Cartographic Activities in the Mustang District

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Abstract

In the framework of this space-related research programme there is a general need to prepare thematic maps with different informational content and in a wide range of scales .

For Mustang district it was necessary to produce maps at the scales of 1:200 000 and 1:50 000 using space-borne LANDSAT images and existing sheets of the one inch map of Nepal. To prepare larger scale maps, e.g. 1:10 000 and 1:2500, Hasselblad aerial images taken with a fisheye lens as well as results of terrestrial-photogrammetric and geodetic fieldwork were used.

Only by combining all available cartographic sources with low-cost geodetic-photogrammetric work an economical solution of the task, defined as the preparation of thematic maps for this research project in the Himalaya, is attainable.

1. Introduction

Geographical, historical , archaeological and other specialized fields of study are represented in the present research programme in the Himalaya. For the space-related scientific investigations a lot of cartographic work has to be done.

The task of the cartographer in the framework of this research programme is not to produce topographic maps of a whole district. The final goal is to prepare thematic maps for different areas of interest containing only special research-related information.

To attain this goal, there have first to be produced study maps for fieldwork and later on base maps to localize the thematic items and to present the results of the research work in a visual way. The scale and contents of such maps need to be selected carefully, with the objectives of the clearly in mind research theme. To reach

this goal economically, it is necessary to make use of all available sources.

At present the studies of the Nepal-German project are concentrating on Mustang district in northern Nepal, especially in the southern part of this region. Interest is focused on buildings, settlements and cultivated areas in use at present but also on deserted tracts as witnesses of the past along the south-to-north traffic routes between India and Tibet. Of special interest, furthermore, is the Muktinath valley with its holy places and a tradition dating back several thousand years.

In the following chapters a short sketch is given of the different cartographic activities involved in preparing study and base maps for this part of the Himalaya.

2. Medium scale maps

Mustang district, an area of about 3600 km² is located in the upper reaches of the Kali Gandaki River and represents an arid high mountain area (fig. 1) with important roads (paths) and passes to the surrounding regions of Tibet, Manang and Dolpo. It is covered by 10 sheets of the one inch map of Nepal (GURUNG 1981).

This map programme, covering the whole of Nepal and now available at a scale of 1:50 000, is considered to be the basic information source for all further mapping activities. Geographic and grid coordinates as well as heights are referred to these sheets cartometrically, but all values given in yards and feet were transformed into the metric system.

