craton and Novosibirsk–Chukotka microcontinent collision.

The northerly vergent nappes structure formed during early substage of collisions in Valanginian to Houterivian times. The nappe roots in the modern structure were tectonically overlapped by island arc sequences of the Alazeya–Oloy belt. The orthogonal collision has changed into the oblique collision during the second half of the Early Cretaceous. The dextral transpressional strike-slip faults assemblages formed during this substage.

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Structure of the inner part of the Verkhoaynsk–Kolyma collision orogen (North–East Asia)

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The Verkhoyansk–Kolyma arcuate orogen (Kolyma loop) originated as a result of Mesozoic collision of Verkhoyansk continental margin of the North Asian craton with the accreted structures (terranes) of different age in the east, making up composite Kolyma–Omolon microcontinent (superterrane) (Parfenov 1991). The Verkhoaynsk continental margin is transformed into the Verkhoyansk fold-thrust belt which represents outer part of orogenic structures (Parfenov 1991, Prokopiev 1998). The inner part of the mentioned orogen constitutes the Chersky collision belt (Oxman 1998). Western zone of collision belt is formed of Late Paleozoic-Triassic terrigenous turbidite deposits of Kular–Nera slate belt and Tuoctakh block which was overlapped by synaccretional Jurassic formations of Inyali–Debin and Polousnyi sinclinoria. In the eastern axial zone of collision belt blocks of Paleozoic deposits are notable, which in former times composed the single Omulevka microcontinent, stacked allochthons of ophiolite and different metamorphosed blocks, belts of collision granites and Uyandina–Yasatchnyi volcanic-plutonic belt.

Structure of the Chersky collision belt formed during the process of some deformational stages. Early thrust-folds assemblages are connected with accretion of different structures and formations of composite Kolyma-Omolon microcontinent and its convergence with Verkhoyansk continental margin (Middle Jurassic). The initial accretion stages are manifested in eastern and axial parts of the belt of polymetamorphic slates and ophiolite obductions to the blocks of Paleozoic rocks, with formation of frustrated allochthons. Significant crust thickening and formation of large nappes overlaps induced rock recrystallization in greenschist facies at low pressure to northern and central parts of the belt and at medium pressure in southern regions. In the western part of the belt, at the same time olistostromes, different synsedimentary melanges of thrust kinematics are under formations. Calculated values of shortening, with nappes and thrust dislocations for separate blocks, made of Paleozoic rocks, are 55–65 %, and for the formations of Polousnyi synclinorium and Tuostakh block – 35–45 %. In eastern parts of the belts nappe-thrust front corresponded to emergent thrust front type (classification, Morley 1986), and thrust deformations, developed in western outer part of the belt occurred almost at the same time from fronts, occurred in underwater settings, or buried fronts of thrust. Strictly collisional assemblages and deformation structures of the next stages show combined kinematics. They originated as a result of transpression and oblique collision of Kolyma–Omolon microcontinent and Verkhoyansk continental margin (Oxman and Prokopiev 1996), and the rotation of convergent structures (Didenko and Bondarenko 1998, 2000) (Late Jurassic––Neocomian). Early thrusts, located to the axial part of collision belt are transformed to the faults with combined strike-slip and upthrow kinematics. The synchronous major folds have enechelon arrangement of the axes coinciding with the changing fault orientations. Such folds deform the earlier thrusts, nappes, recumbent folds and ophiolite sheets. In north-western and south--eastern segments of the belt such faults have right and left lateral components respectively. In the central part of the belt syncollisional pull-apart basin was formed, where Uyandina--Yasatchnyi volcanic–sedimentary rocks were accumulated. Compression vectors on oblique collision are oriented at different angles to convergent boundaries which causes the transpression and locally transtension mechanism to operate. This, may explain the combined kinematics of the second stage faults and their transformation in different parts of the region. Synchronous with this deformation was squeezing out of the rock material in the lateral direction to form the "palm-tree" structures (Oxman and Prokopiev 1996).

At the final stage of Late Mesozoic development of the region (second half of Neocomian) in south-eastern and central segments of the collision belt faults with strike-slip and thrust-strike-slip kinematics were formed, having had as a whole similar stretches with previously formed structures and thrust-strike-slip dislocations in north-eastern part of the region. Deformation data seems to be connected with the closing Anyui–Angayucham ocean, located north-eastwards of the examined region and subsequent collision of Novosibirsk–Chukotka microcontinent with newly formed Siberian continental margin (Parfenov 1991, Sokolov et. al. 1998, 2000)

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Lateral variations of deformation and exhumation modes across the "Sillaro Line" in the Northern Apennines

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The late Pleistocene and Recent tectonics in the Emilian Northern Apennines is controlled by normal faults, as firstly recognized for the Bologna area (Bertotti et al. 1997). The main features consist of a SW dipping master fault, located close to the foothills, and some antithetic faults more to the South, separating grabens occupied by the uppermost unit (Epiligurian deposits) and horsts, where the lowermost unit occur (the Tuscan unit).The most prominent horst correspond to the watershed (Page 1963). Moving along strike toward the Romagna Northern Apennines an important change in the structural style occur. In the western Romagna, the master fault is confined south of the watershed (Mugello fault) and the whole exteral Apennines participate to the footwall uplift. This lateral variation coincide to the so-called Sillaro Line, a longitudinal flexure allowing major subsidence to the West (Emilia Apennines) during Miocene to Pliocene.

The passage from a compressional to an extensional regime occurred during the early to middle Pleistocene. Backtracking the first horizon clearly sealing the compressional structures (the Sabbie di Imola) up to the master fault produces a reliable assessment of the pre-extensional topography and hence of the extension-related exhumation. This approach has been compared to the maximum exhumation reconstructed by apatite fission track carried out in the Romagna Apennines (Zattin 1999). The Emilia exhumation profile has been reconstructed by means of geological data integrated with vitrinite profiles of some deep wells.

The final result has been projected over a topographic map. There is a clear correspondance between the exhumation rates and the topography, the highest Apennines being characterized by a 3 mm/year of exhumation. In the northern Apennines these rates doubled passing from the Pliocene thrust-related (maximum 1.5 mm/year) to the extension-related exhumation. Trace of this change can be found in the deeply incised meanders of the Romagna rivers (e.g. the Santerno river). Incised meanders characterize also the thalweg of some rivers crossing uplifted blocks in the Emilia Apennines (e.g., the Scascoli gorge in the Savena river). Wide terraced intramontane valleys characterize the structural depressed areas, whereas the uplifting blocks of the pedeapennine border show narrow gullies.

Lateral changes of extensional style strongly control the Sillaro river, whose intramontane valley is deflected by the delay ramps connecting the two differently deformed segments.

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