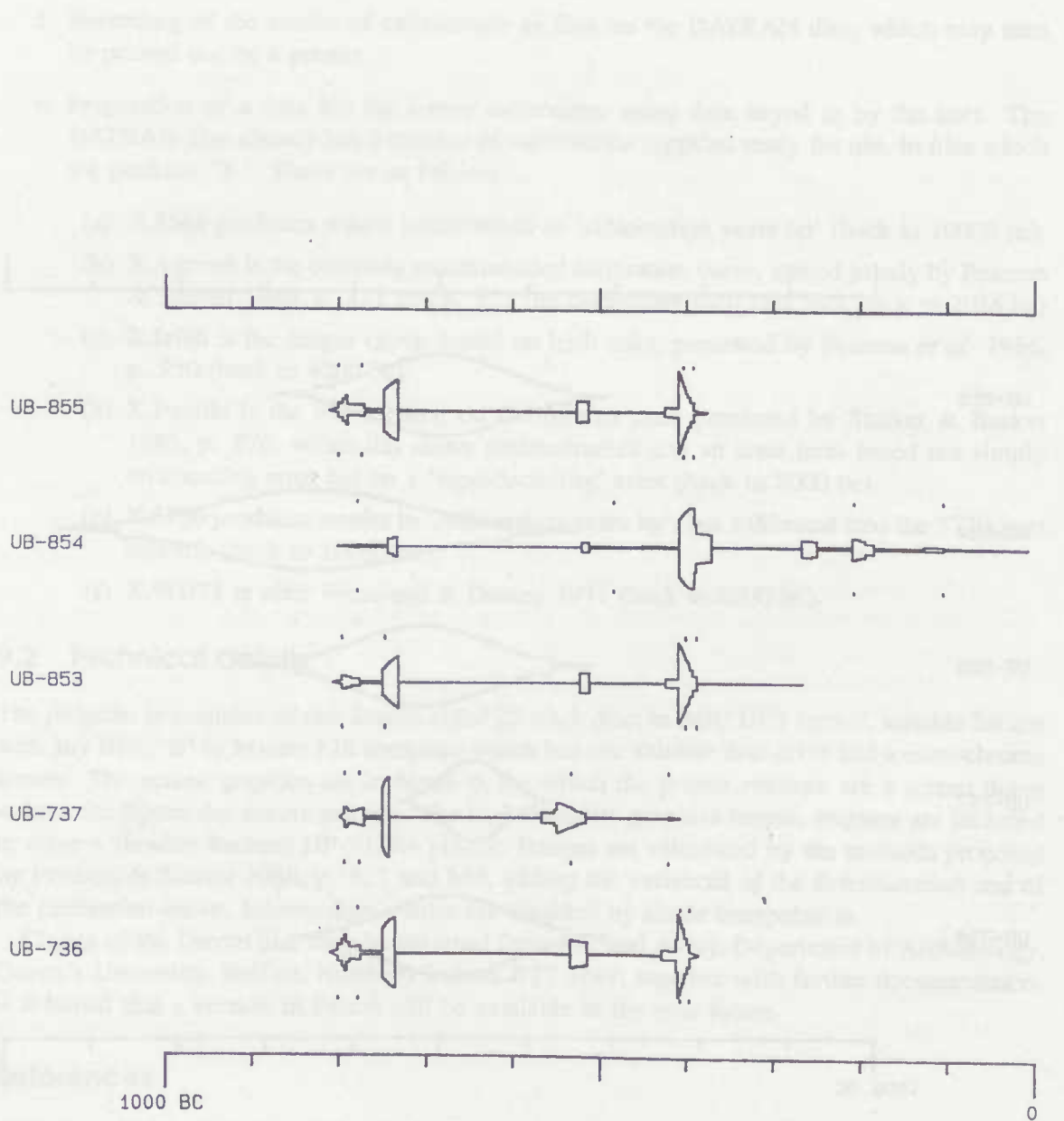


Fig. 9.2: Sample DATRAN output: non-normal probability distribution of calibrated results