TECTONIC SETTING OF SOME PALAEOZOIC METAMORPHICS IN NORTHERN ANATOLIA, TURKEY

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ABSTRACT

In northern Anatolia along the Izmir-Ankara-Erzurum Suture, the low-grade metamorphics display strong protolithologic similarities. However, the classification of these metamorphics with respect to their protolithological stratigraphy, internal organization, age and boundary relations are still not clear due to limited number of metamorphic studies.
Amasya region in NW Central Anatolia is selected and studied to shed some light onto the metamorphic problem in northern Anatolia.
Tectonostratigraphically, three distinctly different metamorphic rock assemblages are differentiated on the basis of their internal organizations and protolithologies, as bottom to top; 1) grayish-black schists with quartz boudins and veins, 2) green schists, 3) green schists with marble blocks and/or boudins. The lower unit is originally a clastic sequence, made of shales, sandstones, cherts and calcareous clastics. It is tectonically overlain by green schists protoliths of which are volcanic and carbonate rocks. The upper unit, composed of huge mar-ble blocks and/or lenses embedded within a volcanic sequence.
The protoliths of greenschist facies metamorphics are interpreted as a magmatic arc-related basinal being metamorphosed by regional dynamothermal metamorphism during pre-Permian. These metamorphics can protolithologically be correlated with Agvanis and Yenise-hir low-grade metamorphics which all are believed to be in Carboniferous age.

INTRODUCTION

Overprinting of series of geological events caused complex terrain evolutions in northern Anatolia. As a result, it is hard and problematic to differentiate the dis-continuous and scattered metamorphic units situated to the north of Izmir-Ankara-Erzincan Suture (Fig. 1).

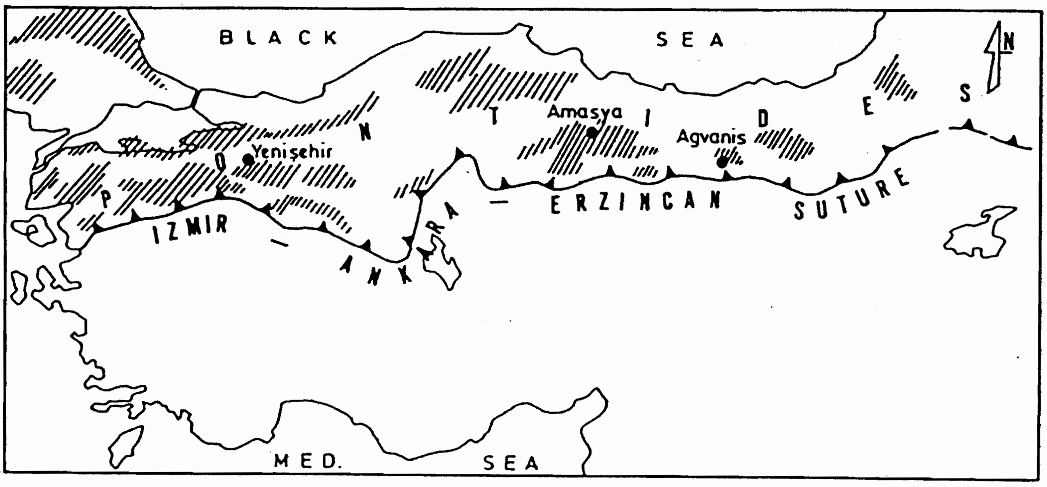

Fig. 1- Distribution of metamorphic rocks in northern Anatolia,situated to the north of Izmir-Ankara-Erzican Suture, irrespective to age (modified from Brinkman, 1976).

Exposures of the metamorphics are widespread in the Pontide belt (Fig. 1) (Blumenthal, 1950; Nebert, 1961; Alp, 1972; Bingol et al., 1975; Erk, 1975; Seymen, 1975; Brinkman, 1976; Ayaroglu, 1979; Kocyigit, 1979, 1987; Krushensky et al. 1980' Ozcan et al., 1980; Sengor et al., 1980' Senturk and Karakose, 1981; Tekeli, 1981; Okay, 1983, 1984; 1989; Akyurek et al., 1984; Korkmaz and Baki, 1984; Goncuoglu et al., 1987; Yilmaz et al., 1989; Bozkurt, 1990; Okay et al., 1990; Kocyigit et al., 1991; Rojay, 1993; Genc and Yucel, 1995).

