is exposed (Fig. 21). Several species of *Megalus, Parmegalus, Conchodus* have been described from levels usually rich in individuals but poor in species (FLÜGEL et al., 1975).

3.2.3. Locality 6 – Adnet

The quarries of Adnet, located in the north-western Osterhorn Block, south-east of the city of Salzburg (Figs. 1, 22) expose upper Rhaetian to Lower Jurassic limestones, deposited at the southern rim of the Eiberg Basin (Fig. 5). They clearly display the succession from the Late Triassic reef-dominated carbonate factory (Stops 6.1 and 6.2) to the aphotic deep-water hemipelagic sedimentation of the Jurassic (Stops 6.2 and 6.3). If both Adnet and Steinplatte have been described as typical warm-water photic-zone reefs (e.g. STANTON & FLÜGEL, 1989, 1995; BERNECKER, 2005), STANTON (2006) proposed rather nutrient rich water favourable to heterotrophic corals. Intermediate reef drowning stages of the Hettangian are nicely exposed in the lower slope sections (Stop 6.3). The Adnet quarries have been the topic of palaeontological, sedimentological, stratigraphic, geochemical, mineralogical, palaeomagnetic, and geotechnical studies for more than 150 years (see KIESLINGER, 1964; BERNECKER et al., 1999; BÖHM et al., 1999; BÖHM, 2003; BERNECKER, 2005; REINHOLD & KAUFMANN, 2010). Nevertheless there are still considerable unknowns in the Rhaetian-Liassic sedimentary history of the area. The continuing quarrying activities create 3-dimensional views and expose new sedimentary structures every few years, but also threaten to destroy older outcrops.

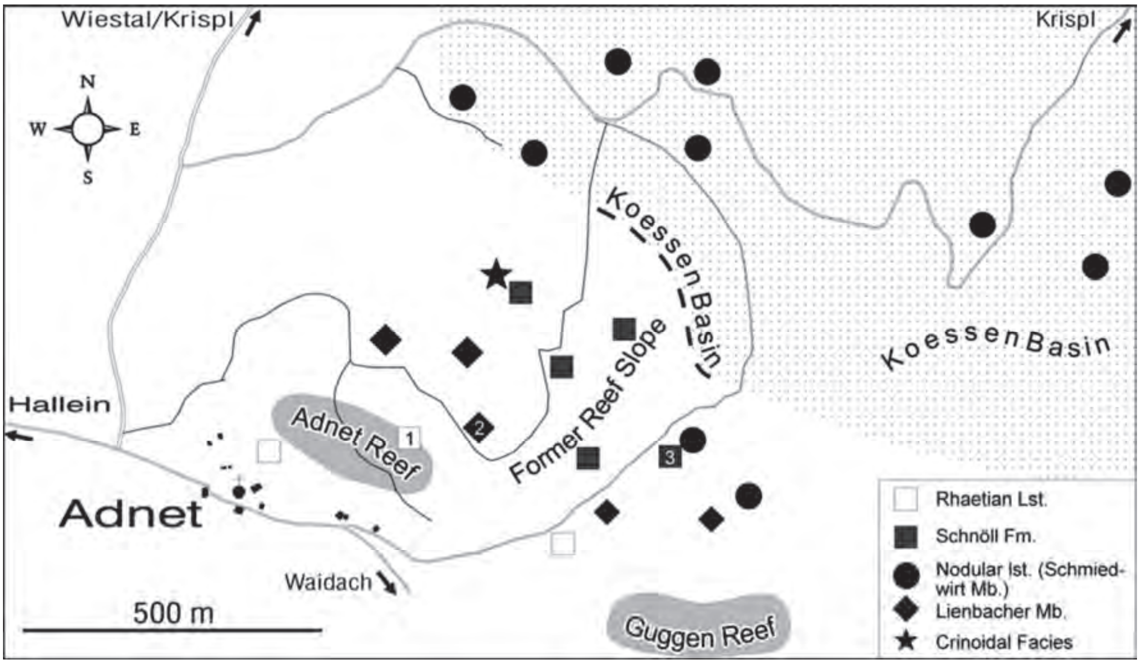

Fig. 22. Detail map of the Adnet quarries with facies distribution (from KRYSTYN et al., 2005 after BÖHM, 1992).

