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Peak Identification, East Tibet: Method and Result

Tim Inoue

Introduction

Less information forces us hard work to identify unknown peaks in the east Tibet. But we can make the way to get the answer by the following scenario.

1) Start from one picture

From where was the picture taken? For instance, here is a peak “Choembo” picture taken by F. Kingdon Ward during his exploration through the Ata valley in 1933.

In 2006, when we had started survey of approach and climbing route of Ruoni, the highest peak in the Kangri Garpo Mountains, this picture was only one source to study the west and south face of the peak. The caption attached to the picture gave us no additional information of camera bearing and point unfortunately. We could not identify the peak by Google Earth which we could access at that time.

There is another way to exploit pictures taken on the airlines. Peak and mountain range pictures taken on the airlines Chengdu—Lhasa or Chengdu—Lin Zhi provide us useful information for peak identification.

Mining the Internet gives us many useful, but, uncertain pictures, taken by tourists. Many Chinese took interesting peak pictures in forbidden Tibet for foreigners. For instance, we had a plan to make an expedition to Tarlha Ri range in 2015. Even though we could get pictures of the east, north and west face. The south face one was missing. We could get the one in the Internet incidentally.

The photographer misunderstood the peak-name, but we could identify it as the south face of Tarlha Ri range.

2) Useful maps

We cannot access the Chinese detail topography of the Nyainqentanglha and Kangri Garpo. Those are not open to foreigners. We can get the old Soviet Union maps. Yukio Matsumoto published nice skeleton map of Kangri Garpo under laying the Soviet map by painstaking work. Finally, Tom Nakamura assembled skeleton maps of the whole east Tibet. These maps are the basic tool to identify peak pictures which were taken by climbers and trekkers.

Kone Kangri in the KangriGarpo was a missing peak in many years. An exploration team had tried to access to the peak and reached the snout of the glacier, but they could...
not see the peak. There are still several unveiled 6000m peaks in the Kangri Garpo. In addition to those maps, it is important to make a skeleton map for the target range by using Google Map or Google Earth.

3) Satellite DSM (Digital Surface Mode I) data

The Satellite DSM (or DEM: Digital Elevation Model) data has recently become more accurate and precise. It is possible to utilize the DSM data with in “centimeter range” for professional use. Only expert engineer can deal with special knowledge, skill, computer environment and cost. But, it is necessary to prepare relatively easy operation and low cost environment for us like climber, explorer or tourist. So, Google Earth (including Google Map) and ALOS (successor of ASTER) are available and powerful for peak identification to date. The DSM of Google Earth has inaccurate and unclear data in some region. The data may be updated frequently. It is necessary to check periodically. For instance, the Bada Ri 6516m expedition in 2015 sent the team to the Nyainqentanglha West. They had gotten Google Earth data and picture for their planning to decide camp and route to the summit. When they were in the mountain, the Satellite took new picture and updated the area data. After the expedition, they surprisingly found new data which captured...
their base camp and attack camp.

ALOS, The Advanced Land Observing Satellite, a Japanese satellite named “DAICHI”, opens “the ALOS World 3D－30m (AW3D30)” data to the public and is free of charge. A few interface tools are introduced to expert engineer. “Kashmir” is popular in Japan and easy to operate to utilize DSM.

The data of ALOS is same as Google Earth. Both solutions have accurate location data, and questionable peak elevation. The different heights are shown on the same peak in the two solutions. The reason is that the data review and evaluation process was not enough because of less cost. If necessary, it is required to order to a certain business unit for the precise DSM of focused area with payment. A precise sample of Mt. Everest is attached to the Web site.

◇ Method of peak identification

In order to identify the peaks of East Tibet, the unknown target peaks and well-known reference peaks picked up from the skeleton map “East of Himalaya, Mountain Peak Maps” should be plotted on Google Earth and ALOS·based Kashmir map with peak ID. Downward, the well-known peak will be the datum point to search surrounding unknown peaks. The wide and zoom pictures of well-known peak become good guide for searching. In addition to the reference peak, surrounding peaks found on Google Earth and ALOS should be plotted on the map with tentative ID and elevation data.