However, the differentiation of the metamorphics with respect to their protoli-thological stratigraphy, internal organization, age and boundary relations and tectonic settings are still not clear due to limited number of studies with well-defined petrogra-phy, geochemistry, petrofabric analyses and radiometric dating.

Various authors had proposed different age and boundary relations (Ozturk, 1979; Genc et al., 1986; Yucel et al., 1989; 1995; Genc and Yucel, 1995; Kocyigit, 1991; Kocyigit et al., 1991) different tectonic setting to the metamorphics and, there-fore different scenarios to the evolution of the Tethy's in northern Anatolia (Bailey and McCallien, 1953; Bingol et al., 1973; Sengor et al., 1980, 1984, 1988; Guvenc and Konuk, 1981; Sengor and Yilmaz, 1981; Tekeli, 1981; Yilmaz et al., 1982; Sen-gor, 1984; Okay, 1989; Okay et al., 1990; Kocyigit et al., Genc and Yilmaz, 1995; Yucel et al., 1995).

Here, the metamorphic sequences will be stratigraphically and petrographically documented with the field data from Amasya region that may shed some light onto the evolution of metamorphics in northern Anatolia regarding to the age, boundary relations and possible tectonic setting of metamorphics.

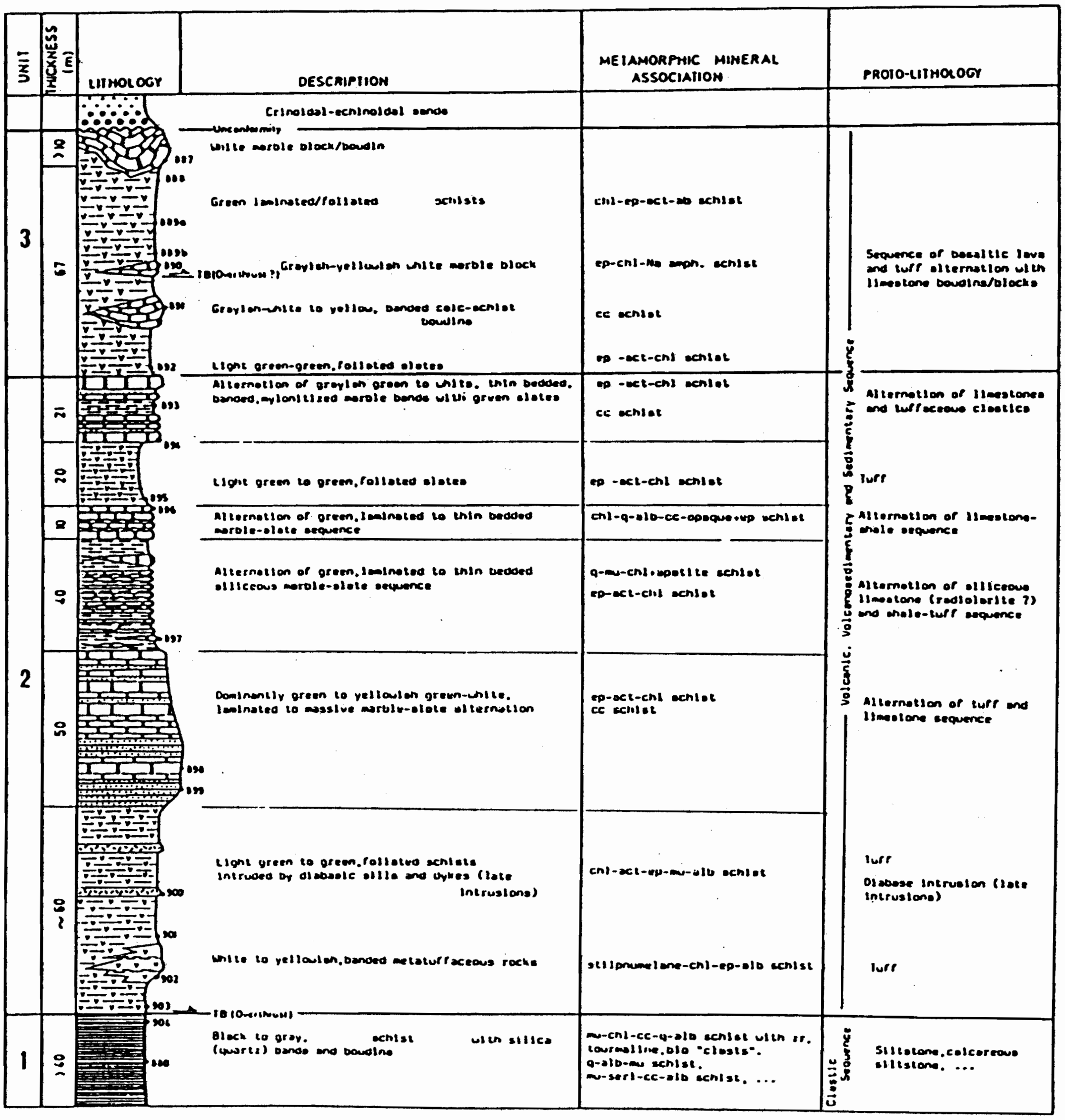

Fig. 2- Measured reference section of the low-grade metamorphics in Amasya (Locality: southern slope of Karasanlar ridge, E of Amasya).

TECTONOSTRATIGRAPHY

The metamorphics which are one of the basement units of the Mesozoic se-quences in Pontides consist dominantly of metavolcanic, metapyroclastic and meta-volcaniclastic rocks, metaclastic rocks and metacarbonates-meta-cherts with a mini-mum observable thickness of about 310 m.

Tectonostratigraphically, three distinctly different metamorphic rock assem-blages are differentiated on the basis of their internal organizations and protolitholo-gies. These subunits depending upon their protolithologies are: (1) Grayish-black schists with quartz boudins and veins, (2) Green schists, (3) Green schists with mar-ble blocks and or boudins (Fig. 2).

