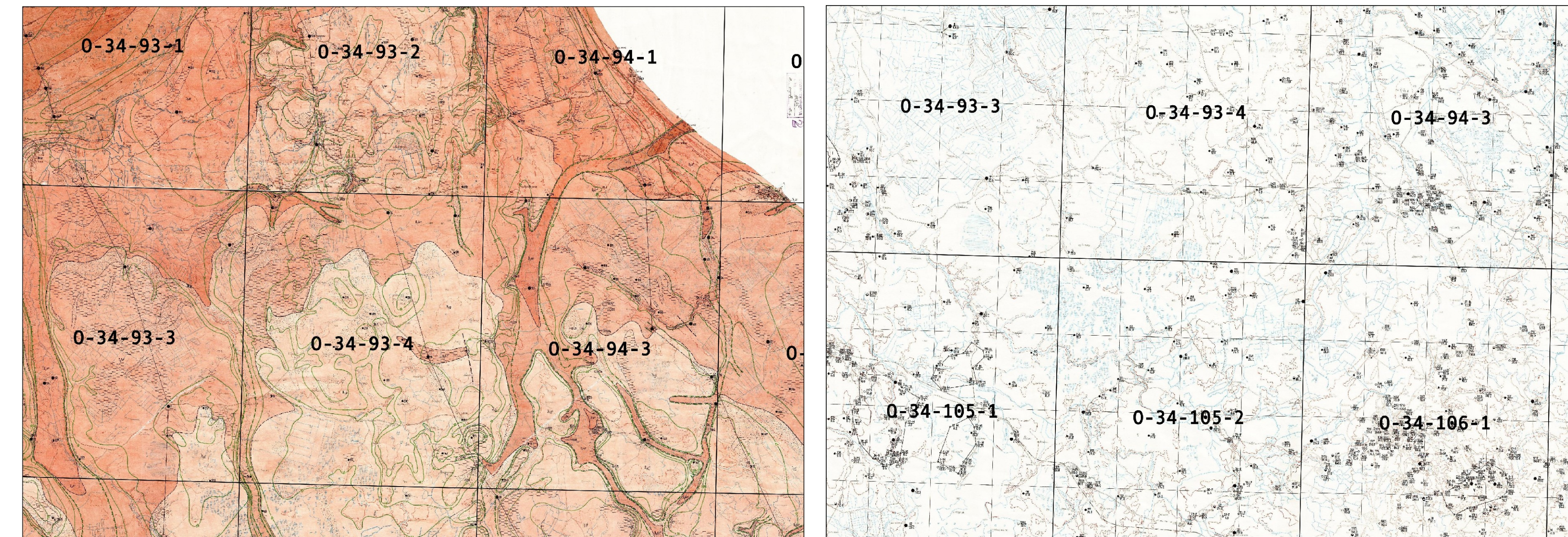


Open Source Solution for Massive Map Sheet Georeferencing Tasks for Digital Archiving

