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THE MATURITY OF ORGANIC MATTER IN SOUTHALPINE SEDIMENTS ALONG THE TRANSALP PROFILE

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Data obtained from analysis of the maturity of organic matter during oil exploration activities are excellent indicators of the thermal evolution of sedimentary basins. The most commonly used maturity parameters are obtained from optical analysis of kerogen and Rock-eval pyrolysis on ground samples with a high organic matter content. The parameters used, are vitrinite reflectance (a component of carbon) expressed in Ro%, the Thermal Alteration Index (TAI – calculated on spores and pollens), and the Tmax parameter (expressed in °C and corresponding to the temperature at which there is maximum generation of hydrocarbons during pyrolysis of kerogen with standard heating rate).

These parameters are highly sensitive in the 60–200°C temperature range and record heating events that have affected the organic matter contained in the sediments for a suitable length of time. They also allow the sedimentary and/or tectonic burial history to be reconstructed by means of suitable simulations. Indeed, knowing this history is fundamental in reconstructing crustal processes.

The structural pattern of the sector of the Southern Alps crossed by the TransAlp profile is characterised by the presence of WSW-ENE trending compressional structures involving previous Mesozoic extensional structures. Predominantly Permo-Triassic sediments outcrop in the most internal sector of the chain above the Varisian crystalline basement and the Permian volcanic coverage; in the central sector there are units from the Upper Triassic and Cretaceous; more recent sediments are present in the synclines of the central sector and at the boundary of the chain.

In order to reconstruct the thermal history, samples, aged between the Permian and Miocene, were analysed; in areal terms, the samples are from sedimentary units outcropping in the chain and from units drilled by exploration wells located in the area of the chain (Sedico 1), at its buried boundary (Nervesa 1) and in its Veneto-Adriatic foreland (Legnaro 1 Dir and Assunta 1).

Almost all the maturity data is stratigraphically concentrated in the intervals with the highest organic matter content: Formazione a Bellerophon (Upper Permian); Formazione di Moena, Formazione di Livinallongo (Plattenkalke and Baenderkalke Members), Arenarie di Zoppè (Middle Triassic); Formazione di Igne (Liassic); Marne a Fucoidi (Aptian-Albian); Marne di S. Donà (Middle-Upper Miocene).

Profiles with maturity data arranged in series are provided by wells drilled in the Veneto plain, vertically ranging from the Middle Jurassic to the Eocene (Sedico 1) through the Miocene (Nervesa 1), from the Upper Permian to the Oligocene (Legnaro 1 Dir), and from the Carnian to the Lower Cretaceous (Assunta 1). In the Southalpine belt maturity series can be reconstructed for the Agordo area (Permian-Ladinian).

The burial histories and relative thermal evolutions of each area in this sector of the Southern Alps mainly depend on their position during the Mesozoic extensional stages (progressive burial stage). In the foredeep and foreland areas the signal produced by the different arrangement during

