

SHORT COMMUNICATION*The 'infracentrifuge', a device for continuous separation of heavy minerals*

IN order to concentrate heavy minerals out of large samples of soil or ground rock, an experimental, all-glass overflow-centrifuge was constructed. Glass was used because all metals are more or less corroded by the heavy liquids normally used for the separation of heavy minerals (bromoform, tetrabromethane, etc.).

Essentially, the apparatus consists of a rotating 2000 cc vessel in which the 'sink' fraction is collected, and a stationary, vertical feeder tube (fig. 1). Around the rotating vessel a reservoir is mounted to receive the spilled heavy liquid containing the 'float' fraction. The velocity of rotation of the rotating vessel can be varied between 0 and 400 rpm.

The feeder tube is connected to a vessel provided with an electric stirrer. Dry sample, introduced into this mixing vessel by means of a vibrating feeder is mixed with the heavy liquid. The flow of dry sample and heavy liquid into the mixing vessel can be controlled independently, so that any desired mixing ratio can be fed into the rotating vessel.

The excess heavy liquid and the float fraction are thrown into the surrounding reservoir, and flow off into a large filtration vessel. The float fraction and the heavy liquid are separated in this vessel by vacuum filtration through filter paper supported by a perforated Teflon disk. The filtered heavy liquid is pumped back into the mixing vessel by a specially designed pump of Teflon and glass (fig. 2). The residual heavy liquid trapped in the float fraction can be recovered afterwards by vacuum percolation with acetone and subsequent distillation of the acetone-heavy-liquid mixture. After the vacuum percolation the float fraction is as dry as the starting material.

An unclassified 11 Kg sample of ground tin-granite (grain size > 0.5 mm) from the Santa Maria granite, Rondônia, NW Brazil (*cf.* Priem *et al.*, 1966) was processed by the infracentrifuge. The velocity of rotation was about 400 r.p.m. The rate of processing was about 5 kg per hour. Four litres of bromoform (diluted with di-*n*-butylphthalate D 2-70) were used, practically all of which could be recovered afterwards. A sink fraction of 975 g was collected in the rotating vessel, and a float fraction of 10.02 kg in the filtration vessel.

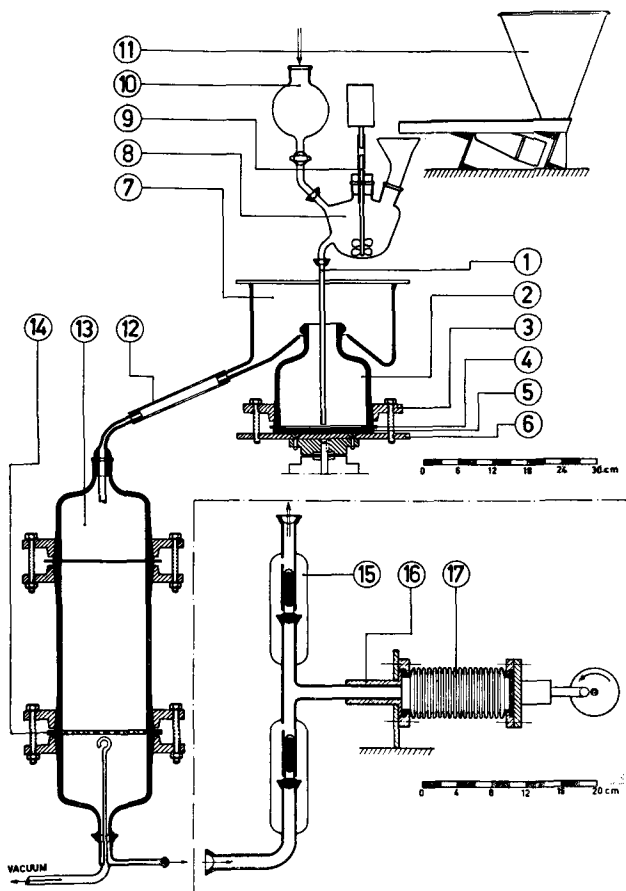


FIG. 1. Details of the construction of the main apparatus. 1, feeder tube, glass, 13 mm, with ball-cup joint S 19; 2, rotating vessel (Kon-KF-Reduzierstück symmetrisch, Duran 50, code: RS 152/50/1 of Schott u. Gen., Mainz); 3, conical flange (code: SVER 152 S); 4, gasket, Teflon (code: DICH 152 T); 5, glass disk, thickness 10 mm; 6, turntable, brass; 7, collecting vessel for overflow, with cover, glass; 8, mixing vessel, glass; 9, stirrer, glass; 10, bromoform reservoir with stop-cock, glass; 11, vibrating feeder with hopper; 12, tube, Teflon, 13 mm; 13, filtration vessel, Duran 50 (Top section: Kon-KF-Reduzierstück symmetrisch, code: RS 152/25/12; modified with conical joint B 29. Middle section: Kon-Rohr, code: 152 0300. Bottom section: Kon-KF-Reduzierstück symmetrisch, code: RS 152/25/12; modified with ball-cup joint S 35); 14, perforated Teflon disk. *Inset*: Details of the construction of the bromoform pump. 15, valve system, glass (essentially two ball-cup joints S 19 with enclosed metal weights); 16, flange, Teflon; 17, bellows, Teflon.

In order to test the efficiency of the infracentrifuge, small samples of the unprocessed ground granite, and of both the sink fraction and the float fraction obtained from the infracentrifuge were analysed. These samples—10 to 15 g each—were centrifuged in an ordinary 3000 rpm laboratory centrifuge, using the same diluted bromoform. The contents of the centrifuge tubes were frozen at -10°C after centrifuging. In this way, the float and the sink fraction are easily separated. The amounts of both fractions were weighed after cleaning and drying.

The concentration of heavy minerals in the unprocessed material was 9.4 %. The concentration of the heavy minerals in the sink fraction of the infracentrifuge was 83.6 %, corresponding to 7.4 % on the unprocessed material. The concentration of the heavy minerals in the float fraction of the infracentrifuge was 1.6 %, corresponding to 1.5 % on the unprocessed material. Hence approximately 80 % of the heavy minerals originally present in the unclassified ground granite material were captured.

These figures show that the infracentrifuge may become a useful laboratory tool for the speedy concentration of the heavy minerals from large samples of soil or ground rock.

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*Laboratorium voor Isotopen-Geologie,
De Boelelaan 1085,
Amsterdam-11,
The Netherlands.*

R. H. VERSCHURE
L. IJLST

Reference

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