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Intramontane lacustrine basins in the Siberian Altai: recorders of Cenozoic intracontinental tectonic and climatic events

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The Altai Mountains are part of the vast intracontinental Central Asian orogenic system that formed during the Cenozoic as a distal effect of continued indentation of the Indian plate into the Eurasian continent. In the Siberian part of the Altai Mountains there is ample evidence to suggest that the pre-Cenozoic structural fabric of its basement is a controlling factor in the Cenozoic deformation and development of this intracontinental orogen. We give evidence that important Paleozoic fault zones were reactivated during the Cenozoic, particularly the Late Cenozoic and play a key role in the formation, evolution and current morphology of the Siberian Altai Mountains. Some of these faults are still active and recent and historic movements along them have triggered large seismic events. Late Cenozoic reactivation was expressed as pure thrust, oblique thrust to pure strike-slip faulting, resulting in an overall transpressive tectonic regime. In some cases, as for the graben basin of Lake Teletskoye, local, pure extensional stresses are responsible for its formation as we show in this contribution. Various other intramontane, tectonic basins developed. Some of these are very recent structures (the Teletskoye Basin) and are Pleistocene in age or younger, others have a prolonged history and contain a relatively complete Cenozoic sedimentary section, with evidence of Late Mesozoic precursor basins (Chuya Basin, Dzhulukul Basin). Some of these exhibit indications of marine incursions, but the basins are predom-

inantly continental. The development of these basins is clearly associated with the location and Cenozoic reactivation of aforementioned long-lived fault zones in the Altai tectonic assemblage. Many of these basins accommodated fresh water lakes during their evolution and some are still the site of contemporary mountain lakes. Their stratigraphy, as well as the sedimentary architecture and basin morphology is manifestly influenced by and progresses with the stages of (Late) Cenozoic intracontinental mountain building and erosive denudation of the growing mountain ranges. Together with the clastic sedimentary input and the provenance characteristics, the intramontane Altai basin deposits are affected by evolving climatic conditions. These conditions dictate the main mode of erosion and transport, influence the sedimentary facies and supply rate and create the framework for a specific biocoenosis signature found in the fossil record. Our contribution reviews the data obtained over the last years from a selection of intramontane lacustrine basins in the Siberian Altai Mountains. We direct our attention in particular to the Teletskoye basin, the Chuya-Kurai Basin and the Dzhulukul Basin. We combine sedimentologic-stratigraphic data with basin architecture and morphology, and with basement geochronologic-thermochronologic constraints (apatite fission-track, U/Pb and Ar-dating) in order to show the potential of these basins as recorders of Cenozoic tectonic and climatic events in relation with basement features. While for example the data obtained from the Chuya Basin yields a continuous Cenozoic picture of deformation and climatic evolution of the Altai area, data from the Teletskoye Basin zooms in with higher resolution on the Pleistocene to Recent history. In general, all data point towards intensifying tectonic reactivation and mountain building of the Siberian Altai Mountains since the Middle Cenozoic, with clear peak activity in the Pliocene to Recent. This is demonstrated by the molasse-type deposits in these basins, and by thermochronologic constraints. This activity is ongoing and structural, (paleo)seismic, geomorphologic and sedimentologic data corroborates this. The lacustrine Altai basins provide a record for a more or less continuous progressive cooling and aridification of the Altai area during the Cenozoic as manifested in the pollen fossil assemblages found in the Altai sediments.