Outcrop 6.1 – Tropf Quarry

The Tropf quarry 47°41.7819' N / 13°08.2109' E, Fig. 22) is the most famous of the Adnet quarries, as it exposes a 3 dimensional view of a Rhaetian coral reef with metre-sized coral colonies, analogue to the late Rhaetian Steinplatte Limestone. Its facies and palaeontology were studied in detail by SCHÄFER (1979) and BERNECKER et al. (1999). Unfortunately, during the past years the most spectacular walls became unsightly or were removed by quarrying. The big branching coral colonies dominating most walls (Figs. 23, 24, 25) belong to the

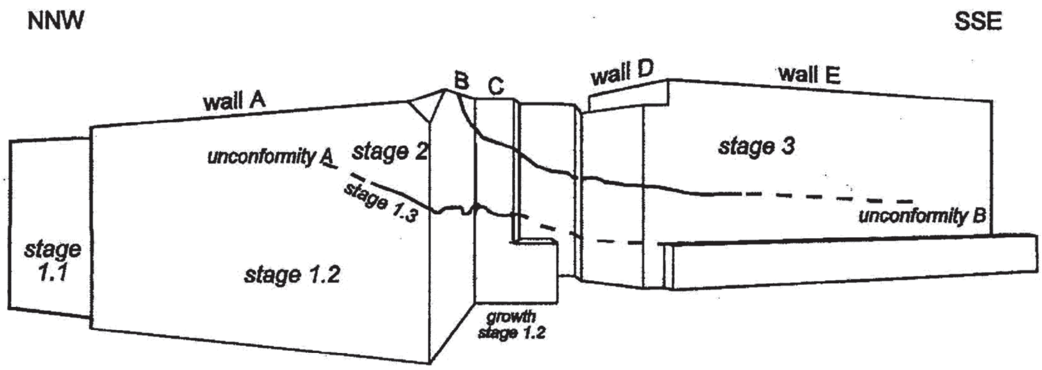

Fig. 23. Sketch of the Tropf Quarry walls as seen during the early 1990s, indicating the reef growth stages and erosional unconformities (from BERNECKER et al., 1999).

genus *Retiophyllia* (formerly called "*Thecosmilia*"). Two varieties can be distinguished by their size (A: big, B: small). Other reef builders are less common: massive and platy corals (*Pamiroseris, Astraeomorpha, Gablonzeria*), sclerosponges (mainly sphinctozoans), and "hydrozoans". Dasycladacean algae (*Diplopora adnetensis*) occur as sand-sized bioclasts and provide evidence for a shallow-water depositional setting. In the upper part of the walls a sediment layer without corals can be seen (Stage 3 in Figs. 23, 24). Megalodont bivalves are common in this layer. At the very top of the outcrop coral colonies occur again, although less frequently (Fig. 24). Possibly correlative sediments of Stage 3, exposed in the Lienbacher Quarry (Stop 6.2), continue up to the Triassic-Jurassic boundary.