In the measured section, the sequence starts with the grayish black and in-tensely deformed schists which are included in muscovite-chlorite-calcite-quartz-albite schist having zircon, tourmaline and biotite clasts experienced a schistose texture (meta-clastic), muscovite bearing quartz schist, muscovite±albite±chlorite-quartz schist with schistose texture (meta-chert), quartz-albite-muscovite schist with schistose texture (meta-pelitic rock) and tourmaline bearing chlorite-sericite-albite calcschist with slaty cleavage (meta-carbonate siltstone) paragenesis. This facies is characterized by the presence of slaty structure and quartz (silica) boudins (Fig. 2).

Tectonically, the sequence continues with light green-green foliated slates (chlorite-actinolite-epidote-muscovite-albite schist with schistose texture) with a metatuffaceous unit (stilpnomelane-chlorite-epidote-albite schist with schistose tex-ture) and is followed by dominantly green-yellowish green-white massive to laminated marble-slate alternation (epidote-actinolite-chlorite schist with nematoblastic chlorite and Na-amphibole). Green, thin-bedded to laminated siliceous marble and marble alternating with green slates (epidote-actinolite-chlorite schist, quartz-muscovite-chlorite ± apatite schist and chlorite-quartz-albite-calcite ± epidote ± opaque schist with schistose texture) grades upward into green foliated schists (epidote-actinolite-chlorite schist with nematoblastic texture) and to thin laminated, banded, mylonitized marble bands (chlorite-albite-calcite ± pyrite clac-schist with schistose structure) alter-nating with green slates (epidote-actinolite-chlorite ± albite schist with schistose tex-ture).

The top of the sequence consists dominantly of green-light green thin bedded-laminated schists (chlorite-epidote-actinolite-albite ± leucoxene schist rich in Na-amphiboles with nematoblastic texture, epidote-chlorite-Na-amphibole an epidote-actinolite-chlorite schists with nematoblastic texture) with dismembered grayish white-yellow marble blocks and/or boudins (Fig. 2).

