We discovered petrological observations that probably can be evidences of a much higher pressure at Belomorian eclogite formation:

(1) Were discovered oriented quartz rods in omphacite, which usually interpreted as exsolution structures of a supersilicic clinopyroxene during decompression of ultra-high-pressure eclogites [Katayama et al., 2000; Tsai, Liou, 2000].

(2) Integral composition of omphacite with quartz rods is identical with dendritic clinopyroxene-plagioclase symplectite with a “single grain” structure and have Ca-Eskola end-member about 5 mole percent.

(3) Jadeite content of omphacite corona around a magmatic clinopyroxene in a silica-poor olivine gabbronorite dykes reaches up to 55-60 mole %. Probably in this case the omphacite had a higher concentration of jadeite because external rims of coronas are composed by symplectite of omphacite, oligoclase with corundum and/or spinel.

(4) Equilibrium mineral paragenesis of Grt+Omph+Opx in orthopyroxene-bearing eclogite over silica-poor gabbronorite gave 22,4 kb at 800 °C by using Grt-Opx geobarometer [Harley, 1984].

(5) Lonsdalite was discovered in the eclogite boudin from Gridino area [Volodichev et al., 2006].

SESSION NO. 36, 14:30

Thursday, 7 October 2010

Aegean geodynamics and extensional tectonics. Part 2 (*Ege bolgesinin jeodinamik evrimi ve gerilmeli tektonikte güncel problemler*)

METU Convention and Cultural Centre, Salon B

36-1 14:30 Isik, Veysel

CENOZOIC EXHUMATION AND SEDIMENTARY BASIN FORMATION IN THE MENDERES MASSIF, WESTERN TURKEY

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New studies of the Menderes massif, western Turkey, improve our knowledge on the Cenozoic extension of Aegean region and contribute to understanding of the tectonic exhumation of mid-crustal rocks of the Tauride-Anatolide platform. Yet sedimentary basin formation in western Turkey during the exhumation of the Menderes massif provides important clues about the process; especially, lithological compositions of the boulder and cobble conglomerates indicate geological position of the source rock area. Basically, exhumation of the Menderes massif is controlled by normal faultings along the Datca-Kale main breakaway fault, Simav, Alasehir and Buyuk Menderes detachment faults. These faults juxtapose non-metamorphosed or metamorphosed from low-grade rocks to high-grade metamorphic and intrusive rocks.

The earlier period of crustal extension in western Turkey and exhumation of the Menderes massif have been handled by the Datca-Kale main breakaway fault and its northern continuation Simav detachment fault. In the hanging wall of the main breakaway fault, Oligocene Kale basin fill contains basal conglomerates originated mainly from rocks of the Lycian nappes. The upper sections of the basin fill, however, include fragments of the metamorphites (mainly marble) from Menderes massif. The footwall of the Simav detachment fault consists of high- and medium-grade meta-sedimentary and meta-igneous rocks (e.g. paragneiss, orthogneiss, schist, amphibolite, quartzite and marble) and granitoids with variably mylonitic and cataclastic in nature. Top-to-the N-NE shear sense indicators in the Datca-Kale main breakaway fault and Simav detachment fault suggest that exhumation of the Menderes core complex was initiated as an asymmetric core complex. Furthermore, this indicates that the Menderes massif was exhumed to be a source rock area for Kale basin during Oligocene.

Normal faulting would follow in the Early Miocene. Opposite-dipping two detachment faults, named the Alasehir and the Buyuk Menderes detachments, led to further uplifting the core complex and contributing to exhumation of the central Menderes massif and forming of approximately E-W-trending half-grabens. Early Miocene deposits of these half-grabens and coeval N-trending basins include boulders and cobbles with mylonitic textures representing rocks of the core complex. This shows that the Menderes massif has already been exhumed along Datca-Kale Main breakaway fault and Simav detachment fault and reached up to the erosion level. Post-Miocene basins, therefore, can not be related to the first exhumation stage, even if some of them are located on the corrugations of the Simav detachment.

