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INTERNATIONAL GEOLOGICAL CORRELATION PROGRAM

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IGCP-163-IGBA

New Scaling Factors for Trace Element and Radiochemical or Other Physical Age Measurements.

Present project conventions for scaling of these quantities have proven less than satisfactory, and at the Madrid meeting it was decided that we should abandon literal scale factors in favor of some variant of exponential or 'scientific' notation. Although any recognized set of scaling conventions is computationally manageable once the first machine readable form of the data has been generated, simplicity and clarity are essential in earlier stages of data capture. The scheme described in sections 1-6, inc., of this circular is the most recent in a troublesome series of trials begun shortly after the Madrid meeting. It seems to work admirably, and, as the transfer of data from coding sheets must continue on a reasonably prompt basis, we have begun to use it on new data. In the absence of well supported objections or proposed modifications, machine editing of old copy to conform with it will begin in mid-April.

(I hope a 2-month period will be adequate for mail discussion by concerned project members and regret the need for this informal mix of arbitrary action and democratic discussion. Although specifically requested only in sections 6-8, comments concerning all sections of this circular will be welcome. Firm standardization is very difficult to achieve in a group that is as loosely organized and meets as infrequently as ours. Funding authorities tend to judge us in the first instance by the amount of data we have compiled. If we deferred compilation until we had achieved complete a priori standardization, the project would simply die.)

1. Age Notation

The scaling factor of an age measurement is simply a multiplier, and conforms exactly to exponential or scientific notation. So we also conform to that notation, without, however, first shifting the implied or actual decimal point leftward except perhaps to eliminate trailing zeroes. Thus, 5 million years is recorded as 5E6, 155 million years as 155E6, 1500 million years as 1500E6 or 15E8, 500,000 years as 5E5, 2

billion years as 2E9, etc. (IGBA uses the Franco-American billion, not the Anglo-Germanic one.)

2. Trace Element Notation

Unlike that of an age, the scaling factor of a trace element amount does not directly modify a measurement. Rather, it defines the unit in which the measurement is reported; its function is much more that of a divisor than a multiplier. Instead of 'E' as separator we therefore use 'P', a mnemonic for 'per', i.e. 5ppm is 5P6, 550ppm is 550P6 or 55P5, etc. (Note that truncation of trailing zeroes decreases the exponent of a trace element amount but increases that of a radiochemical age.)

3. Decimal Notation in Age and Trace Amounts

Except for trace elements sometimes included in conventional 'essential oxide' analyses, for which see sections 4 and 5 below, the use of decimal notation in trace element and age data is very rare, so rare that its retention in computer input is not worthwhile. We wish contributors would edit out such decimal values as occur, but if they do not this will be done in the conversational transfer from coding sheet to card image file. The use of different separators for the two types of data is a convenient reminder that in this operation, as with truncation of trailing zeroes (see the examples in sections 1 and 2, above), the exponents move in opposite directions. For example, 111.5 million years is recorded as 1115E5 but 111.5ppm as 1115P7.

4. Trace Amounts Without Scaling Factors

In the coding sheets the only common occurrence of trace amounts without scaling factors is of those reported as part of conventional 'essential oxide' analyses. Most contributors enter these in Block C in the original, decimal notation without factor, e.g., Cl as .03, S as .12. The implicit exponent here is 2, but with elimination of the decimal point it becomes 4, so that .03% of Cl is recorded in the card image as Cl=3P4, and .12% of S as S=12P4.

5. Oxide Components not Included in Block B

No provision is made in Block B of the coding form for a number of once infrequently determined elements, chiefly Ba, Cr, Rb, Sr, V and Zr, formerly always reported as oxides. The practice persists in some recent work but is becoming rare. In analyses of igneous rocks the amounts involved are always in the trace element range and it is natural to include them in Block C. But except perhaps for S (for which see further below) and C it seems a scientific absurdity to record an element sometimes as itself and sometimes as its oxide. So we do not. If the contributor has not already made the conversion, the data-transfer operator converts each such oxide to its equivalent

elemental weight and enters it in the card image file as a trace element. Thus, for instance, 358ppm of BaO becomes Ba=316P6. (The conversational data transfer program could be expanded so that this and similar conversions were performed internally: the current version does not have this capability.)

6. 'Essential' Components Reported as Traces

It sometimes happens that P_2O_5, MnO, or TiO_2 is reported as 'tr' in a rock analysis. We then convert it to a trace element, i.e. an entry of 'tr' in the MnO box of Block B is recorded in the trace element list of the card image as Mn)0P?, the question mark indicating that the value of the exponent is unknown. (Given the sensitivity of modern analytical devices, one wonders whether Mn)0P? says anything more about Mn than could be said about (almost) any other element in the periodic table. Is there really enough information in the 'tr' designation to be worth preserving? Has any reader of this note ever made practical petrographic use of such information? How? Comment is invited.)

7. Components Reported as 'nd'

In the coding sheets so far processed there have been a few examples of 'nd', but none in which it was clear whether the symbol denoted 'not detected' or 'not determined'. In some cases contributors recorded this uncertainty under 'Additional Notes'. We wonder whether it makes sense to honor it in this fashion. Does 'nd' convey any generally recognized unambiguous information worth recording? Comment is invited.

8. Nuisance Components

In older analyses one occasionally encounters values listed for components such as HF, SO_2, SO_3, SO_4, Na_2SO_4, H_2S, FeS, etc. These were quite uncommon even when they were considered stylish and are now rare almost to the point of extinction. In analyses of eruptive rocks other than certain carbonatites their amounts are invariably in the trace range and there is usually considerable doubt as to whether they are observed values in the usual sense or arbitrary normative recalculations. With the possible exception of the oxides of S in some of the rarer carbonatites I believe they could all be dropped without loss. There are at present no firm project standards concerning them. Comment is invited.

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