Das Alter der Radiolarite ist umstritten: BERNOULLI (1960, 1964) vermutet, dass die Radiolarit-Sedimentation in der Lombardei (isochron) mit der Wende Dogger / Malm einsetzt. Nach PASQUARÈ (1965) würde sie bereits im Callovian beginnen. Exakte Daten fehlen vorderhand noch.

Noch in den ausschliesslich pelagischen Serien des Malm und der Unterkreide zeugen zahlreiche Resedimente von einer starken Mobilität des Untergrundes. Im lombardischen Becken ist beispielsweise der Übergang vom Rosso ad Aptici (jüngste Schichtgruppe der Radiolarite, ? unteres / mittleres Tithon) in die weissen Coccolithen-Kalke der Maiolica häufig durch eine submarine Rutschung oder intraformationelle Brekzien gekennzeichnet. Nach LÜTHI (1973, unpubl.) besteht im Kern der Valcuvia-Synklinale zwischen den beiden Formationen eine Schichtlücke (submarine Erosion), die das obere Tithon umfasst; er stellt die Basis der Maiolica ins unterste Berriasian.

Summary

In Western Lombardy late Variscan andesites, dacites and rhyolites were deposited in a WSW-ENE oriented graben-like structure. Early Triassic clastic sedimentation indicates a marine ingression from the East. In Lombardy, a carbonate platform was installed in the middle Anisian and persisted locally up to the lower Carnian. From the uppermost Anisian onwards bituminous and subordinate tuffaceous sediments were deposited in local depressions with restricted water circulation. In the studied area, middle Triassic facies boundaries coincide approximately with future N-S oriented faults. Tectonic activity controlling late Triassic and Jurassic facies patterns is thought to be related to movements along both WSW-ENE and N-S trending structures.

In Western Lombardy we distinguish four important paleotectonic elements:

— the *Generoso Basin* (cf. BERNOULLI 1964)

— the *Arbostora* and *Gozzano Swells*, which originally were parts of a probably continuous «Arbostora-Gozzano-Element» corresponding to the Permian volcanite body.

— the *Monte Nudo Basin*, divided into a central, more strongly subsiding part NW of the Arbostora Swell and a southwestern part between the Arbostora and Gozzano Swells.

The term «Arbostora Swell» replaces the term «Lugano Swell» (or «Arzo Swell») of previous authors.

Facies changes and remarkable differences in thickness of the Rhetic sequences on both sides of the Lugano Line were described by BERNOULLI (1964) and interpreted as the result of accelerated tectonic activity along the Lugano fault system. On the future Arbostora Swell, a reduced facies, the *Tremona series*, is present which is transgressive on the Norian Hauptdolomit (cf. Plate 8). In the future Monte Nudo Basin, peritidal sedimentation seems to be continuous up to the upper Rhetic and probably the lowermost Liassic. In the upper parts of this sequence, in the Concho-

don Limestone, residual deposits (terra rossa, caliche) suggest repeated emersions. West of the Lago Maggiore fault system no upper Triassic sediments are known.

In Western Lombardy, the initiation of a disintegration of the former platform into a small-scale pattern of individual fault blocks is documented by abrupt changes in thickness in the Rhetic series. This is particularly evident on the Arbostora Swell which is cut by a system of subparallel, roughly N–S oriented faults. These thickness variations typically anticipate those observed in the overlying lower Liassic spiculitic sediments.

On the Arbostora Swell, the different lithotypes of the *Saltrio beds* permit a rather detailed reconstruction of the swell for the Lower Liassic time (Plate 9). Cross-bedded epiclastic calcarenites (type Viggiù, ? Hettangian) are restricted to small grabens and may be derived from neighbouring highs. Dark, bituminous, redeposited laminites, generally overlying a hardground (type Poaggia) are limited to grabens, caused by slightly younger tectonic movements. Biogenic components in the laminites were supplied from persisting small horsts with Saltrio-type crinoidal limestones. The earliest dated Liassic sediments in the Arbostora area are lowermost Sinemurian in age. We think, however, that the Arbostora Swell was submerged even at an earlier stage, as ammonite-bearing Involutina limestones of Hettangian age occur within the litho-/biohermal Broccatello Formation along the eastern margin of the Arbostora Swell (cf. WIEDENMAYER 1963).