36-2 14:50 Oner, Zeynep

SYN-EXTENSIONAL FAULT GENERATIONS AND THEIR ROLE ON THE LATE CENOZOIC ALASEHIR SUPRADETACHMENT BASIN EVOLUTION IN THE MENDERES METAMORPHIC CORE COMPLEX, WESTERN TURKEY

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The Menderes metamorphic massif (MM) in western Turkey is the largest core complex in the Aegean extensional province. It includes exhumed high-grade metamorphic rocks of Gondwana origin intruded by metaluminous to peraluminous granitoid plutons. Late Cenozoic structural grabens (Alasehir, Büyük Menderes) bounded by high-angle and seismically active faults crosscut the MM and are filled with Quaternary sediments. The E-W-trending Alasehir basin represents a well-preserved supradetachment basin with the N-dipping Alasehir detachment fault separating metamorphic rocks of the MM and the syn-extensional Salihli granitoid from the overlying Miocene and younger sedimentary rocks. The nearly 100-m-thick cataclastic shear zone beneath the detachment surface contains S-C fabrics, microfaults, Riedel shears, and shear bands, all consistently indicating top-to-the NNE shearing. The Miocene Salihli granitoid intruding the MM and the detachment surface displays mylonitic textures and ductile-brittle structures (microfaults, asymmetric objects, mica-fish, pressure shadows), all consistent with also top-to-the NNE extensional shearing. The oldest sedimentary rocks overlying the Alasehir detachment surface are the Lower Miocene lacustrine shale-limestone units (Gerentas, Kaypaktepe units) overlain by the Middle-to-Upper Miocene fluvial and alluvial fan deposits (Acidere and Gobekli units). Extensive occurrence of these alluvial-fluvial sedimentary rocks indicates a surge of clastic deposition along the northern edge of the core complex associated with the onset of range-front faulting in the MM by the late Miocene. Plio-Quaternary lacustrine-to-alluvial deposits (Yenipazar, Asartepe, and Erendali units) unconformably overlie the Neogene sedimentary units. The continued uplift of the MM provided the necessary relief and detrital material for the Plio-Pleistocene fluvial systems in the Alasehir supradetachment basin (ASDB). Quaternary alluvium fills the modern Alasehir graben bounded by a seismically active N-dipping, high-angle fault. We classify four different fault generations controlling the deposition, basin geometry and internal deformation in the ASDB. The Alasehir detachment fault (F1) is a N-dipping, low-angle corrugated fault plane with turtleback structures at the surface. E-W-striking, km-scale major high-angle faults (F2) crosscut and offset the detachment fault along the southern section of the basin. These faults strongly controlled the deposition of the Upper Miocene-to-Plio-Quaternary sedimentary units and resulted in significant changes in their dip angles and directions due to block rotation and tilting. The E-W-striking, low-angle normal faults (F3) mimic the geometry and kinematics of the N-dipping Alasehir detachment fault, and occur both in its footwall and hanging wall blocks during the basin evolution. Crosscutting relationships between the F2 and F3 fault generations indicate that high-angle normal faulting was a continuous mode of extension as the MCC continued its exhumation during the late Cenozoic. N-S-striking, high-angle scissor faults (F4), which crosscut the MM, the detachment surface and the basinal strata, caused differential uplift between individual rotational fault blocks showing different structural architecture. Strike orientations of sedimentary units adjacent to these scissor faults show significant changes due to rotational deformation along the N-S-striking, oblique-slip, high-angle scissor faults. The Neogene sedimentary rocks indicate higher amount of rotational deformation in the southern section of ASDB. Higher dip angles in the lower to upper Miocene units in comparison to shallower dip angles in the Plio-Pleistocene Yenipazar and Asartepe units are a result of progressive rotational deformation along F2 and F4 faults. Horst-graben structures, extensional drag folds, growth faults and folds are commonly seen in the basinal strata, but no true contractional folds or reverse faults have been observed along the southern flank of the Alasehir supradetachment basin. We interpret a few N-S-striking reverse fault planes as the extensions of range-perpendicular scissor faults. This fault kinematics and the distribution of range-parallel and range-perpendicular faults had a major role in the development of the shape and depth of the accommodation space within the ASDB, and controlled the deposition patterns and fluvial drainage systems. Local unconformities formed as a result of differential extension and uplift rates within the basin. There is no evidence for large-scale contractional deformation or major interruptions in the syn-extensional deposition history of the ASDB, and therefore we rule out the pulsed-extension models that suggest a period of contractional deformation in the late Cenozoic evolution of the MM. We conclude that the late Cenozoic extensional deformation was a continuous process controlled by four different fault generations and their kinematics affecting the syn-extensional deposition and overall basin evolution in western Turkey.

36-3 15:10 Kurt, F. Serap

ALTERNATIVE CENOZOIC EXHUMATION HISTORY OF THE KAZDAG CORE COMPLEX, WESTERN TURKEY

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Kazdag core complex is located on the north of Edremit gulf. The core complex consists of high-grade metamorphic rocks and granitoid intrusions. Detailed field observations and microstructural studies indicate that two different detachment faults play important role on the exhumation of Kazdag core complex.