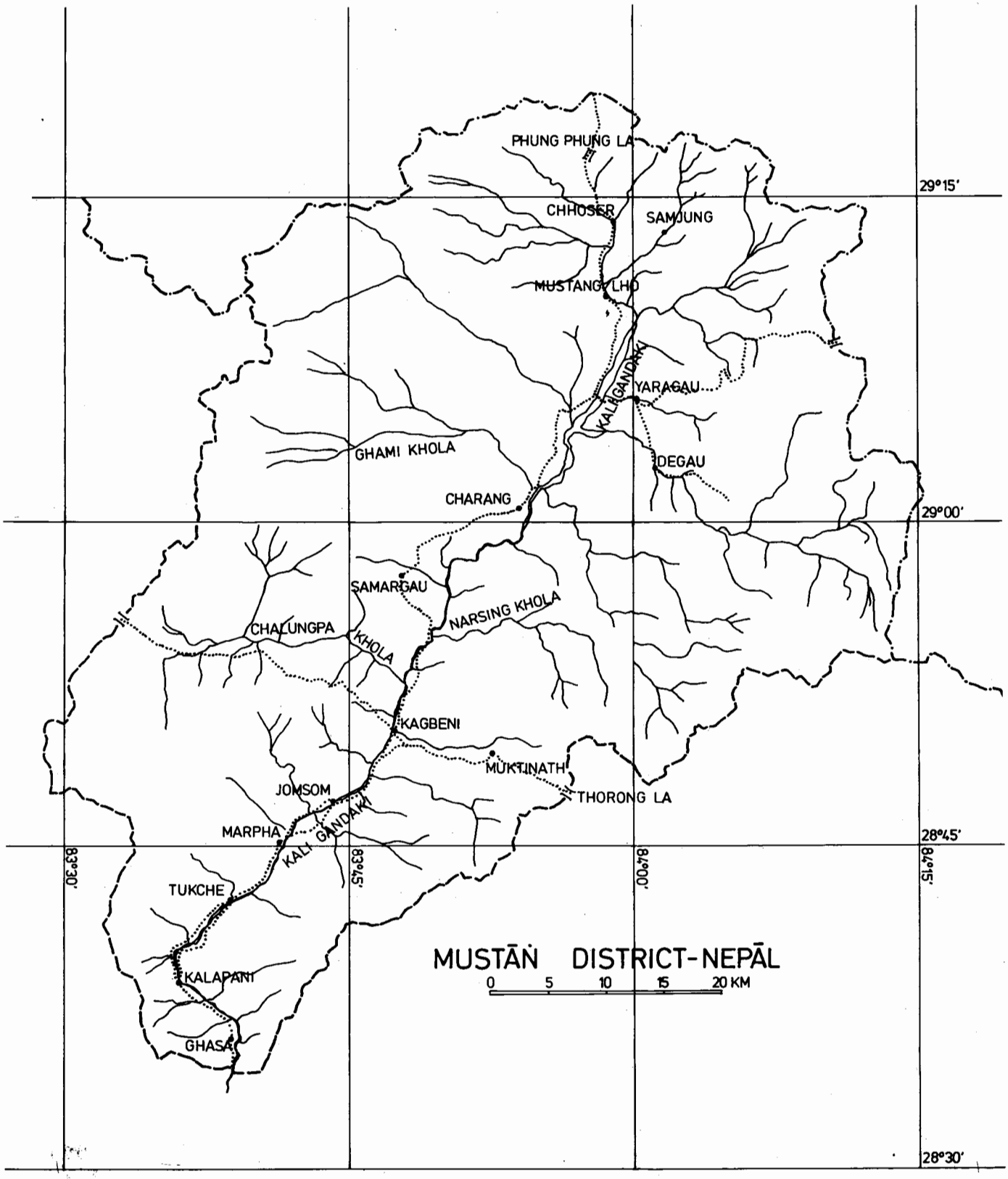
Based on these sources, different maps were produced using all available and economically justified basic material, such as map sheets or space-borne images.

For the representation of the whole of Mustang district, a map scale of 1.200 000 was chosen. The informational content of the previously mentioned sheets of the one inch map proved unsuitable; too many details in situation and relief are shown on these maps. Thus a special map, the Mustang District Satellite Image Working Map was prepared. Its informational content consists of the black and white image of a LANDSAT MSS scene combined with the digitized irrigation pattern of the land utilization map of Nepal at its original scale of 1:50 000. The satellite image map is a study or work map and does not show greater detail. Completing the information content is the task of specialists in the different fields of research.

To carry out detailed studies in the Kali Gandaki valley or in the densely settled areas of the Muktinath valley, the informational content and the scale of the previously mentioned map is not sufficient. Nor are the sheets of the one inch map, available only as blueprints, suitable as a base for the intended research studies without revision. Thus with the help of Russian KATE 200 photos and a Westeuropean SPOT satellite image, a study map was prepared (fig. 2) combining these data with transformed information derived from the sheets of the one inch map.

The information content of this map is limited to the irrigation pattern and a few additional elements of the ground plan. It is therefore possible to upgrade the information further with data derived from space-borne images or the

Figure 1: Mustang district in northern Nepal with the upper reaches of the Kali Gandaki River and the holy place of Muktinath.