In the central Monte Nudo Basin a lower Liassic transgression could not be proved; there seems to be a gradual transition from the Conchodon Limestone to the *Lombardian Kieselkalk* (Moltrasio Limestone auct.). During the Sinemurian the basinal Kieselkalk replaced step by step the Saltrio beds in the Arbostora area, proceeding from W (Mt. Campo dei Fiori) to E; this is well documented by ammonite faunas. Local horsts, however, persisted up to the late Sinemurian (Saltrio-Salnova, Borgioli-Arzo). At the same time, the Gozzano Swell was partly inundated and red lithic arenites (type Gozzano of the Saltrio beds) were deposited.

Within the Lombardian Kieselkalk Formation we distinguish a lower *Spiculite series* and an upper *San Giulio series*. During early Liassic times, differential subsidence led to a pronounced submarine topography, possibly favouring prolific growth of silicious sponges along the basin margins. It seems difficult to explain the volumetric distribution of the Spiculites with a purely hemipelagic sedimentation model. We believe that the accumulation of the spiculitic sediments was controlled by currents, possibly by low velocity - low density turbidity currents. These deposits were subsequently modified probably by an intrabasinal current system. The greatest thicknesses of the lower Liassic Spiculites (up to 1300 m, cf. Plate 10) were measured NW of the Arbostora Swell, in the central basin. During the uppermost Sinemurian and the early Middle Liassic, differences in subsidence between the Monte Nudo Basin and the major part of the Arbostora area are not expressed by facies changes but by considerably thinner sequences on the former swell.

The younger part of the Lombardian Kieselkalk - the San Giulio series (middle Carixian to lower Domerian) - is a flysch-like deposit: proximal resediments laterally grade into distal ones away from the Lago Maggiore fault system, suggesting important synsedimentary fault movements along this line. The proximal facies is composed of slides and slumps, polygenic breccias (channelized debrites) and

proximal turbidites. The distal facies is represented by a regular alternance of burrowed spiculitic limestones and hemipelagic marly intercalations. The geometry of the sediment body reflects an accelerated subsidence of the western Monte Nudo Basin (cf. Plate 10, *C*).

Approximately at the Carixian / Domerian boundary, a new facies differentiation between the Arbostora Swell and the Monte Nudo Basin is recognized (cf. Fig. 4): thin hemipelagic sediments were deposited on the swell and in the adjacent Generoso Basin while turbiditic sedimentation (San Giulio series) continued in the western Monte Nudo Basin. Obviously, the Lugano fault system was of minor importance during the post-Sinemurian sedimentary evolution of Western Lombardy.

From middle Domerian onwards, mainly hemipelagic sedimentation prevailed also in the western Monte Nudo Basin. At this time synsedimentary faults caused a differentiation into subbasins and swells in the Arbostora area. The *Campo dei Fiori Swell* which corresponds to the western part of the former Arbostora Swell acts during the late Liassic and probably up to the late Jurassic (stratigraphic gap between Domerian and Kimmeridgian-Tithonian) as a barrier between an area with merely pelagic sedimentation (red marly nodular limestones, silicious marls) in the East and a western realm with renewed turbiditic sedimentation (cf. Fig. 4, 5). These flysch-type deposits, of Toarcian and lower to middle Dogger age, are called *Valmaggiore Formation.* The now submerged Gozzano Swell is thought to have supplied the sediments, but erosion apparently only affected a semiconsolidated sedimentary cover. NW of the Campo dei Fiori Swell the Valmaggiore Formation interfingers with a marly slope-to-basin Ammonitico Rosso facies with resedimented pelagic material (cf. Plate 11).

In the upper Jurassic, pelagic deep-sea sedimentation prevailed over the whole of Lombardy. However, neritic resediments, locally occurring between silicious marls at the base of the Radiolarite Formation (upper Middle Jurassic - lower Tithonian) suggest areas of persisting shallow-marine deposition, which were probably situated to the S or SW. White coccolith limestones (Maiolica, upper Tithonian-Berriasian to Barremian) overly, locally with a stratigraphic gap, the Radiolarite Formation.

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