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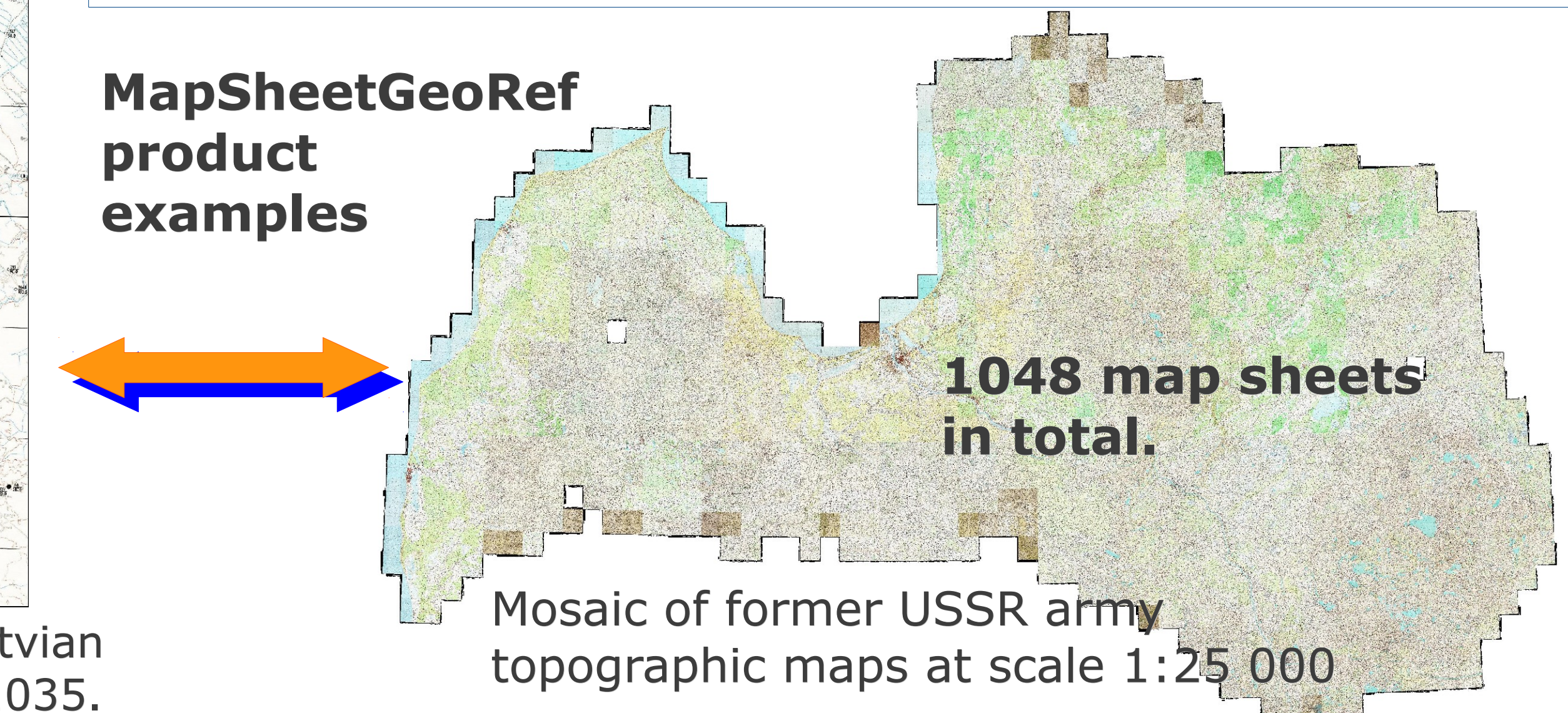
Scanned maps **need to be georeferenced**, to be useful in a GIS environment for data extraction (vectorization), web publishing or spatially-aware archiving. Widely used software solutions with georeferencing functionality are designed to suit a universal scenario for georeferencing many different kinds of data sources. Such general nature also makes them very time-consuming for georeferencing a large number of map sheets to a known grid. This work presents an **alternative scenario for georeferencing large numbers of map sheets** in a time-efficient manner and implements the approach as the **MapSheetAutoGeoRef** plug-in for the freely available open source Quantum GIS [1].