Next, review date and time, place of the shot and additional information of the newly acquired pictures. If the peaks have unique feature points, it is useful to identify. If the travelling photographer had a GPS receiver, tracking record can indicate the location of the picture because digital camera has date and time in each picture data. It is easy to make a same 3D simulation shot of the target picture on Google Earth or ALOS by using the picture location. In case of aerial picture, flight record provides shot location as well. Sequential shots of aerial picture easily suggest the location even though those shots have a few lacks.

Kone Kangri in the Kangri Garpo is a missing peak for years. The location of the peak is clearly pointed on topography. Searching Kone Kangri on the road through Parlung Tsangpo by using Google Earth 3D image, a visible area was found in the upper part of Yupu Village. It was easy to find pictures of the peak in the database of PC.

Reference data and tool
1. Skeleton map “East of Himalaya, Mountain Peak Maps”
2. Google Earth and Google Map
3. ALOS data and Kashmir map
4. GPS data: Expedition record, traveler; tracking data
5. Digital camera Picture and Time Data (yyyy-mm-dd hh:mm:ss)
   Unique feature of picture
6. Flight tracking data Flight Number, Date
7. Report of expedition and travel

◇ ALOS data
ALOS (DSM) 「ALOS World 3D - 30m (AW3D30)」 JAXA
ALOS: Advanced Land Observing Satellite (DAICHI)
PRISM: Panchromatic Remote-sensing Instrument for Stereo Mapping
Earth model: WGS84
data: DSM (Average)
Digital Elevation Model (DEM) or Digital Surface Model (DSM)
Accuracy: 5m
Kashmir: http://www.kashmir3d.com/ALOS/

Experience
- The data of East Tibet, AW3D30 has noise and inaccurate data in certain areas.
- The latest ALOS2 will be utilized in the near future which has more accurate data.
- Kashmir is comfortable for analysis with colored contour lines such as 6000 meter and others.
- Kashmir has a function to put names of peaks on the map. It is easy to identify peaks.

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Fig 7 Height comparison

The altitude data extracted from ALOS and Google Earth indicate lower height numbers on the sharp or thin summit structure peaks than that of actual. The satellite survey of the Himalaya will notice the apparent flattening effect. But a few data looks higher elevation than the data of the skeleton map. Google Earth and ALOS often indicate different elevations on the same peak. Peaks of some areas have extreme low elevation data in ALOS; therefore careful evaluation will be required.

Data correction on Google Earth and ALOS by past operation like SRTM and ASTER has been executed and the revised up loaded data can be seen. But, it is not the case in East Tibet region.

ASTER: Advanced Spaceborne Thermal Emission and Reflection Radiometer (TERRA, USA)
SRTM: Shuttle Radar Topography Mission
Identification of Zepu and Jalong range

Flight from Chengdu to Lhasa flies over the Nyainqentanglha Mountains. If weather permit, countless number of unclimbed peaks will appear and disappear in the window. Many beautiful pictures are taken by passengers. Those pictures will become important source of peak identification.

Flight number, date and time record of the digital camera indicate the location of the picture. Flight direction of Chengdu-Lhasa usually goes from east to west that means the shadow of mountain appears in south or north, not east or west. Analyst can narrow down search direction. Google Earth will provide an adjusted simulation image of the picture. Previously marked peak ID on Google Earth can be easily identified by the peak image.
Fig 9 Flight information and bearing of the picture found this area on Google Earth.
Well known Zepu and Jalong Peak ID helps recognition.

Fig 10 ALOS-Kashmir map of same area of Google Earth.
Coloring helps feature of the range. Camera angle is shown on the map.
The Alpine Club of Kobe University

Fig 11  Simulated image by ALOS-Kashmir

Fig 12  Identified aerial picture of Jalong Zepu Range
Previously fixed peak 6420m of Jalong indicate 6248m from ALOS
The number 6420m looks too higher than actual.
◇ Aerial picture identification: Mainri Snow Mountain (Kawagebo) & Kangri Garpo

The flight Chengdu-Lhasa or Lin Zhi flies over Sichuan Mountains. Minya Konka and other rocky mountains will appear in the window and the flight will approach to the Nyainqentanglha. Mainri Snow Mountain and Kangri Garpo Mountains are visible in the far south horizon.

![Aerial picture of mountain range](image)

**Fig-13** Flight information and Camera data suggested the range and Google Earth image fixed peaks. Aerial pictures of the mountain range provide informative overview of the peaks. Hidden peaks stand in the deep valley often appear in the aerial view with those feature. Aerial picture is a powerful tool of peak identification.