In other sections, the following paragenesis are obtained green biotite bearing chlo-rite-actinolite-calcite-albite ± epidote ± sphene schist with schistose structure (meta-tuff), green biotite-bearing epidote-actinolite-albite-shpene schist with lepidoblastic texture (meta-diabase), chlorite-actinolite-albite ± epidote ± sphene schist with porphy-roblastic texture (meta-tuff), epidote-actinolite-albite ± muscovite ± sphene schist with lepidoblastic texture (meta-gabbro), epidote-chlorite-actinolite-albite ± shpene schist with lepidoblastic texture (meta-diabase), actinolite-albite-epidote ± biotite ± sphene (few) schist with lepidoblastic texture (meta-"gabbroic" rock), epidote-actinolite-albite ± green biotite ± sphene ± chlorite schist with schistose texture (meta-volcanic rock), actinolite - epidote-albite ± sphene ± green biotite ± chlorite schist with relict vol-canic texture (albite-epidote filled amygdaloidals) (meta-pillow basalt).

In addition to above mentioned protoliths, green meta-cherts (some are radiolarian cherts with poorly preserved radiolaria tests) are significant facies of the metabasics.

The schistose texture is observed in meta-tuffs and meta-sedimentary rocks, lepidoblastic texture in meta-diabasic-gabbroic rocks, porphyroblastic texture in meta-tuffs with nematoblastic chlorite and Na-amphibole. The bedding attitudes and schis-tosity planes have conformable attitudes and the pillow structures of the basalts are well preserved as well. However, cataclastic and mylonitic textures are also well de-veloped at the contacts of various different meta-facies.

CORRELATION, AGE RELATIONS AND INTERPRETATION

Some metamorphics are correlative units in the northern Anatolia especially the Agvanis metamorphics (Okay, 1984; Rojay, 1985), Tokat metamorphics (Blu-menthal, 1950; Alp, 1972; Ozcan et al., 1980; Rojay, 1993) and Yenisehir meta-morphics (Genc et al., 1986; Yilmaz et al., 1989; Kocyigit et al., 1991) on the basis of degree and type of metamorphism, protolithostratigraphy, tectonic and stratigraphic setting. However, the controversial, confusive and misusage of the nomenclature, especially the "Karakaya" terminology, cease most of the studies from a regionwide correlation.

The widely excepted age for the low-grade metamorphics in northern Anatolia is pre-Liassic due to regionwide Liassic discordance.

However, the equivalent low-grade metamorphics in the northwestern Anatolia are unconformably overlain by Triassic clastics (Krushensky et al., 1980; Gence et al., 1986; Kocyigit et al., 1991) and by Permian clastics and carbonates (Genc et al., 1986; Goncuoglu et al., 1987). Studies carried out on the fragments of Triassic clastics showed that Carbonif-erous and Permian age fragments are present besides the metamorphic quartz and rock fragments (Kocyigit et al., 1991; Rojay, 1993).

An age of 272±3 Ma is obtained by K/Ar radiometric dating from the granitioids having cross-cutting relationship with low-grade metamorphics (Cogulu and Krum-menacher, 1967). Therefore the age of the metamorphism should be older than age of the granitic intrusions which is early Permian.

Collectively, the metamorphics should be older than Permian, based on the overlying Permian sedimentary units and cross-cutting relationship with granitoids. However, the regional considerations and correlations with protolithologically similar, fossiliferous equivalent units in Kutahya-Bolkardagi Belt (Goncuoglu et al., 1992; Goncuoglu, this volume) indicate that the deposition and metamorphism of the as-semblage will be contemporaneous with Carboniferous.

Depending on the protolithology of the sequence, various facies of the meta-morphics were deposited in a basin where intense subalkaline to alkaline basaltic volcanism was active. The extensive distribution of mafic volcanics with pillow basalts and possible radiolarites (pelagic influx) may manifest a deep sea depositional set-ting in an active continental marginal basin (Dickinson and Selley, 1981). Therefore these metamorphics can be interpreted as a magmatic arc related basinal sequences which were resulted from a regional dynamothermal metamorphism in green schist facies.

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