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THREE DIMENSIONAL GEOMETRY OF THE LEPONTINE NAPPES IN THE MAGGIA REGION, CENTRAL ALPS

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The Lepontine Alps represent the classic region for fold nappe development in mid-crustal levels and for the overprinting geometry of multiple deformation phases on all scales. Recently they have also become critical for models of burial to great depths and subsequent very rapid exhumation. Before any such model can really be applied or critically assessed, the geometry of the units involved must be accurately known in three dimensions and combined with the fourth dimension of time to establish a consistent history. However, the three-dimensional geometry of the Lepontine nappes is not unequivocally established because detailed modern structural mapping is incomplete and there are inconsistencies and contradictions between adjacent areas. This project combines new structural mapping of critical and/or contradictory areas with existing observations to develop a testable three-dimensional model of the geometry of the Lepontine nappes in the Maggia region. A consistent regional model must incorporate a great deal of information on the location of unit boundaries relative to topography and on the orientation and kinematics of up to five distinguishable phases of deformation. Assimilating and integrating this complex information into an internally consistent model, together with the problem of its effective visualization, has been a major hurdle to our understanding. It is only very recently that computer-based tools for handling large amounts of geological/geographical data and their three-dimensional representation have become available. In this project, a model is being developed using a computer-aided earth modelling system (CAEM, e.g. Gocad) for visualization and analysis and a Geographical Information System (ARC/INFO, ArcView) as the data repository. The possibilities for $2^1/_2$-dimensional visualisation in GIS allow preliminary assessment of geometrically intricate and ambiguous zones. The Maggia region has been chosen because many of the major nappes and the complete range of deformation phases are exposed in a compact region. The high topographic relief and limited subsurface information available from hydroelectric tunnels also aid three-dimensional reconstruction. The computer modelling system provides a powerful tool to aid in the storage, retrieval and interpretation of field data. It also helps target the critical areas for more detailed structural mapping, namely those where there are inconsistencies or where the location and orientation of structures have a critical influence on the three-dimensional interpretation. Clearly without very extensive subsurface information (e.g. from boreholes, tunnels, reflection seismic etc.), there can be no unique solution. However, the model developed will at least represent an internally consistent solution in accord with available data and geological experience. Such a model can then be critically evaluated and modified in the future as additional surface and subsurface data become available.

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