![Aerial picture with peaks marked](image)

**Fig-14** After comparison check by aerial picture with Sketch and skeleton map extracted from Google Earth, KG-21 and KG-155 those peaks are not visible on the ground appears.

◇ Known peak and unknown peaks are in the same picture: Pulongu Range
To identify the peaks in the Nyainqentanglha, Namcha Barwa is a powerful reference point. In case of Pulongu Range, the aerial picture captures Namcha Barwa and Gyala Peri in the south. Therefore it was easy to find camera bearing. At first Pumobunji was fixed. Pulongu was identified continuously on the jointed serial picture. Jointed serial pictures are effective.

Fig 15  Many peaks were fixed by Namcha Barwa and jointed aerial image

◇Known peak and unknown peaks are in the same picture : Serial shot: Jainija6586m

Fig 16 The result of Pulongu identification and time series of the flight suggested the area of the picture.
The picture (Fig-16) taken after taking Pulongu area includes Namcha Barwa and Gyal Peri. Position of these two peaks in the picture comparing with previous shot indicates progress of the flight to west. The two prominent peak of Jainija and P6444m stand side by side. This feature is also remarkable identifier. The image simulation was done by Google Earth. Elevation numbers of Jainija and P6444m are 6045m and 6002m in ALO. Those data are extremely low and questionable. Additional survey of this area should be retried.

Discovery of hidden Kone Kangri

There are still veiled 6000m peaks such as KG-21 KG-35 Kg-36 KG-54 KG-55 KG-57. Remote shots of KG-21, KG-35 and KG-36 exist, but are too small to recognize.

In 1999, Gakushuun party approached to Kone Kangri through Gone valley and reached on the snout of Gone Glacier. They could not see the peak unfortunately. Since this exploration, this peak has remained as mysterious peak until 2009.

Lopchin Expedition by Kobe University party had passed the road through Parlung Tsangpo and took many pictures of Kangri Garpo with GPS tracking data. The picture of Kone Kangri was included in those image data.

At first, as preparation, the peak was plotted on Google map with surrounding peaks which was extracted from the skeleton map and specially granted topography.

Searching view point on Google Earth 3D images through Parlung Tsangpo, good location near the village of Yupu was found. The date and time was gotten from GPS and the target picture was found in...
the image database.

Digital camera and GPS is basic tool during travel and many pictures targeting unknown peaks will be reviewed after coming back home. We should instruct this way to travelers who are going into remote valleys and mountains.

◇ Sample of analysis operation by ALOS DSM with Kashmir

Kashmir has function of 3D imaging and Mapping with contour coloring pallet. These functions utilize clear mapping, image shot and pointing peaks. Pallet has flexible coloring with unlimited contour generation.

◇ Browsing Internet: Tarlha Ri

“Tarlha Ri Range” is an independent range and visible from surrounding road. Therefore it is easy to get nice pictures. In reality, fine pictures of east face, north face and west face are in the binder. To find capable approach and line to the summit was an important issue. South face had not been unveiled.

The picture was found incidentally and fortunately through Internet browsing without key word because of misunderstanding of naming on that picture by the photographer.
Many pictures are pinned up on Google Earth and incorrect captions or wrong locations are detected. But, valuable picture may found sometimes.

**Comparison of height number of Zepu Kangri: which is main peak?**

Zepu Kangri has three peaks on the summit ridge. These peaks have different three elevation numbers of Google Earth skeleton map and ALOS.

In Google Earth, the Peak 6338m elevation in ALOS is 6157m. To decide the highest peak, additional study is required.
**Unique point** : KG-41 (Kangri Garpo)

Explorers often go into unknown deep valleys to survey peaks and try to take pictures. Narrow sight in the valley prevents them from taking good pictures. They are perhaps obstructed by ridge and forehead of the peak even if they want to see the main peak. KG-20 (Genikutz), KG-21, KG-40 and KG-41 stand in the back end divide ridge of KG-20 is invisible from Midui Longba. The east peak of KG-40 can be seen from Midui Longba, so that someone said KG-40 should be Genikutz. KG-40 is twins (West Peak and East Peak) and is visible in Xinguo Longba. Xinguo Glacier has two forks. KG-41 stands in the west fork. KG-41 should be visible at the confluence of two glaciers.

