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The Marocche rock avalanches (Trentino, Italy)

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The floors of the Adige and Sarca River valleys are punctuated by numerous rock avalanche deposits of undetermined age. With a view to understanding predisposition and triggering factors, thus ultimately paleoseismicity in the region, we are studying the geomorphology and timing of the largest rock avalanches of the River Sarca-Lake Garda area (e.g., Marocche, Monte Spinale, Lago di Tovel, Lago di Molveno, San Giovanni and Torbole). Among the most extensive of these deposits, with an area of 13 km2 and a volume of about 109 m3, are the Marocche. Marocche deposits cover the lower Sarca valley north of Lake Garda for a length of more than 8 km with 200 m of debris. Both collapse and bedding parallel sliding are a consequence of dip slopes and the extreme relief on the right side of the valley of nearly 2000 m from the bedrock below the valley floor to the peaks combined with the zones of structural weakness.

The rock avalanches developed within carbonate rocks of Mesozoic age, mainly limestones of the Jurassic Calcari Grigi Group. The main scarps are located on the western side of the lower Sarca Valley, along the steep faces of Mt. Brento and Mt. Casale. The presence of these scarps is strictly related to the Southern Giudicarie and the Ballino fault systems. The former is here constituted by regular NNE-directed ESE-vergent thrust faults. The latter has been reactivated as normal faults. These complicated structural relationships favored complex failure mechanisms, including rock slide and massive collapse.

At the Marocche itself, based on field relationships and analysis of lidar imagery, we differentiated two large rock avalanches: the Marocca di Kas in the south which overlies and in part buries the Marocche (s.s.) in the northern sector. Previous mapping had suggested up to five rock avalanches in the area where we differentiate two. In spite of hypotheses suggesting failure of the rock avalanches onto stagnating late Pleistocene glaciers, preliminary 36Cl exposure dating results for boulders of the two deposits suggests middle and late Holocene ages. The latter are well comparable with post-Roman ages proposed by Trener in 1924 based on the presence of artifacts found at the base of the younger deposits during construction of hydroelectric tunnels early in the last century.