The first detachment fault, called Selale detachment in the literature, separate from rocks of the Cetmi melange to metamorphic and granitoid rocks and has dominant top- to-the N sense of shearing. The second detachment fault, named as Yesilyurt detachment in this study, is a low angle normal fault at the present. It juxtaposes Lower Miocene Kucukkuyu formation to Cetmi melange. The shear sense kinematic indicators display top-to-the south sense of shearing. This detachment was probably high angle normal fault during the opening of E-W trending Edremit graben and control the deposition of Kucukkuyu formation and then it is rotated to the present low angle position. The basal conglomerates of Kucukkuyu formation contain fragments originated from metamorphic rock of the core complex and rocks of the Cetmi melange, which suggest that the Kazdag massif was already on the surface during the deposition of Kucukkuyu formation. The last tectonic episode is characterised by the strike-slip faults postdating the Yesilyurt detachment fault.

As a result, it can be speculated that the Selale detachment could be related structurally to the Datca-Kale main breakaway fault and its northern continuation Simav detachment. If it is true, the ophiolitic rocks constituting the upper plate attributed to Izmir-Ankara suture zone behave as a rootless unit in the extensional tectonic history of western Turkey.

Keywords: Kazdag, Core complex, Aegean region, Edremit graben, detachment fault

36-4 15:50 Bonev, Nikolay

REGIONAL TECTONICS AND 40AR/39AR TIMING OF CRUSTAL EXTENSION IN THE EASTERN RHODOPE MASSIF, BULGARIA-GREECE, AND MESOZOIC-CENOZOIC GEODYNAMIC EVOLUTION OF THE NORTH AEGEAN REGION

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We synthesize here the Mesozoic-Cenozoic evolution of the eastern Rhodope Massif, and provide a tectonic framework and 40Ar/39Ar age constraints for the processes involved during crustal extension in the north Aegean region. Triassic rifting has its magmatic expression in proto-ophiolitic metamafic rocks of the Serbo-Macedonian and the western Rhodope massifs, whereas it is scarcely represented by Permo-Triassic near-margin sediments in the eastern Rhodope Massif. Triassic-Jurassic rift propagation into the Carpatho-Balkan and Hellenic domains of the Maliac-Meliata oceanic basins and its southward intra-oceanic subduction has created near to the Rhodope margin an Early-Middle Jurassic intra-oceanic arc and established on the upper plate the Vardar ocean in a back-arc setting. Both island arc and associated Triassic-Jurassic sedimentary units were thrust northwards over the Rhodope high-grade basement in the late Jurassic ($^{40}Ar/^{39}Ar$ ages 154-157 Ma) during an arc-continental margin collision. This event contributed to the Mesozoic, paleoalpine crustal thickening. The late Jurassic thrust sheet forms the uppermost Mesozoic low-grade unit (greenschist to sub-greenschist facies) that we correlate with the Circum-Rhodope Belt. Underlying are an upper, high-grade basement unit lithologically heterogeneous unit (diverse in age) and the lower unit of high-grade basement composed of orthogneisses with Permo-Carboniferous protoliths. These two latter units are involved in south-directed ductile nappe stacking in amphibolite facies and related to the subduction (of the Vardar ocean) reversal towards the north since the Middle Cretaceous. Cretaceous nappe stacking further contributed to crustal thickening in the region. The Cenozoic tectonics is dominated by the extensional collapse of the Alpine orogen and the formation of detachment-bounded core-complex type metamorphic domes in Bulgaria and Greece. The domes expose the lower high-grade basement unit in the footwall, with the hanging wall consisting of the upper high-grade basement unit and the Mesozoic low-grade unit. Unmetamorphosed syn-tectonic Paleocene-Eocene sedimentary rocks and post-tectonic Oligocene sedimentary and volcanic units represent cover successions. The Kesebir-Kardamos dome displays NNE-directed ductile to brittle shear fabrics overprinted by brittle extensional shearing in the footwall mylonites and the bounding detachment. The Byala reka-Kechros dome exhibits the same structural pattern as the Kesebir dome in the footwall mylonites and the bounding detachment, but with a SSW-directed extension. This structural feature reveals a partitioned kinematic flow direction, likely related to a transfer fault linking the opposite sense detachment systems in both domes at a high crustal level. In the Byala reka-Kechros dome extension direction inherited the kinematic direction of the Cretaceous nappe stacking. In both