NOTISER

Notes

Computer program for calculation of norms of igneous and metamorphic rocks

By

T. Amble, K. Thoresen and O. H. J. Christie

The need for computer programs in petrographical and geochemical use is very great and is steadily increasing. A general program, written in Fortran II D, for norm calculations has been completed and is now available from the Mineralogisk-Geologisk Museum. The program has been designed for the IBM 1620 II computer of the University of Oslo.

The computer is fed with punch cards containing information of rock analyses expressed in weight per cent of the usual oxides. It recalculates the analyses to cation percentage and calculates the CIPW catanorm and/or the Barth mesonorm.

The following additional operations can be made:

1. Simplified recalculation of the cation percentage values for standard-cell calculations (oxygen = 160).
2. Calculation of selected data for the most common three- and four-component diagrams.
3. Punching of cation percentage values on punch cards, one for each analysis, in case further statistical or trend-surface analysis is needed.
4. During the calculation the computer will write the details of the various calculations.

Those interested may write for a program to Mineralogisk-Geologisk Museum, Sars gate 1, Oslo 5, Norway.

Deposits of probable Upper Cretaceous Age off-shore from Andöya, Northern Norway

By

Svein Manum

Samples of sediments obtained (in 1951) off-shore from Andöya in the Vesterålen archipelago by Mr. T. Soot-Ryen, then director of Tromsö Museum, are probably of low Upper Cretaceous Age according to their content of microplankton and microspores. The discovery of these sediments is significant because deposits so high up in the Mesozoic are not known to occur within at least 1,000 km of Andöya. Within a small graben on Andöya itself, however, deposits ranging from the lowermost Upper Jurassic to the Middle Neocomian are preserved.

The samples were collected during a zoological survey in July 1951 when Mr. Soot-Ryen was dragging a large triangular dredge off-shore from Andöya. He followed a northwest course from the harbour of Andenes, and the sampling was carried out along the eastern slope of the submarine valley which cuts into the continental shelf there, and along the steep part of the shelf itself north of the submarine valley. Dragging started at a depth of 1,290 m; the sampler was lifted and emptied after some time from a depth of 1,000 m, dropped again, and finally lifted from a depth of 830 m. On both occasions when the dredge was raised and especially the second time, many pieces of an indurated, light greyish mudstone, ranging up to 20 cm in size, were found embedded in tough greyish clay. The collector considered it highly probable that the pieces were scraped off projecting rocks on the sea-bottom, apparently at depths of about 1,000 m. The samples were obtained approximately between 69°38′N and 69°25′N and 15°40′E. The distance from Andöya was between 21.5 and 10.8 nautical miles.

From the appearance of the samples, Mr. Soot-Ryen believed them to be younger than the Upper Jurassic to middle Neocomian deposits known from the graben at Andöya. Unfortunately, the contained shell-fragments were recrystallized and too small for identification and dating. However, a preliminary microscopical examination of a few of the samples has revealed assemblages of microplankton and

microspores, which, on detailed investigation, should prove useful in more precise age determinations.

The following are some of the types of microplankton provisionally determined from these sediments:

Deflandrea. This is a conspicuous constituent. Three or four species have been recognized, two of which appear to be related to the *D. granulifera-D. verrucosa*-component of the microplankton assemblage described by Manum and Cookson (Skr. Vid.-Akad. Oslo, I. Mat.-Naturv. Kl., No. 17, 1964) from the Upper Cretaceous of the Canadian Arctic Archipelago.

Hexagonifera cf. *vermiculata* Cookson and Eisenack, 1961; *H.* cf. *suspecta* Manum and Cookson, 1964

Odontochitina sp.

Hystrichosphaeridium cf. *stellatum* Maier, 1959

Canningia sp.

Chlamydophorella cf. *nyei* Cookson and Eisenack, 1958

Diconodinium cf. *arcticum* Manum and Cookson, 1964

Palaeoperidinium cf. *cretaceum* Pocock, 1962

Palambages sp.

This microplankton assemblage recalls to some extent the one described from deposits on Graham Island believed to be of low Upper Cretaceous Age (Manum and Cookson op. cit.).

The microspores seen so far support the low Upper Cretaceous age suggested by the microplankton content.

Residual cipolino: End-product of calcareous rocks in regional metamorphism. A comment

By

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In a recent paper (Norsk geol. tidsskr. 45: 303–313, 1965), R. D. Schuiling dealt with the problem of some carbonate rocks, which are particularly common in high-grade metamorphic terranes, and which are named variously plagioclase-granulite, diopside-granulite, calc-silicate granulite, and silicated carbonate rocks.

After clearly pointing out that a sedimentary origin has been proposed by all the authors who have described these rocks, he tackles the question of their genesis. If the mineralogical composition of such rocks is 'roughly according to oxide percentages' (computed chemical composition is deduced from mineralogical composition of 17 'residual cipolinos', Nos. 1–17 of Table 1, Schuiling, op. cit., p. 306) 'and if it is admitted that Ca and Mg would be present almost exclusively as carbonates in the original sediment, a composition is arrived at which is highly unusual for a sediment'.

Besides, one can hardly believe that these rocks, which 'seem to form fairly well-closed systems with regard to influx of material', are the result of the transformation of a limestone band by Si, Al, Fe, Mg-metasomatism. Hence their formation should be 'viewed as an end-product of *normal* limestones, with *normal* amounts of impurities from which the carbonates were expelled during metamorphism'.