PHUNG PHUNG LA
29°15'
CHHOSER
SAMJUNG
MUSTANG LHO
KALIGANDAKI
YARAGAU
GHAMI KHOLA
DEGAU
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29°00'
SAMARGAU
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CHALUNGPA
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JOMSOM
THORONG LA
MARPHA
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28°45'
83°30'
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84°00'
84°15'
TUKCHE
KALAPANI
GHASA
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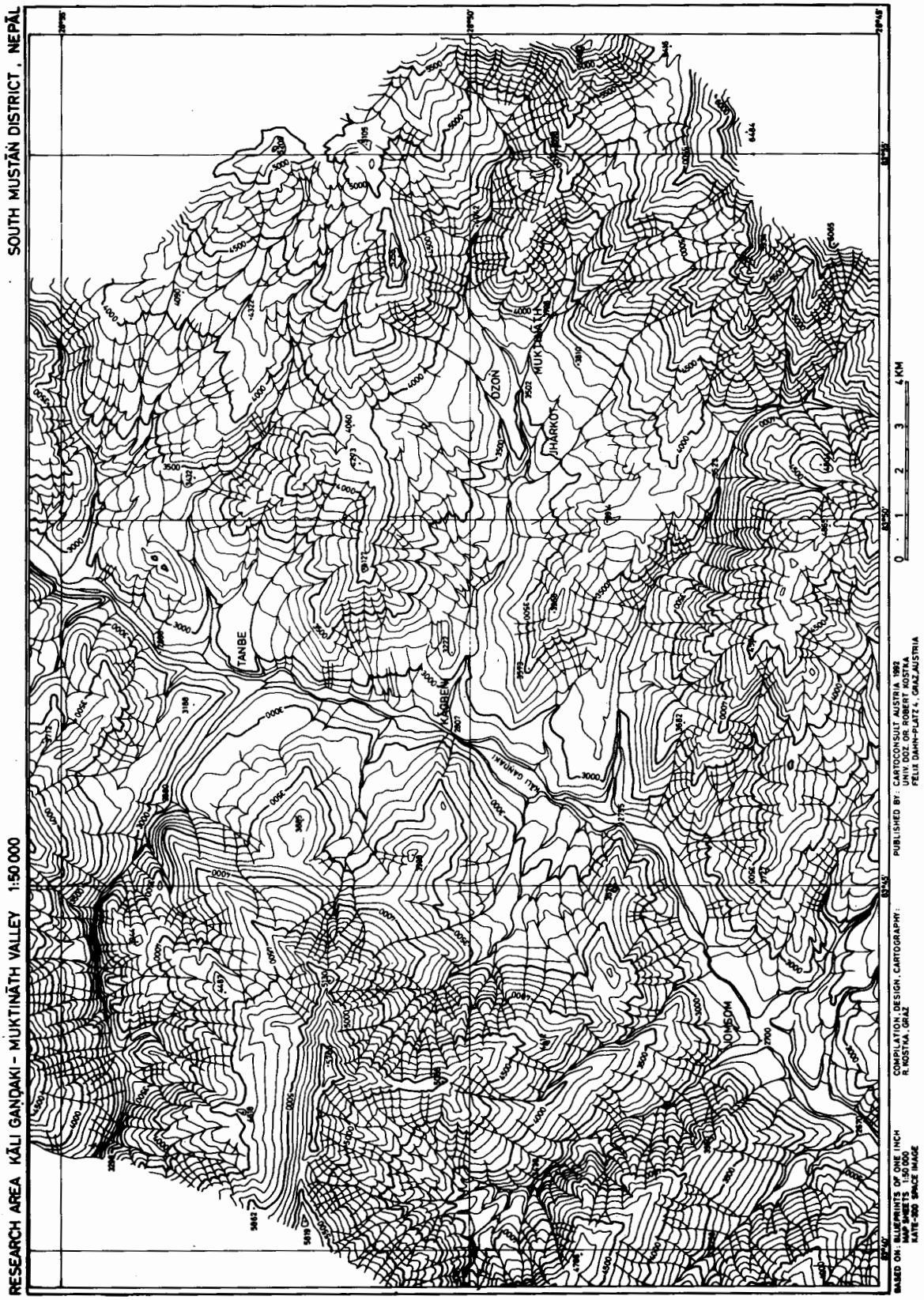

Figure 2: Research area Kali Gandaki - Muktinath Valley 1:50 000, derived from the sheets of the one inch map and satellite images (reduction).