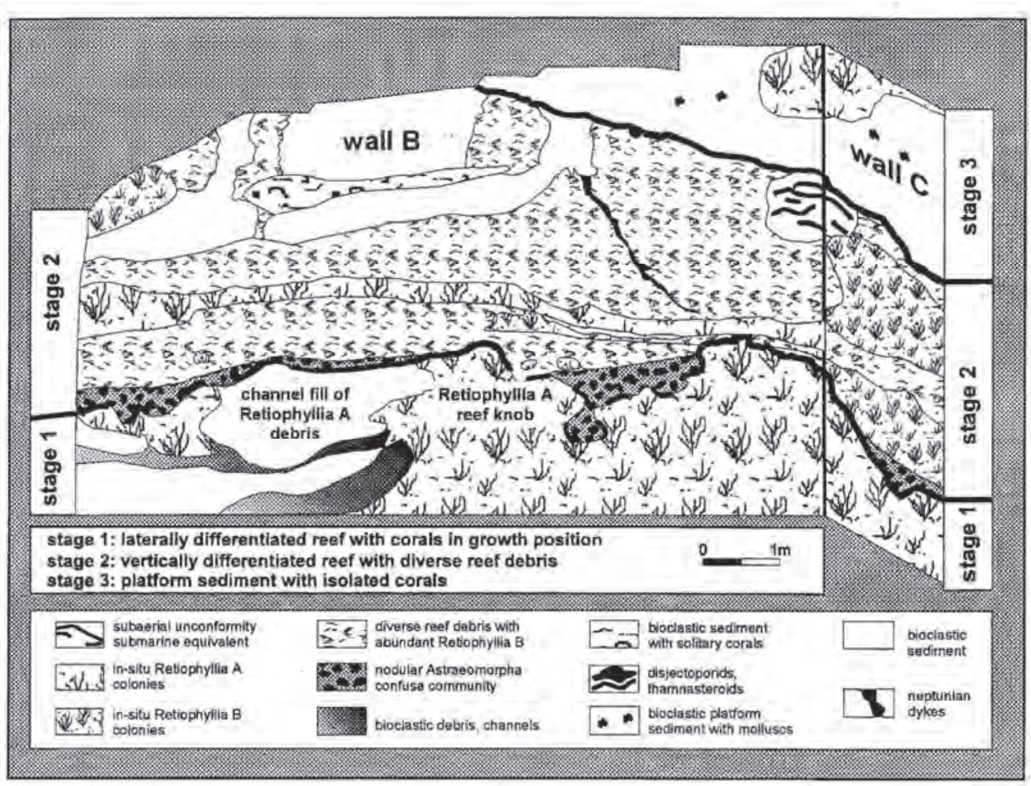

Fig. 24. Detailed facies distribution on walls B and C (Fig. 23) and positions of unconformities A and B. Note pronounced relief unconformity A (up to 4 m), Unconformity B is less pronounced (from BERNECKER et al., 1999). Notice that the capping beds of Steinplatte, locality 7, correspond to the stage 1 to 3 here and the coral garden to stage 2.

Fig. 25. Transect from growth stage 1 to stage 2 at the Tropf quarry. Small arrow point to the distinct disconformity surface between the "Large *Retiophyllia* A community" and the thiner *Retiophyllia* B colonies. Wall B, width 1.70 m, height 2.50 m (from BERNECKER et al., 1999).

BERNECKER et al. (1999) found two unconformities with distinct relief cutting through the reef and showing signs of erosion and karstification (Figs. 24, 26). A third unconformity marks the Triassic-Jurassic boundary, which is exposed in the Lienbacher Quarry (Stop 6.2). The coral reef of the Tropf Quarry probably formed at the lower slope, similar to the Capping Beds of the Steinplatte. These lowstand reefs formed after an initial sea-level drop earlier in the late Rhaetian, when the higher parts of the platform south of the Eiberg Basin became exposed and reef building had to move slope-downwards.

Outcrop 6.2 – Lienbacher Quarry

The Lienbacher Quarry (47°41.8202'N / 13°8.2572'E, Fig. 22), about 100 m northeast of the Tropf Quarry, exposes "Stage 3 Rhaetian reef" limestones (NW part of the quarry), which are overlain by a thin blanket of upper Hettangian yellow-red Enzesfeld limestone and the Sinemurian Adnet Formation (Lienbacher Member). The Rhaetian and Triassic-Jurassic boundary were described by BERNECKER et al. (1999), the Liassic by BÖHM et al. (1999) and DELECAT (2005). During the Triassic and Liassic this site was positioned downslope of the Tropf Quarry. The depositional slope was dipping by about 10°–15° to the northeast during the Sinemurian (and likely also during the Rhaetian) as indicated by geopetal infills. The

