The rock matrix: formation and evolution of rocks in polyphase metamorphic basements

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Let us accept that each metamorphic tectonite basically displays a dual property: the **mineral assemblage** of a specific **metamorphic stage** and its expression into **fabrics**; both properties are, in time, subjected to changes. The metamorphic re-equilibration history may form, during geologic time, **n** mineral assemblages (metamorphic stages). Considering k fabric types (e.g. coronite, tectonite and mylonite fabrics), $\mathbf{k} \times \mathbf{n}$ different **basic fabrics** can appear. By the superposition of these basic fabrics, metamorphic stage after metamorphic stage, **petrostructural fabric types** (i.e. rocks) are produced.

Namely, they are all the combination of basic fabric types (of length $\leq n$) that each basic fabric can produce, with the restriction that the row index is strictly increasing. That is, the k fabric type at n cannot form before k type at $n-1$ time, in implicit accord with time evolution of metamorphic transformations. Imagine now considering only the combination of length m, where $1 \leq m \leq n$. There are

$$\binom{n}{m} = \frac{n!}{m!(n-m)!}$$

strictly increasing sequences of row indexes. Each sequence produces $\mathbf{k^m}$ different petrostructural fabrics. The number of possible petrostructural fabrics after n metamorphic stages is then obtained by summing over m, where the unit on the left hand side accounts for the rock which started the process, the protolith.

$$1 + \sum_{m=1}^{n} \binom{n}{m} k^m = \sum_{m=0}^{n} \binom{n}{m} k^m$$