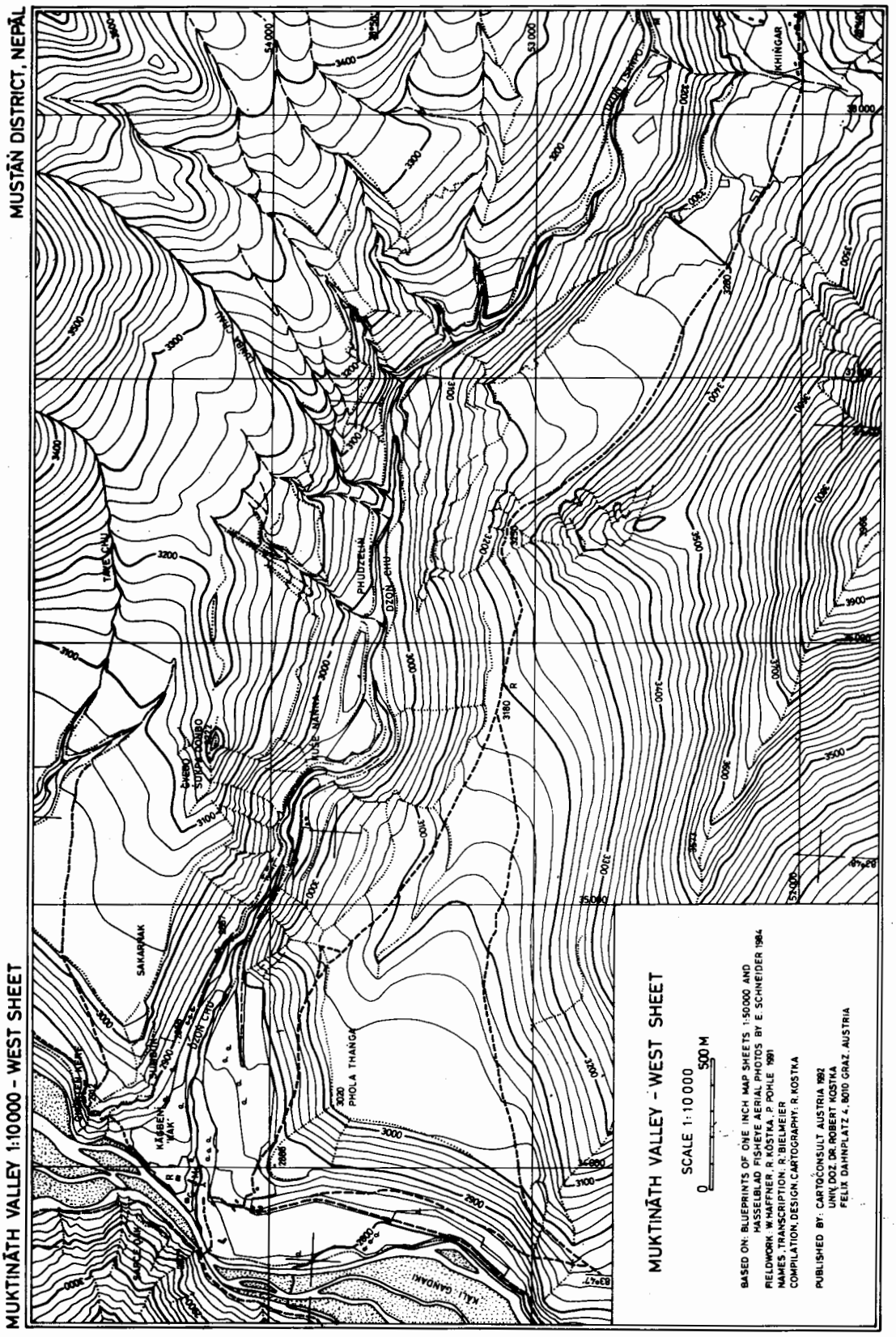

Figure 3: Muktinath valley, reduction of West sheet (original scale 1:10 000), showing the Kali Gandaki valley, the village of Kagbeni and the lower part of the Dzong river valley.

result of field studies. The relief representation is given through contour lines with an equidistance of 100 meters, derived from the one inch map. A generalization process was necessary, disregarding less important details in order to make the product - the base map for the results of the thematic studies - easily readable.

