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CONTINENTAL COLLISIONS ANALAGOUS TO THAT FORMING THE QINGHAI-XIZANG PLATEAU

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INTRODUCTION

Papers presented at this symposium have provided, for the first time, a coherent picture of the present state and geological development of the Qinghai-Xizang plateau as a response to the Cenozoic collision of India with Asia along the Indus-Yarlung Zangbo suture zone.

The importance of the collisional process in tectonic evolution has been appreciated since Wilson (1) pointed out that recognition of the plate structure of the lithosphere indicated that, through much of earth history, oceans have been opening in some places and closing in others.

The process of ocean closing is complex and diverse and the variety of phenomena associated with collision are well illustrated in the Alps and the Mediterranean. A distinctive set of collisional phenomena developing after suturing involves continental thickening, partial melting and both intrusive and extrusive magmatic activity (2). In the Qinghai-Xizang plateau we interpret the extent of these processes to be very generally indicated by: (I) the area of very high ground (> 5 km) and (II) the envelope of areas of geothermal activity in the Himalaya and on the plateau (Tong Wei and Zhang Mingtao, this volume).

The exact mechanism of continental thickening and partial melting is as yet poorly understood and future studies of the Qinghai-Xizang plateau are most likely to throw light on the processes that operate. It is clear that thickening the continent in response to convergence will bring its lower part into a realm where isotherms are normally hot enough to induce partial melting but the thickened continent will be cold and conduction alone could only warm it very slowly. Some combination of conduction and convective heat transfer seems essential and the role of the mantle is as yet uncertain. Some workers (e.g. Toksöz, this volume) have suggested that the occurrence of an unusually hot uppermost mantle may influence partial melting of the continent after collision.

ANALOGUES OF TIBET

There are numerous areas on earth where igneous rocks whose formation has involved partial continental melting are distributed over a wide area on one side of a suture zone that marks a former continental collision. In some of these areas the time of suturing can be shown to have preceded by a few million years the episode of widespread igneous activity. We have interpreted such areas as analogues of the present Tibetan plateau (2 , 3) Table 1 lists a selection of these areas in order of increasing age. No effort has been made to be exhaustive in the list. Although some of the areas are better known than others, the main aim of the compilation is to show that Tibet-style continental reactivation phenomena are and have been (at least since the Proterozoic) a relatively common element in earth history.

Figure 1 is a map of the world illustrating the distribution of the sutures and Tibet-style terrains listed in the table. These areas constitute a substantial proportion of all continental crust, and we suggest that Tibetan style reactivation represents a significant stage in continental evolution involving the separation of high-level rocks enriched in water and large ion lithophile elements from anhydrous granulitic lower crust.

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TABLE 1

CONTINENTAL COLLISIONS WITH TIBETAN-STYLE REACTIVATION

	COLLISIONAL EVENT	SUTURE ZONE	AGE	KEY REFERENCES
1	Arabia-Eurasia	Bitlis-Zagros	Began in Mid-Miocene, continues	(4) Şengör and Kidd (1979)
2	Alps	Arosa-Matrei zones and equivalents	Late Middle Eocene	(5) Trümpy et al. (1980) (6) Bögel and Schmidt (1976)
3	India-Eurasia	Indus-Yarlung Zangbo	Middle to Late Eocene	(2) Dewey and Burke (1973) Numerous papers in this volume
4	Verkmoyansk	Chersky	End Jurassic	(7) Fujita (1978)
5	Cimmerian Continent-Laurasia	Various Palaeo-Tethyan sutures	Late Triassic to Late Jurassic	(8) Şengör (1979) (9) Şengör et al. (1980) Şengör (this volume)
6	Hercynian	Lizard-Harz Ortegal-Massif Central	Upper Carb. Mid-Carb.	(2) Dewey and Burke (1973)
7	Eurlaurentia-Asia	Urals	Early Permian	(10) Ivanov et al. (1977)
8	Eurlaurentia-Gondwanaland	S. Appalachian-Ouachita-Marathon	Late Carb.	(11) Hatcher (1978) (12) Wickham et al. (1976) (13) King (1977)
9	Pan African	Numerous sutures	Latest Precambrian Locally into Lowest Paleozoic	(14) Burke and Dewey (1972)
10	Grenville	Llano (Texas)	$1x10^9$ years	(2) Dewey and Burke (1973) (15) Şengör and Butler (1977)
11	Coronation	Wopmay	$1.8x10^4$ years	(16) Hoffman et al., (1974)