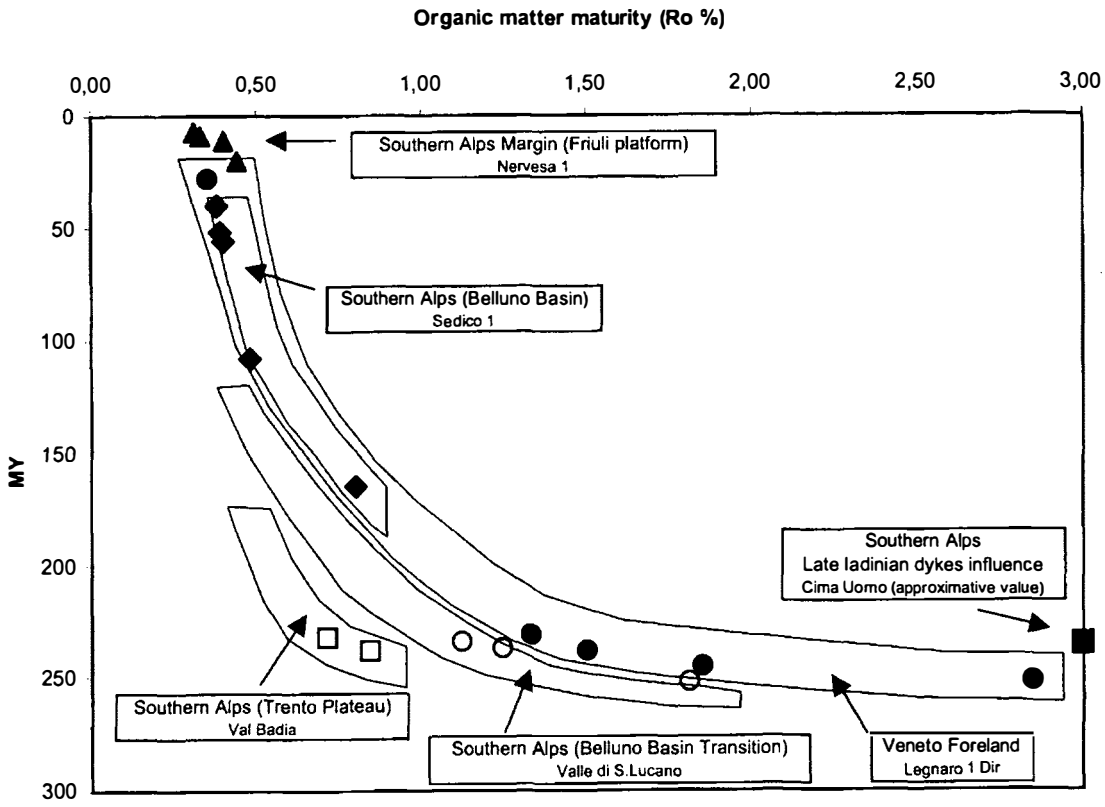

Fig. 1: Organic matter maturity for different thermal evolutions

the alpine compressional stages (further burial or partial exhumation stage) overlies that signal.

The distribution of the available maturity values in the Southalpine belt indicates an area in the south (Agordo area) that is tendentially maturer than the central-northern area (Marmolada and Val Badia). In the Agordo area the Upper Permian units contain kerogen with high maturity (Ro 1,8%), the Middle Triassic units contain a very mature kerogen (Ro 1.1–1.2%) while in Marmolada the Formazione di Moena (Upper Anisian) has Ro values of less than 0.6%, indicating a substantially immature kerogen.

The maturity trend, with decreasing values for SSE to NNW trending coeval units, can probably be attributed to different burial events between the Upper Triassic and Lower Cretaceous.

The values (as regards the Middle Triassic unit) gradually become smaller towards the north (Marmolada, Val Badia) and should correspond to transition zones to Mesozoic structural highs with reduced sedimentation (continuation of the Adige Plateau).

The maturity values (already within the "oil window") observed in the Jurassic unit at the south eastern boundary of the chain (well Sedico 1) correspond to the depocenters of the Belluno Basin.

The rise in isotherms, during the Norian-Liassic extensional stages and recorded throughout the whole Southalpine area, emphasises the different levels of maturity of the kerogen in those areas with different burial values during the Mesozoic.

Significant local maturity anomalies recorded in the Ladinian units (high maturity or even organic metamorphism) were noted. These anomalies can be attributed to localised heating phenomena during the late Ladinian. For example, at Cima Uomo (S.Pellegrino Pass) the influ-

ence can be clearly seen of the numerous dyke intrusion linked to Upper Ladinian magmatism on the organic matter contained in recently sedimented just deposited (Lower Ladinian). The kerogen in the Plattenkalke Member of the Formazione di Livinallongo is in full organic metamorphic phase (petroleum potential zero, despite the high organic carbon content).

A similar phenomenon is recorded in the Middle Triassic carbonate platform series drilled in well Corte Vittoria 1, located in the Veneto subsoil near the area studied, where there are no rocks with a minimum organic matter content, but where clear signs of contact metamorphic phase are noted on the mineral matrix.

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