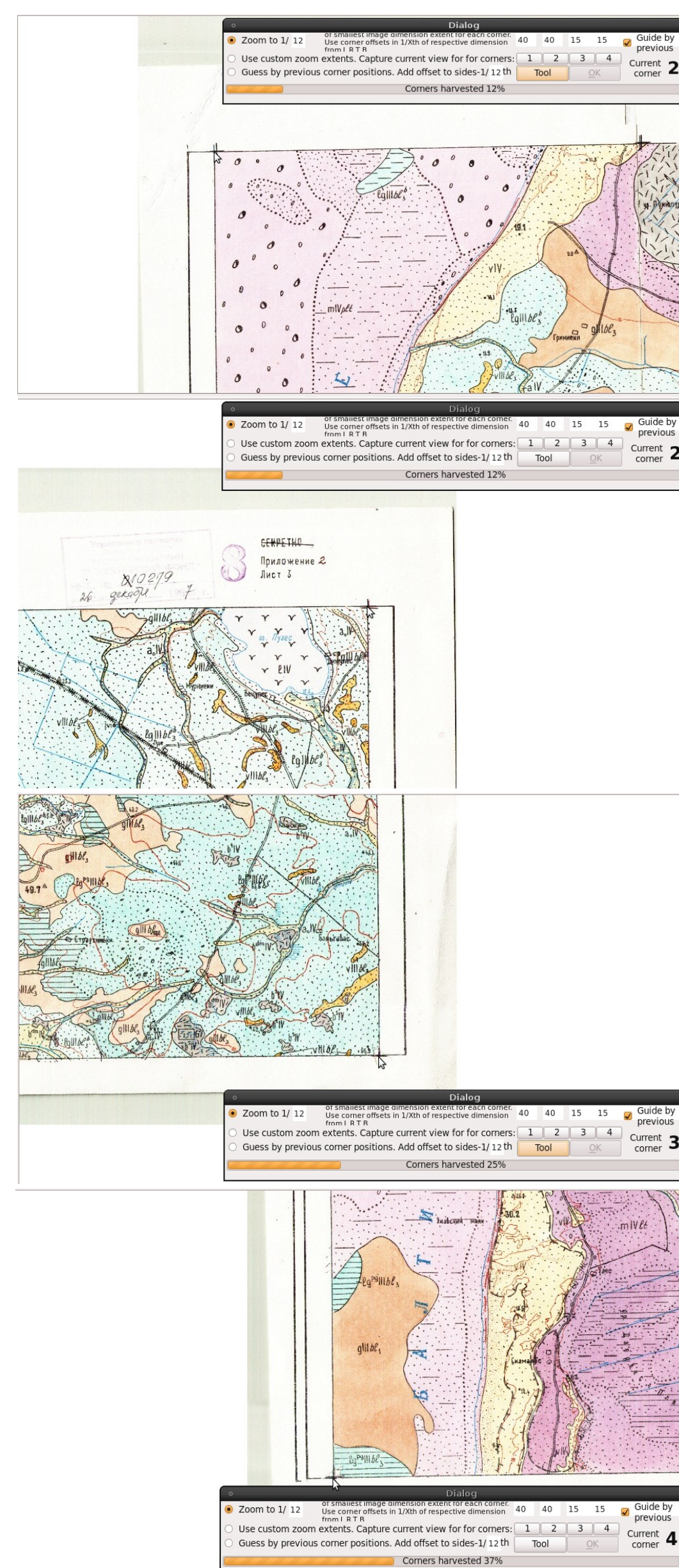
Example fragments from mosaics of subquaternary hydrogeology maps and well location maps of Latvian Environment, Geology and Meteorology Centre geology archive map series at scale 1: 50 000, area 11035.

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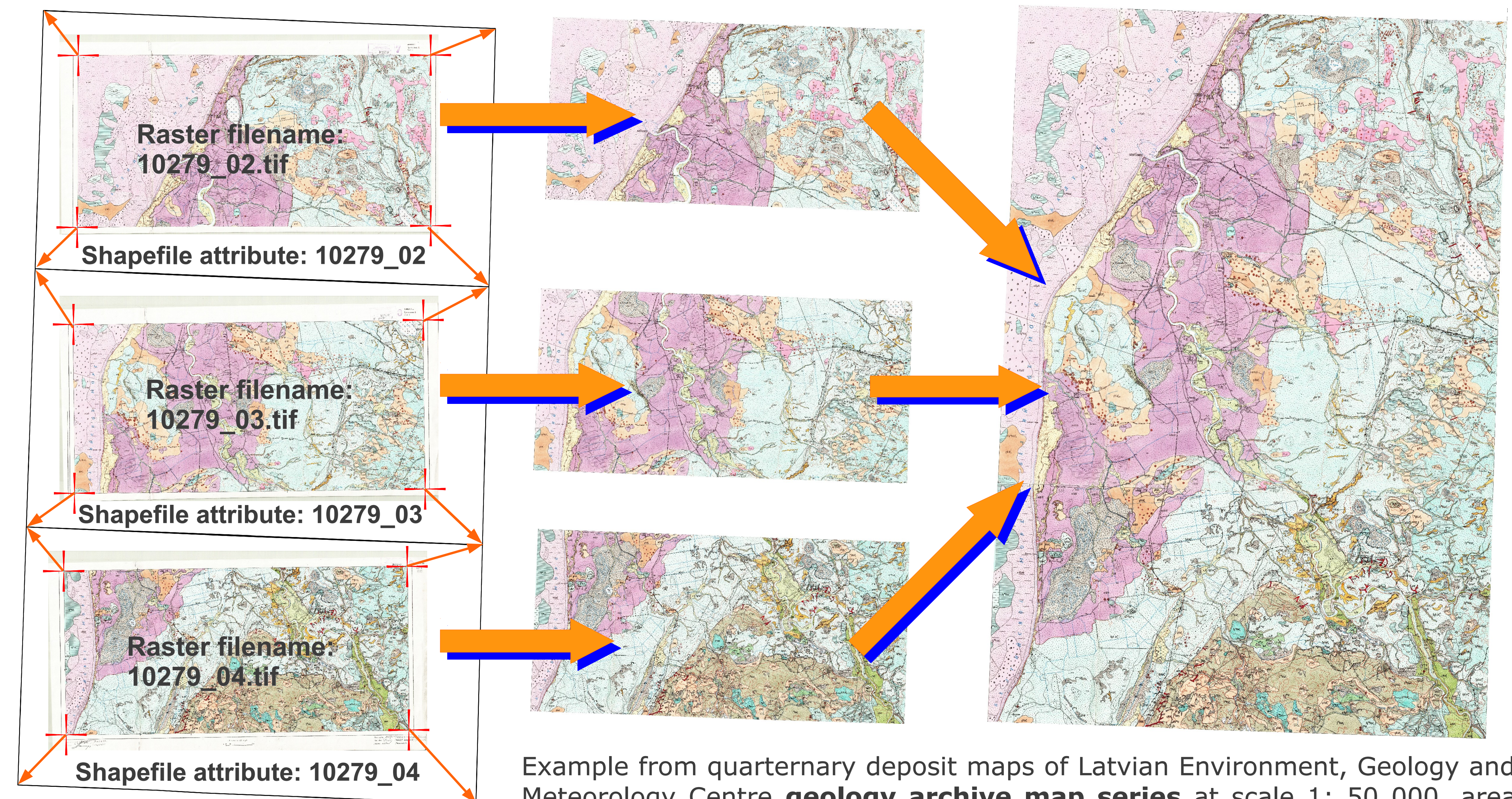
**MapSheetGeoRef
product
examples**