Zoom shot of KG-41 (Fig-23) has a characteristic feature on the ridge. This feature is captured in the picture from Snow Dome (Fig-24) and peak identification of KG-41 is complete. Peaks with unique feature are easy to identify. KG-41 is captured in the aerial remote shot (Fig-14) of Kangri Garpo Mountains from Chengdu – Lhasa flight.

***************Other sample of the peak identifications***************
Fig 25 Nyainqentanglha West Mountains south face

Fig 26 West view from the top of Ta Ri 6300m

Fig 27 Chagla from the west ridge of Kyizi
Fig 28  Dojiza & Yuri  South - east view

Fig 29  Namcha Barwa & Kangri Garpo

Photo by Wuri Wusa
Fright: Chengdu - Lhasa
Fig.30 P6840m, Nyainqentanglha
The Grand Hengduan Mountains
横断山是值得中国骄傲的一个区域，即便在世界各大山岳中也独具特点，这里仍有许多世人未曾涉足的山峰。我非常钦佩编辑组的努力，能够将横断山的历史、山岳以及动植物编辑成册，大横断一定会不断吸引世界各地的登山家以及登山爱好者前往。
横断山脉研究会（日本）会长 中村保

横断山脉是中国极致风光最密集的区域。透过文字和图片，大横断的壮美画卷徐徐展开。你能从中读到多种民族文化的传承，也能看到如天堂遗落的色彩，更能感受到镜头后的深沉热爱。
《户外探险》杂志执行主编 王鹏

这是一部中国户外人双脚踏查写就的横断山脉历史。发现、探索、思考、解读、呈现，本书将带领读者了解大横断的前世与今生。
《山野》杂志执行主编 谢漪珊

大横断摄影师的血液里涌动着人类探索的气息。透过镜头，带领读者一起登上高山，俯瞰世界，这便是他们充满激情并骄傲工作的理由。
《华夏地理》主编 买天让

三年探索才有此书。这些情怀不灭之人，这些勇敢探路之人，这些“假跟山过不去”的人，让我们有机会重新认识横断山。
星球研究所创始人 耿华军

这里是全球未登山的资源富集地，超过300座海拔6000米以上雪峰遗世独立。地理大发现之后，勇气和想象力支撑着人类不断开拓探险的疆界，但任何时候我们都需要怀有敬畏之心。
探路者联合创始人 王静

横断天路，是中国首条与世界接轨的国家步道，也是大十字步道构想的开篇之作。当大十字梦最终照进现实，中国必将成为世界瞩目的徒步天堂。
班夫中国创始人 钱海英
老人与山

撰文/马德民

无论从哪个角度探讨中国的横断山区，都避不开一位日本老人——中村保。

大多数登山者，即使是喜马拉雅山区的专家，大概也不能回答这两个问题：西藏哪个冰川的海拔最低？西藏哪个冰川的面积最大？

第一个问题的答案是 14 公里长的阿扎冰川，它的末端延伸至海拔 2440 米。第二个问题的答案是长达 30 公里、2～5 公里宽的来古冰川，它让我们想到巴塔哥尼亚和阿拉斯加的冰川。这两个冰川都位于喜马拉雅的东南部。

这些有趣问题的发问者，就是著名登山家中村保先生。他也是喜马拉雅山区最多产的未登峰探险家，在过去的 18 年中，他 30 次探索喜马拉雅东部的未登峰世界。超过 250 座海拔 6000 米以上的未登峰分布在西藏东南部、四川西部和云南西北部，详细的地图、照片和山峰信息给那些寻找未登峰的登山家开启了一扇通往天堂的大门。这些峰顶激发着攀登者的攀登欲望：这里有从未有人看见的沟壑、未被触动的山脊和未登的山顶。


“在攀登喜马拉雅山的黄金时代结束后，一些被海拔 8000 米高峰遮掩的美丽山峰等待着我们的到来，不计其数的未登峰以难以置信的浩大气势召唤着攀登者的探寻。那些峰顶是惊人和壮观的，并且很多地区保持着悠久的历史文化传统。这些人迹罕至的峰顶与五条伟大的河流峡谷同生共存——金沙江、澜沧江、怒江、独龙江和雅鲁藏布江。1990 年，我开始对中国西部的边疆进行探索，然后集中在青藏高原的 ‘阿尔卑斯’ 区域——未知的峰顶和冰川在念青唐古拉东部、岗日嘎布山脉范围和三江并流区域。”尽管随着卫星全球定位系统和遥感技术的出现，卫星图像和其他先进制图技术的应用把世界描绘得更清楚，但是中村保依然如故地坚持他的探
险梦想。

