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Preface — Some words on the post-collisional magmatism

The post-collisional geodynamic setting has not been fully integrated in the model of plate tectonics, which is based on geological processes occurring at major plate edges, mid-ocean ridges, active margins and in spectacular intercontinental collisions. Studies on intraplate, in particular those devoted to intraplate anorogenic magmatism, have paid little attention to plate tectonics. The popular mantle plume hypothesis has only weak links with plate movements. In that framework, the post-collisional setting has had only minor consideration, often being described simply as a 'relaxation phase' following collision. This has resulted in a poor definition for the post collisional. It appears however that voluminous magmatism is produced during the post-collisional period. The collision s.s. (period of maximum convergence) is not favourable for the ascent of magmas; and the intraplate period is characterized by widespread but often sparse magmatism. Magmatism from active subduction at a plate margin is to be metamorphosed during the collisions that inevitably follow. Many magmatic bodies must therefore be related to a distinctive post-collisional period.

How we understand this magmatism depends however on the sense given to the expression post-collision. The prefix 'post' indicates that the period is younger than the collision, but also that it is still related to it. Most authors in this volume consider the collision as the initial major impact of two or more 'continental' plates, characterized by major thrusts and high-pressure metamorphism. This differentiates the collision event itself from the much longer period of plate convergence that follows ocean closure. In that sense, the post-collisional period begins generally in an intracontinental environment —the major ocean is closed—but still with large horizontal terrane movements along mega-shear zones, precluding its assimilation to an intraplate setting. Tibet and south-eastern Asia are present-day example of post-collisional setting: they are affected by large horizontal movements, the collision itself with India being represented by the oldest main thrusts. The intraplate setting will begin in this region with the end of these movements, as the entire area acquires a unique pole of rotation and constitutes a single plate. This transition from post-collisional to intraplate period thus marks also the end of the orogenic period. The beginning of the intraplate period can be considered as post-orogenic in the sense defined similarly as for post-collisional. This would be the case, for instance, of the Tassilis Cambrian–Ordovician sand sedimentation in the Sahara (9 millions km^3) which post-dates Pan-African post-collisional magmatism (580–525 Ma), including late alkaline magmatism, as well as large horizontal movements along shear zones. However, its enormous volume, covering a major part of the newly formed African plate from Mauritania to Arabia, is a consequence of the Pan-African orogeny. Few magma emplace in this period, if any.

Some geologists consider the whole period of plate convergence following impact as being a single collisional setting, the post-collisional period described above being called late-collisional, and the post-collision representing the end of this period. Although I had previously held this view, I now believe that this definition is blurring, the prefix 'late' being more vague than 'post'. The transition from late- to post-collisional also is not clear. In fact, the prefix 'late' could be dropped without loss of

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meaning. A summary of the definition proposed is given in Fig. 1. Though based on the largest usage, most of us will probably have small differences with the definition. As in all definitions, the role of that given in Fig. 1 is to promote discussion and to avoid misunderstanding through the use of precise concepts.

The post-collisional setting, as defined above, is a complex period that can include geological events such as large movements along shear zones, docking (oblique collision), lithosphere delamination, subduction of small oceanic plate and rift generation. As these events include continuous or episodic extensional regime, various types of magmatisms occur in such settings.

Can post-collisional magmatism be characterized? Surely neither easily nor definitely. However, contributions to this issue seem to indicate three important common characteristics: (1) post-collisional magmatism is, in volume, mainly potassic and in particular high-K calc-alkaline with subordinate amount of shoshonitic rocks. Strongly peraluminous and alkaline–peralkaline granitoids may be voluminous but are more sporadic; (2) post-collisional magmatism is commonly linked to large horizontal movements along major shear zones; (3) the source of post-collisional magmatism has been generated during the preceding subduction and collision period, whether it lies within the crust or lithospheric/asthenospheric mantle. Moreover, this source commonly contains a large juvenile component, either mantle or newly-formed crust of igneous or sedimentary character. Unravelling the complexity of the post-collisional setting requires precise knowledge of the nature of the source of magmas. This is difficult to determine however as juvenile mafic lower crust is more similar geochemically and isotopically to lithospheric mantle than to felsic crust, particularly old felsic crust.

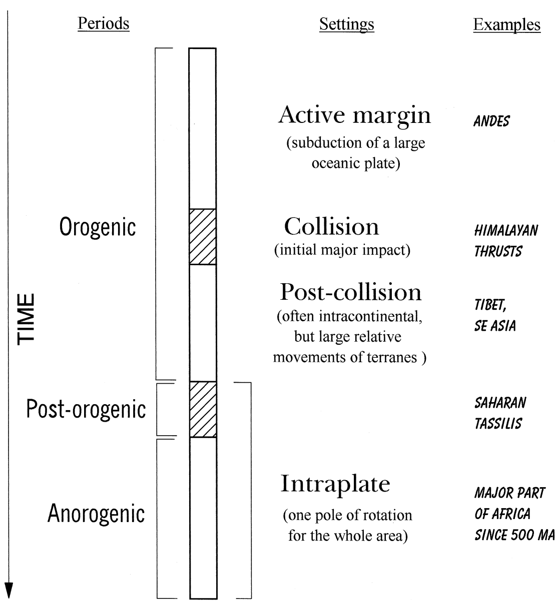

Fig. 1.

It appears that all authors in this volume agree that geochemistry of post-collisional magmatic rocks reflects the composition of their source materials. Much less assent exists on the idea that geochemistry can characterize geotectonic setting. The use of current tectonic discrimination diagrams is largely questioned, particularly for the post-collisional period when a wide variety of magma types can be generated. That is probably true. However, it should be observed that all kinds of magmatism do not occur in all geotectonic settings, which would be the case if magma geochemistry is completely decoupled from geotectonic setting. For example, the TTG (tonalite–trondhemite–granodiorite) series does not occur in an intraplate setting, the high-K calc-alkaline series is particularly abundant in the post-collisional period and alkaline magmatism is ubiquitous although privileging post-collisional and anorogenic settings. When the source of a magma is determined, it is then important to envisage the tectonic setting in which this source could be mobilized. Old Archaean crust has little chance to be melted if it is underlain by a thick cratonic lithospheric mantle, whereas it could probably be melted when remobilized within a mobile belt and then separated from its lithospheric mantle. The data demonstrate that large horizontal movements along mega-shear zones during the post-collisional period can trigger magmatism, in particular from young still hot mantle or crustal sources. Mainly high-K calc-alkaline to shoshonitic in composition, post-collisional magmatism sometimes includes some strongly peraluminous granitoids and often ends with silica-oversaturated alkaline-peralkaline magmatism, heralding the quieter intraplate period.

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