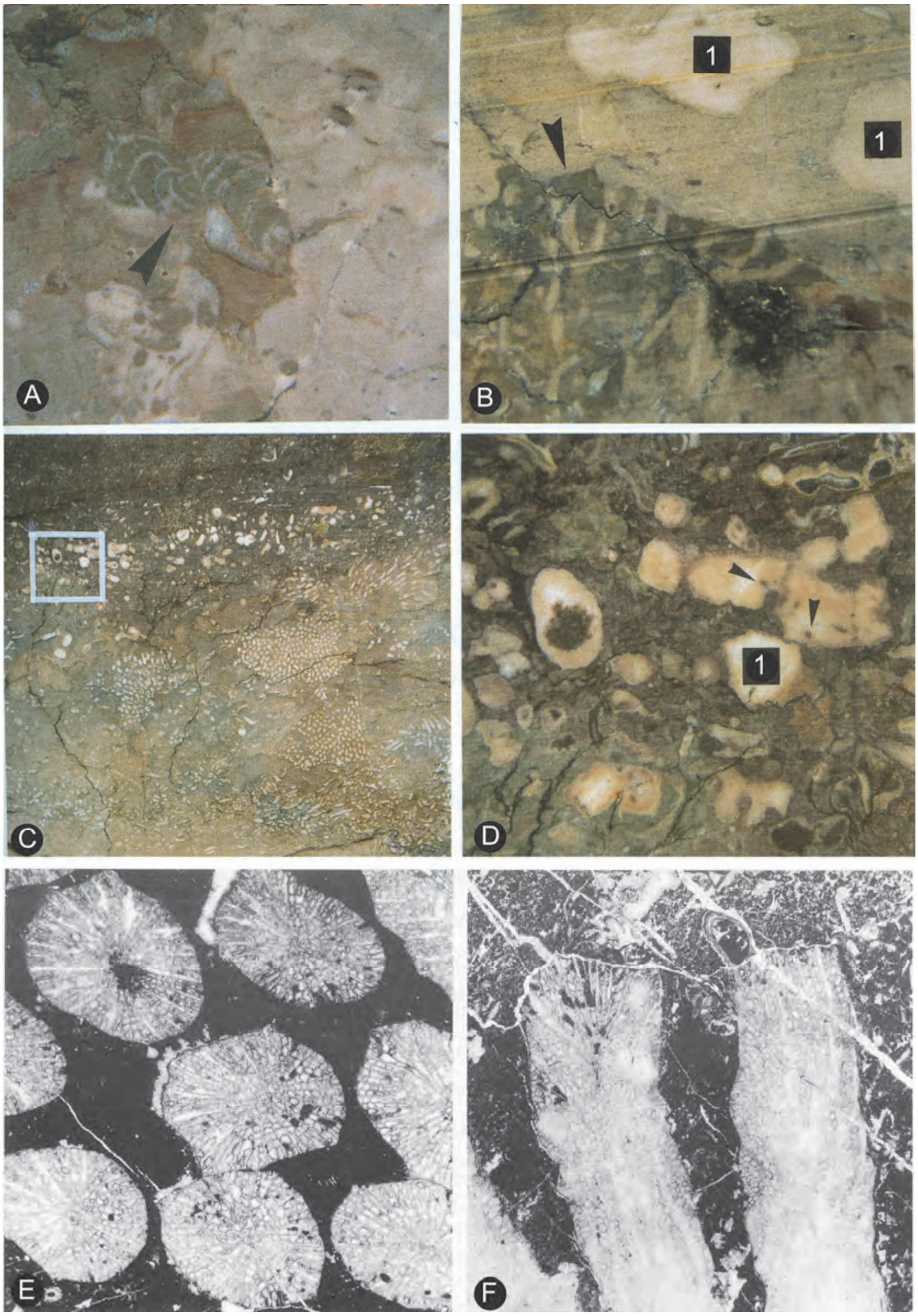

Fig. 26. A) Surface of the unconformity: Hardground encrusted by the sphinctozoid sponge *Cinnabaria*? *adnetensis* (arrow). x 0.9; B) Unconformity B separating growth stage 2 (bottom) and 3 (top). The arrow points the irregular surface. Note the large nodular *Astraeomorpha* colonies (1). Wall E, x 0.9; C) Unconformity A separating growth stage 1 (bottom) and 2 with the nodular *Astraeomorpha* colonies, x 0,1; D) Close-up of C), with *Astraeomorpha confusa* (1) showing evidence of bioerosion (arrow) x 0,6; E) *Retiophillya clathrata*. Cross section of a high-growing branching colony x 2.5; F) *Retiophillya clathrata*. Longitudinal section x 2.5. (All photos from Bernecker et al., 1999).