Screenshots of corner selection process



For automating map sheet georeferencing process several requirements have to be met. A grid **reference** for the respective map series available in a **vector data** format is required. This data source has to contain an **attribute field** with **map sheet names** in a form that can be matched with the scanned **raster file names**. **Coordinates** for spatially referencing each map sheet raster **are extracted** from this source **and matched with the pixel positions** of the four corners representing the actual map frame in the original scan, a process **known as calibration**. After all of the corner pixel positions have been identified, the raster registration process **does not change the original raster** – it only **writes the georeferencing information into the image header**. The resulting files are written in the **GeoTIFF open standard** raster file format [2]. This approach is suitable for spatially referencing **many different types of map series**, irrespective of their visual style, framing, physical state of the material, image acquisition artifacts or the target coordinate reference system. While it is possible to automate the corner recognition process with machine vision methods, such a solution is specific to certain visual characteristics of the targeted map series and therefore always dependent on further customized software development [3].



Example from quaternary deposit maps of Latvian Environment, Geology and Meteorology Centre **geology archive map series** at scale 1: 50 000, area 10279.

The pixel positions in the original map sheet rasters have to be identified by a human operator. **This is the only** major step in the workflow that requires **operator attention**. All **zooming between** each of the map sheet **corners** and loading of the scanned map files is **automated** and **highly customizable** process.

Results:

- ♦ **The MapSheetAutoGeoRef plug-in automates** most of the steps in the **georeferencing process**.
- ♦ Currently provides postprocessing operations, such as **warping, resampling results to fixed cell size, masking map sheet margins** and **mosaicking** the resulting rasters **into a single large mosaic**.
- ♦ This permits a **unified workflow** to produce **geospatial data product** suitable for on-line publishing though **web map service(s)**[4].
- ♦ Tested on several popular map series in Latvia, totaling thousands of sheets. Depending on characteristics of original scans, the plug-in allows to process **up to thousand map sheets per person day**.

References

1. Quantum GIS, <http://www.qgis.org>
2. GeoTIFF, <http://trac.osgeo.org/geotiff/>
3. Titova O. A., Chernov A. V. 2009, Method for the automatic georeferencing and calibration of cartographic images. In: *Pattern Recognition and Image Analysis*, vol. 19(1), pp. 193–196. Pleiades Publishing, Moscow
4. OpenGIS Web Map Service (WMS) Implementation Specification, OGC, <http://www.opengeospatial.org/standards/wms>