1996年9月，村村保在“地平线报告会”上首次发布了喜马拉雅东部山峰的研究报告。村村保指出，这一区域的主体包括西藏东南部、云南北部和四川西部，其面积达6000米的未登山峰，将成为未来世界攀登的一个重点区域。

对于众多熟知的西藏海拔8000米的高峰，喜马拉雅东南部的未登山峰几乎无人问津。一方面是因为这一区域交通不便，缺乏基本的地理测绘信息；另一方面，中国的山岳文化以传统的三山五岳为审美对象，喜马拉雅东南部的未登山峰并不完全符合这一审美标准。然而，西方地理地质学家们并没有忘记这个被世人遗忘的角落。苏格兰地质学家华特·古格里和瑞士测量专家蒙霍夫在其著作中均明确提到了“中国的阿尔卑斯”这样的字眼。

真正从攀登角度定义喜马拉雅东南部的未登山峰是“中国的阿尔卑斯”的第一人是村村保。他在喜马拉雅东南部重点考察了西藏古拉地区山脉，并用“East of the Himalayas—Alps of Tibet”作为自己著作的名称。这一观点受到国际攀登界的追捧，数年间，以著名登山家Mick Fowler为代表的一批喜马拉雅东南部未登山峰探索者相继完成一系列令人震撼的攀登路线，激发了攀登者们对这一区域的探索。今天，村村保依然每年跋涉在通往未登山峰的路上，为攀登世界攀登着一个个小路。

“在山中，最大的问题是孤独，孤独对我来说是一种珍贵的财富，有时候是出自内心真正的需要；然而，从来没有一种痛苦。正是与这些山峰为伍，我每次都能在自己内心展开一段迷人的旅程，以便更好地审视自己，理解自己，并且更大地理解他人和自己周围的世界。”

“伴随着孤独和沉默的探险，有时也使我迷惑，更多伴随着它带来的所有奥秘。无论如何，我的天性仍然是孤独的观察者，大部分时间我是敏感的行动者。因此，我是一个梦想家，毫无疑问，我的事业在我脑海中形成的时刻就开始存在。让我们记住，横断山是我们地球上最灿烂和多彩的一部分，它记录的不仅仅是我们过去、现在，还有遥远的未来。”

祝贺《大横断 寻找川滇藏》（GRAN HENDUAN BOOK）出版。

衷心祝贺中国首部多角度描述横断山脉的巨作横空出世。

位于喜马拉雅以东绵延不断的横断山脉，即使在世界各大山脉中也独具特色。该书对横断山脉进行了综合性的记述，其内容价值不可估量。

该书不仅展现了横断山区的山脉，还通过地理、文化、历史、民族以及动植物等多个视角进行了描述，堪称里程碑式的力作。

我曾历经25载实地考察了包括横断山脉在内的喜马拉雅以东各大山脉，将成果集大成于《大横断 寻找川滇藏》（中文日文译本）一书并公布于世。我发自内心希望此次《大横断 寻找川滇藏》一书的出版能够获得广大读者的关注。

对于该书的出版，再次表示深深的祝贺。

村村保
2018年8月

中村保
帕隆藏布大峡谷
全长78公里 最大深度4530米 平均深度3555米

古米大峡谷
全长30公里 最大深度3860米 平均深度3290米

虎跳峡
全长16公里 最大深度3774米 平均深度3027米
三江并流景观带距离63.5公里

三江并流卫星影像图
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<th>二郎山报春</th>
<th>建塘塘花报春</th>
<th>梦叶报春</th>
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<td>云南报春</td>
<td>青海仙花</td>
<td>钟花报春</td>
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<td>金兴百合</td>
<td>大叶金莲杜鹃</td>
<td>山光杜鹃</td>
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<td>益母草龙胆</td>
<td>阿嫩子龙胆</td>
<td>泸定百合</td>
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