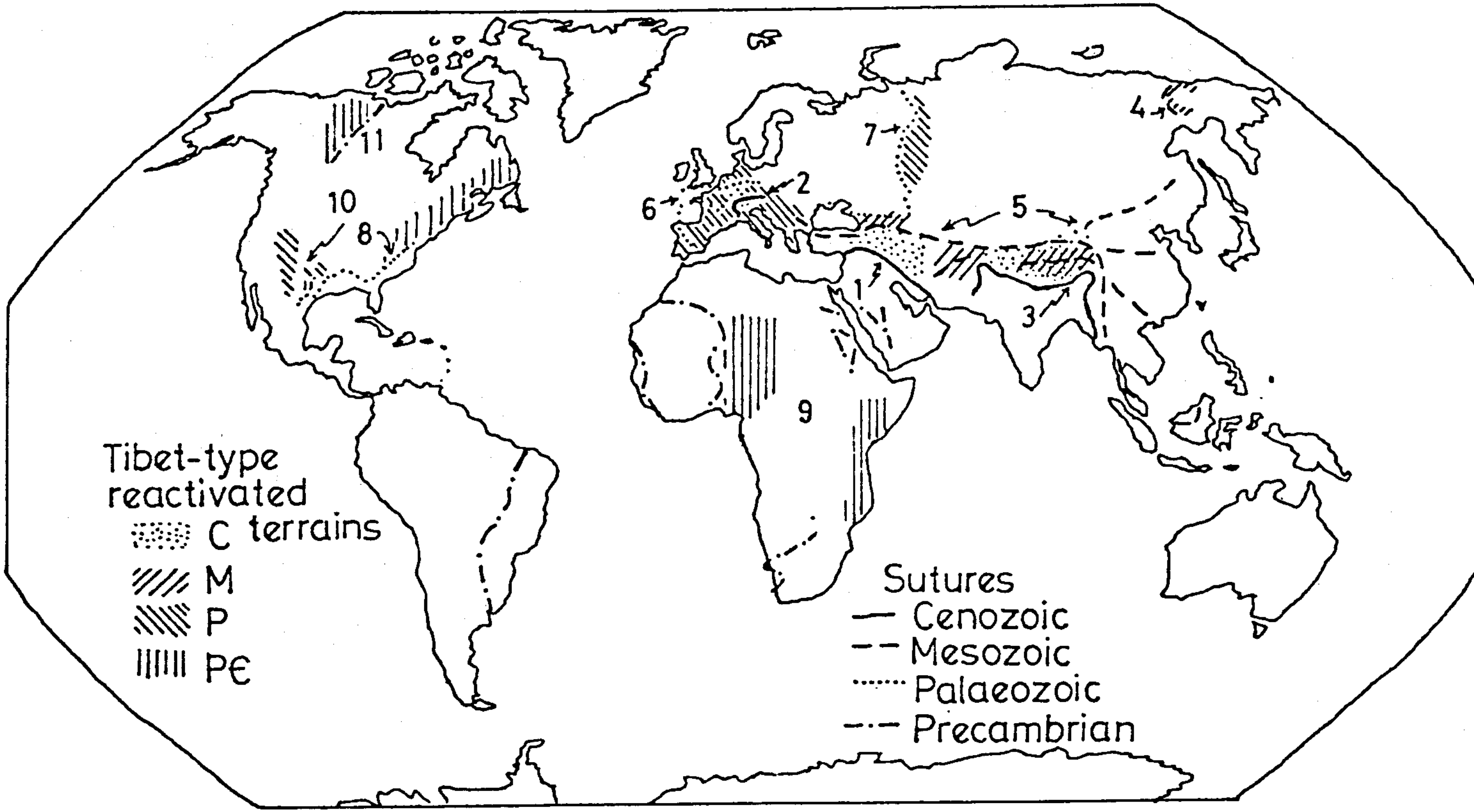

Figure 1. Location of selected Tibetan-type reactivated terrains and suture zones with ages ranging from Cenozoic to Proterozoic. Numbers correspond to those in Table 1.