The Origin and Structuration of the Continental Crust

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It is commonly agreed that the continental crust is generated at subduction zones, although it has long been unclear how exactly this is accomplished. The main problem has been how to separate the silica-rich products of magmatic differentiation from the mafic residues. Various mechanisms involving delamination have been suggested, but none so far could be demonstrated. Another problem with making the continental crust through direct magmatic differentiation is the high ^{18}O ratios in the continental crust, requiring a hydrothermal or erosional/depositional additional step in the production (unless this signature is a later overprint). Our work in the Altaids of Central Asia has shown that some $5.3x10^6$ km^2 of new continental crust was generated by the growth and consolidation of subduction/accretion complexes. New Nd isotopic work in granites intruding the Altaids has revealed that the source regions of these are all close in age to the accretionary prisms which they intrude. Lead isotopes from granodiorites in the Junggar region have shown that these melts are mantle sourced. Analogy with modern subduction/accretion complexes is the surest key to understanding the petrological/ geochemical make-up of their ancient analogues. Accordingly, we have compared the bulk composition of volcaniclastic sediments drilled in those forearcs least affected by continental detritus. Although primitive intra-oceanic arcs (Tonga, Izu-Bonin) shed only moderately enriched sediments, the trace element enrichment in bulk sediments derived from the Central American arc and the mature Nankai arc are notably similar to bulk continental crust. This preliminary work has strenghtened our earlier conclusion that erosion of the silica-rich differentiates from the tops of magmatic arcs, the deposition of these erosion products in subduction trenches and their ultimate tectonic stacking in accretionary complexes prepare the fundamental material out of which the continental crust is formed and further structured. Migration of magmatic fronts into growing subduction/accretion complexes locally remelts them and leads to further differentiation in the cores of mature island arcs or Andean arcs. Both arc activity and ridge subduction lead to pervasive barrovian metamorphism of accretionary wedges and redistribution of fluids and chemical constituents in them. Change of arc character owing to the vicissitudes of the subduction regimes (change in age of subducting lithosphere, change of convergence angle, change of the motion of the overlying plate in an inert asthenosphere reference frame, change of ocean floor roughness including the subduction of basaltic oceanic plateaux, guyots or aseismic ridges) may lead to repeated intra arc shortening, strike-slip or extensional events creating numerous generations of diverse structure families superimposing one another. Terminal, Himalayan type-collisions create Tibet-type high plateaux, in which lithospheric blob detachment leads to remelting and redifferentiation concentrate large-ion lithophile elements into the upper crust, which is the end product of continental crust genesis. Such collisions also generate large, conjugate sets of strike-slip faults and intracontinental block uplifts such as those we see in Asia today. Our model, as summarised here, accounts for all the major geochemical and structural properties of the continental crust since the Archaean and offers opportunities for further detailed testing based on surface observations. Large areas in the earth's continental crust resemble the Altaids in their tectonic history, such as the Pan African system in northeast and north-central Afro-Arabia and large areas of the Gondwanides. Particularly the nature of the Pan-African fragments in the basement of the Eastern Alps is crucial for the understanding the nature of the crust here.

Altersstellung der Palite des Bayerischen Pfahls

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Der Bayerische Pfahl ist Teil eines tektonischen Lineamentes, welches sich in fast schnurgerader herzynischer Richtung über nahezu 150 km von Schwarzenfeld in der Oberpfalz durch das nordostbayerische Grundgebirge, den Bayerischen Wald bis in das österreichische Mühlviertel erstreckt. Der Pfahl wird auf seiner Südseite über weite Strecken von einem Gesteinszug begleitet, der aus unterschiedlichen teilweise mylonitisierten Gesteinen