The generation of this map type is planned for the entire upper reaches of the Kali Gandaki River. Thus it should be easy to localize agricultural areas and settlements along with monasteries (still in use or abendoned), caves and other features accurately.

These maps in the range of scales from 1:200 000 to 1:50 000 were generated to serve the needs of a wide range of studies. They concern not only results derived from literature or existing map sources but also remote sensing data combined with the results of fieldwork.

For detailed studies, maps at larger scales are necessary.

3. Large-scale mapping

As a topographic base of information for studying detailed areas, neither existing map sheets nor available satellite images, as mentioned before, were sufficient. Thus it was necessary to use large-scale aerial photos, if available, or execute geodetic and/or terrestrial-photogrammetric fieldwork.

Besides the mapping of the whole Muktinath valley at a scale of 1:10 000, a large-scale mapping of the irrigated fields of the Kagbeni area was done. Furthermore the holy places of Muktinath and the cave ridge near Jharkot were mapped. Only the first two mentioned examples are described in the following paragraphs.

A special remote sensing technique was necessary to get a generalized map of the Muktinath valley (West- and East sheet at a scale of 1:10 000) using existing Hasselblad aerial images taken by E. Schneider with a fisheye lens in 1984. The huge distortion of the 6x6 cm^2 Hasselblad photos with the fisheye lens Distagon f 30 mm must be taken into account for a proper evaluation. This concerns not only the parameters of the inner orientation but also the technique of the photogrammetric plotting.

The informational content of the map sheets derived from these maps consists of details in the ground plan recognizable in the stereo images and the relief information through contour lines with an equidistance of 20 meters (fig. 3).

No further technical details are given here; reference is made to the literature (GRUBER and KOSTKA 1992). The goal in mentioning this map production process is rather to show that the technical possibilities depend on the individual problem and that,as a result of limiting conditions, individual solutions of the mapping process, especially in large-scale mapping are necessary.

To prepare the land use map of Kagbeni (reference may be made to P. Pohle in the same volume) the fisheye images were not sufficient. As a cartographic base for this land use mapping five sheets of land register map at a scale of 1:1250 were also used. As there are terraces and slopes bordering on the irrigated fields, terrestrial photogrammetric fieldwork had to be done to obtain topographical information. This work was executed in the year 1991 and the results reflect

the topographic situation in that year at a scale of 1:2500. The measurements for preparing the land register maps, however, were done in the year 1975, so this land use information had to be revised and brought up to date (see also P. Pohle, in the same volume). The combination of the thematic and topographic source maps was chosen especially with a view to help visualize the landscape-ecological situation of the settlements and the irrigated fields in the confluence area of the Dzong river with the Kali Gandaki. The information presented in this large-scale map other than topography and visible land use was the result of detailed field studies.

4. General remarks on the mapping processes

Except the last example, none of the maps mentioned above is a final product. They should serve for fieldwork purposes as basic information and also, in the framework of literature studies, as study or work maps.

To get the required results economically for the different tasks, it was necessary to use all available sources. In the case of the Mustang valley these were:

Maps: the one inch map, but also overview maps, the sheets of the land-utilization map or thematic maps;

Spaceborne images: as NASA-LANDSAT MSS scenes PRIRODA-KATE 200 photos in 3 spectral bands or a SPOT2-XS transparency /film for localizing the artifically irrigated fields.

With the help of all these sources the map preparation processes were executable economically, the only further methods being aerial photography with non-metric cameras, terrestrial photogrammetry and geodetic fieldwork.

By combining and selecting the suitable data and methods, the required study maps for the intended research work could be prepared. In future these maps ought to be used as basic information for the preparation of different thematic maps.

References

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