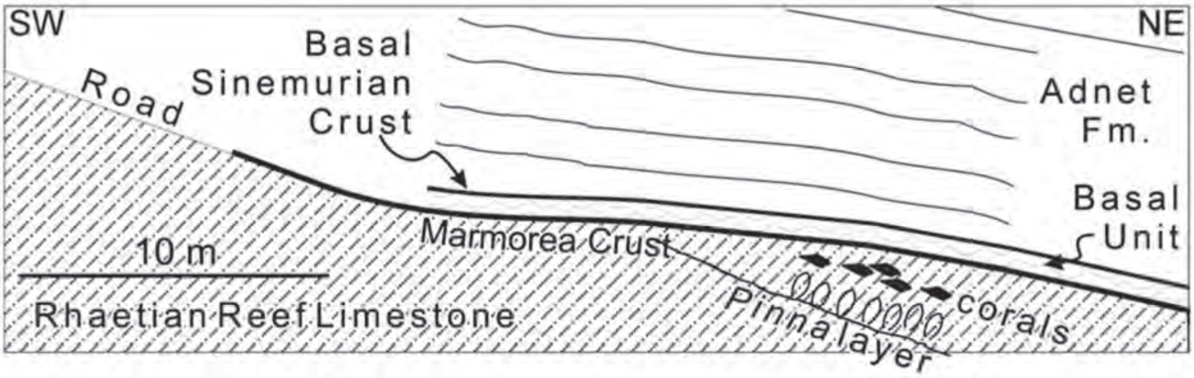

Fig. 27. Slightly exaggerated sketch of the depositional small-scale relief as exposed in the NW part of Lienbacher Quarry. The upper Hettangian Marmorea Crust covering the underlying massive Rhaetian reefal limestone is shown as a thick line. It forms the pavement of the road at left. It is overlain by the Adnet Formation (Lienbacher Mb.) with only 20 cm of stromatolites of the Basal Unit and the Basal Sinemurian Crust, followed by medium-bedded limestones. The original relief was restored by tilting the section 10° to the right, according to the mean inclination of geopetal infills. Fossils fragments in the Rhaetian limestone indicate depositional surfaces dipping steeply to the NE (from KRYSTYN et al., 2005 after BÖHM, 1992).

depositional slope is confirmed by the asymmetric growth of deep-water stromatolite domes visible on SW-NE trending walls (SE part of the quarry). On NW-SE trending walls the domes show symmetric growth forms (BÖHM & BRACHERT, 1993; BÖHM et al., 1999). The 100m distance from Tropf Quarry and the 15° slope combine to a vertical relief of about 25 m between the quarries. On the outcrop scale, the Rhaetian top surface (Triassic-Jurassic boundary) shows a slightly wavy relief with a mound-like structure forming a small terrace in the NW quarry corner (Fig. 27). The fine-scale rugged relief of the surface has been interpreted as small-scale karstification (BERNECKER et al., 1999) and REINHOLD & KAUFMANN (2010) indicating subaerial exposure at the Triassic-Jurassic boundary. Platy and massive corals (mostly *Pamiroseris*) are present in the Rhaetian limestones, but have too low coverage to form reef build-ups. Besides few in situ colonies bioclastic accumulations can be interpreted as storm layers (BERNECKER et al., 1999). The Rhaetian karst surface is overlain by 0-10 cm of yellow-red Fe-oxide rich crinoidal limestones (Enzesfeld Limestone with crinoids, brachiopods, ammonites, foraminifers, ostracods and Schizosphaerella; late Hettangian) forming the ferromanganese Marmorea Crust (with late Hettangian ammonite fauna). The upper Hettangian limestone also fills up neptunian dykes that penetrate into the Triassic. Red limestones of the Adnet Formation following disconformably above the Marmorea Crust belong to the late Sinemurian *obtusum* Zone.