This is the reason why Schuiling proposes for the group of rocks under consideration the name 'residual cipolino' which must be used globaly with its genetical connotation.

The problem of the genesis of these 'residual cipolinos' will not be considered here. Some observations made during recent fieldwork in Antarctica (Terre de la Reine Maud, Sör-Rondane) on the same kind of rocks will be the subject of a future contribution by the present writer. The point I do want to discuss is that of the proposal of a new petrological term the definition of which, moreover, includes a genetical meaning. In other words, this means that this term will only be used, if accepted, by those who agree with Schuiling's views on the 'residual cipolino' formation; this also means that those who do not agree will have to propose another term. This is one more case whose result will certainly be to make all discussions ambiguous. Thus, I do not think it is desirable to use both a descriptive and a genetical name for the same object. Moreover, I do not think it is desirable to propose a genetical definition for a rock. Anyway, the grouping of the two words (residual and cipolino) seems to be rather unfortunate, because, used alone, cipolino has a quite different meaning.

I agree that the existing names (plagioclase-granulite, calc-silicate granulite, etc.) lead to confusion and that the term granulite should be used only in very well-defined cases. Moreover, granulite now has too many different meanings to be maintained in the geological literature.

Schuiling leaves 'the way open to other suggestions'. May I suggest that the last term to which he refers, 'calc-silicate *granofels*', proposed in 1959 by R. Goldsmith (Granofels, a new metamorphic rock-name. Jour. Geol. 67: 109–110), is a very good general descriptive term and is well applied to the features Schuiling sees in the 'residual cipolinos'.

Therefore, a new name is not necessary, and a genetical connotation should be avoided. If this point of view is admitted, the only way to include the genetical aspect in the descriptive term will be to use an adjective. In the present case, 'residual calc-silicate granofels' seems to be a good expression. Reading this term, all petrologists will have a clear picture of the rock and at the same time will understand that Schuiling has good reasons to believe in its residual character.

Residual cipolino: End-product of calcareous rocks in regional metamorphism. A reply

By

R. D. Schuiling

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In this issue of this journal, Michot (1966) takes exception to the author's introduction of the term 'residual cipolino', as well as to the author's contention that it is permissible to use two kinds of names and definitions for one object: the one linking it to direct observations (descriptive definition), and the other to its inferred mode of origin (genetic definition). This, even in petrology, is not a new notion. We might take, for instance, Mehnert's (1959) two definitions of kinzigites, the one being a petrographic, descriptive definition: garnet-cordierite-plagioclase rocks $\pm$ biotite-graphite-quartz; the other being a genetic one: rocks with excess Mg-Al-Fe, from which alkalies, SiO_2, and H_2O were driven out.

We might even hold that this two-fold system of classification and names is inherent to petrology, as it deals on the one hand with

petrography (descriptive), and on the other hand with petrogenesis (genetic).

I am pleased to see that Michot agrees with one of my suggestions for the descriptive part (calc-silicate granofels) which I proposed for the rocks under consideration. If other petrologists can agree, I think this settles the problem of the first, descriptive kind of name-definition. With regard to the second, genetic kind of definition, Michot points out rightly that it can only be used by people who hold similar views on the mode of origin. I agree with this point. People who disagree with the proposed mode of origin of the residual cipolinos might well use the following genetic name-definitions of these rocks:

a) Metamorphosed ferruginous dolomitic marl, if one sees them as the product of straightforward metamorphism, accompanied only by loss of CO_2 and H_2O, or

b) Regional-metamorphic skarns, if one believes them to be the product of influx of Si, Al, Fe and Mg into limestone bands.

With regard to possibility b) I would like to take this opportunity to clarify a point in the paper under discussion. As I was not able to correct the proofs myself, a passage was omitted in which I indicated the difficulty in explaining these residual cipolinos as regional-metamorphic skarns due to the influx of Si, Al, Fe and Mg into a limestone band. As residual cipolinos contain on the average 10% of CaO, equivalent to roughly 18% of $CaCO_3$, and as they have thicknesses which commonly range from 5 to 30 cm, this means that the original limestone before the process of skarn-formation (involving addition of material) must have had thicknesses of 1 to 6 cm. It seems highly unlikely that such thin bands would ever have occurred intercalated between normal sediments and still retain their distinct characteristics along the strike over several km. It seems therefore more probable that they developed by a process of subtractive metasomatism into residues of normal limestones which were, on the average, 5 to 10 times thicker than what we now find. This means that they must have had thicknesses ranging from 25 to 300 cm and over. Geologically speaking, this seems a much more acceptable scale.

Returning to Michot's discussion on classification, it seems appropriate to cite what I wrote on this subject some years ago (SCHUILING 1960, p. 17): 'A purely descriptive classification cannot and does not exist. When we give a description we only describe what we consider

significant, thereby making a choice which is mainly determined by one's own theories on the origin of what we are describing.' And, I may add, if we don't make this choice but try to classify according to some genetically irrelevant criterion, we only bring chaos into order instead of vice versa. Let everyone decide for himself of what use would be a classification of rocks according to color (magnetite ore, basalt, bituminous limestone falling in the class of black rocks) or according to mineral content only (sandstone, rhyolite, granite, quartz veins, gneiss falling in the class of the quartz-bearing rocks).

We deceive ourselves when we read too much into names and classifications. We should not pay too much attention to them; they are no more than handles, a convenient shorthand for lengthy descriptions of salient features (descriptive names) or of modes of origin (genetic names), as the case may be.

LITERATURE

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