Outcrop 6.3 – Rotgrau-Schnöll Quarry

The RGS Quarry (47°41.8029'N / 13°8.5872'E, Fig. 22) is positioned near the toe of the slope, just up slope from the transition of the Rhaetian limestone facies to the basinal Kössen facies. This quarry was studied by BLAU & GRÜN (1996), BÖHM et al. (1999) and DELECAT (2005). It is the type locality of the peculiar Hettangian Schnöll Formation, which represents the recovery of sedimentation on the lower slope after the hiatus of the Triassic-Jurassic boundary. The Schnöll Formation forms a wedge onlapping the slope of the Adnet reef, thinning from a maximum thickness of about 15 m in lower slope settings to a few decimetres on the higher slope (e.g. north and west of the Lienbacher Quarry; Fig. 28). Even on a smaller scale the thickness is very variable as can be seen in the RGS Quarry, where the Schnöll wedges out from a thickness of more than 5 m in the north-eastern part of the quarry to only about 1 m in the south-western part. Accordingly, the sedimentary successions differ between the two parts of the quarry. In the NE part the succession starts in the lower member of the Schnöll Formation (Langmoos Member). The base of the Langmoos is not exposed here. The exposed thickness is less than 1m of 10m in total. Sponges are very common and the occurrence of stromatactis points to early microbial diagenesis. The lowest exposed layer is rich in radiolarian (DELECAT, 2005). In the overlying Guggen Member the frequency of sponges decreases, while crinoidal debris becomes more important. Several local ferromanganese crusts occur within the Guggen Member, which is eventually capped on top by the Marmorea Crust with a rich late Hettangian ammonite fauna (e.g. DOMMERGUES et al., 1995). The succession in the SW quarry part starts with cross-bedded grey limestones (microlithoclastic packstones and grainstones) with echinoderms, bivalves, brachiopods and rare foraminifera (mostly miliolids). These submarine dunes may represent Triassic relict sediments. They form a NE dipping wedge that is onlaped by the Schnöll Formation. After correcting for tectonic tilt the inclination of the foresets is about 20° and that of the top surface about 5°, dipping to the NE. The top surface of the grey packstones is an erosional unconformity. Stable isotopes, however, give no indication that the erosion was subaerial (BÖHM et al., 1999). The packstones are strongly fractured. They are overlain by a layer exceptionally rich in siliceous sponges, with an ammonite fauna of middle Hettangian age. The layer is capped by a ferromanganese crust, partly pyritized and rich in crinoidal debris and foraminifera. “Micro-oncoids” occur (BÖHM et al., 1999). The sponge layer formed as an allochthonous accumulation (DELECAT, 2005). The sequence above the sponge layer is similar in both parts of the quarry, with thick bedded, crinoid-rich limestones of the Guggen Member, which are, however, only about 1 m thick in the SW, but more than 3 m in the NE part. They terminate in the Marmorea Crust, followed by the Basal Unit of the Adnet Formation, which has a thickness of only 0.5 m in this quarry, and is capped on top by the basal Sinemurian crust and the well-known layer of deep-water stromatolites. Above the stromatolites, the succession continues with thin-bedded nodular limestones of late Sinemurian age.

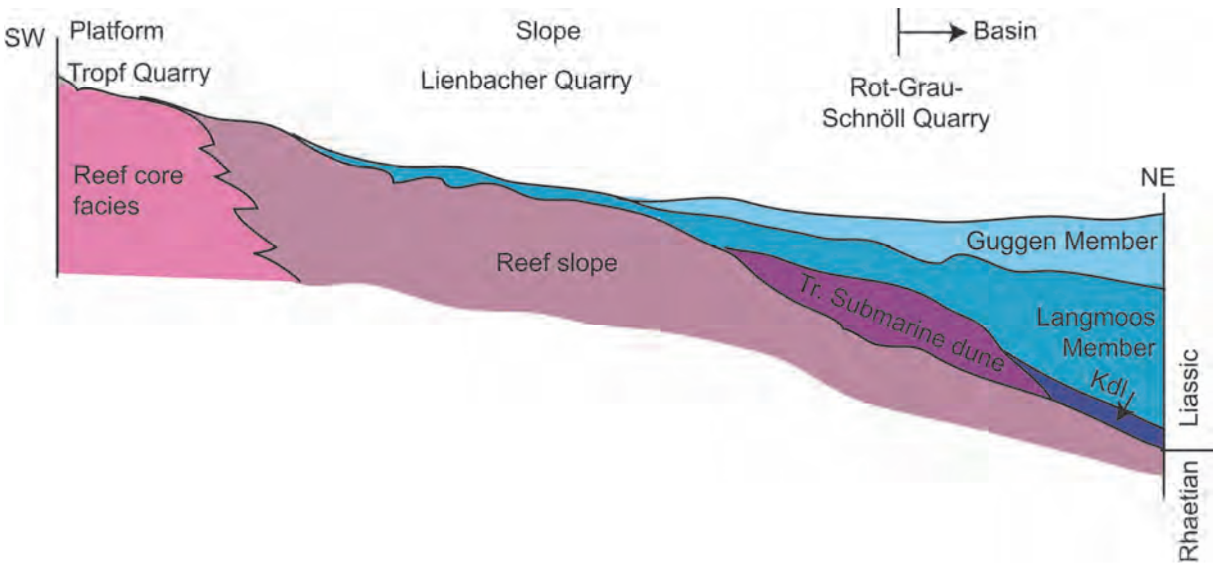

Fig. 28. Schematic distribution of the Kendelbach (Kdl.) Formation and the two members (Guggen and Langmoos) of the Schnöll Formation on the slope of the Adnet reef (modified from DELECAT, 2005).