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Ethno-Ecological Approach of Tibet South-Central Rural Environment Knowledge as a Support to Kashin-Beck Disease's Etiology *

by

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But an examination of local, traditional food items can do even more than merely assist with the aetiologies and occurrences of certain maladies ...
MEYER-ROCHOW (1998)

Vous êtes des personnes très instruites, des diplômés ; vous devez comprendre que je suis un paysan analphabète. C'est vous qui devez me comprendre moi, et pas moi qui dois vous comprendre. Jaïr Londono, peasant, during a workshop held at Chiclayo (Peru).
In : MORLON (1992)

KEYWORDS. — Tibet ; Ethno-Ecology ; Landscape ; Rural ; Alternative Foods ; Kashin-Beck.

SUMMARY. — The paper first comments on the three main groups of etiological hypothesis regarding the Kashin-Beck disease : lack of selenium, role of drinking water and presence of mycotoxins in food. Then the ethno-ecology concept is introduced. Ecoclimatology, geological features and agro-ecology of Tibet are briefly recalled.

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Methodology of field survey is described. Results deal with two items, namely landscape unit's recognition and alternative foods. Fourteen landscape units are recognized ; their diversity depends mainly on mountain environment and fields' location. Thirty-five wild edible plants are listed and shortly commented on. In conclusion, landscape recognition has some similarity with Tamang knowledge of Nepal, whilst alternative foods listed have only a maximum of six species (17 %) in common with other Himalayan regions. This observation enhances the need of exploring each Himalayan region regarding its potential ethnobotanical resources.

MOTS-CLES. — Tibet ; Ethno-écologie ; Paysage ; Rural ; Nourritures alternatives ; Kashin-Beck.

RESUME. — *Approche ethno-écologique de la connaissance de l'environnement rural du Tibet centro-méridional comme support à l'étiologie de la maladie de Kashin-Beck.* — L'article discute, en premier lieu, les trois ensembles d'hypothèses étiologiques suggérées concernant la maladie de Kashin-Beck : déficience en sélénium, rôle de l'eau potable et présence de mycotoxines dans la nourriture. Ensuite, le concept d'ethno-écologie est introduit. L'écoclimatologie, les caractéristiques géologiques et l'agro-écologie du Tibet sont brièvement rappelées. La méthodologie de l'enquête de terrain est décrite. Les résultats concernent deux aspects de la connaissance environnementale, à savoir la reconnaissance des unités de paysages et les nourritures alternatives. Quatorze unités de paysage sont distinguées, leur diversité dépend essentiellement de l'environnement montagnard et de la situation des champs. Une liste de trente-cinq plantes sauvages comestibles est établie et celles-ci sont brièvement commentées. En conclusion, le système de reconnaissance paysager montre quelque ressemblance avec celui des Tamang du Népal, tandis que seules, au maximum, six plantes communes (17 %) sont signalées d'inventaires d'autres régions himalayennes. Cette observation confirme la nécessité d'explorer chaque région himalayenne en ce qui concerne ses potentialités en ressources ethnobotaniques.

TREFWOORDEN. — Tibet ; Etno-ecologie ; Landschap ; Landelijk ; Alternatief voedsel ; Kashin-Beck.

SAMENVATTING. — *Etno-ecologische benadering van de kennis van het landelijke milieu in Centraal-Meridionaal Tibet ter ondersteuning van de aetiologie van de Kashin-Beckziekte.* — In dit artikel worden in de eerste plaats de drie groepen aetiologische hypotheses waarnaar verwezen wordt i.v.m. de Kashin-Beckziekte behandeld : selenium-deficiëntie, de rol van drinkbaar water en de aanwezigheid van micotoxinen in het voedsel. Vervolgens wordt het begrip etno-ecologie ingevoerd. Er wordt kort herinnerd aan de Tibetaanse ecoklimatologie, geologische karakteristieken en agro-ecologie. De methodologie van de enquête te velde wordt beschreven. De resultaten betreffen twee aspecten van de milieukennis, meer bepaald de kennis van de landschapseenheden en de alternatieve voeding. Veertien landschapseenheden werden onderscheiden ; hun verscheidenheid hangt in de eerste plaats af van het bergmilieu en de ligging van de velden. Een lijst van vijfendertig eetbare wilde planten met beknopte toelichting wordt opgesteld. Ten slotte wordt aangetoond dat het landschapsherkenningssysteem enige gelijkenis vertoont met dat van de Tamang in Nepal, terwijl hooguit zes planten ook in andere regio's in de Himalaya (17 %) gemeld worden. Deze waarneming bevestigt de noodzaak om het potentieel aan etnobotanische bronnen van elke regio in de Himalaya te onderzoeken.

Introduction

The aim of the present paper is to describe the environmental knowledge of populations inhabiting a part of the Autonomous Province of Tibet, *i.e.* an ethno-ecological approach. The study carried out is part of a running multidisciplinary programme, initiated in 1992 by "Médecins Sans Frontières – Belgium" in South-Central Tibet (fig. 1). Its aim is to prevent and fight against an endemic

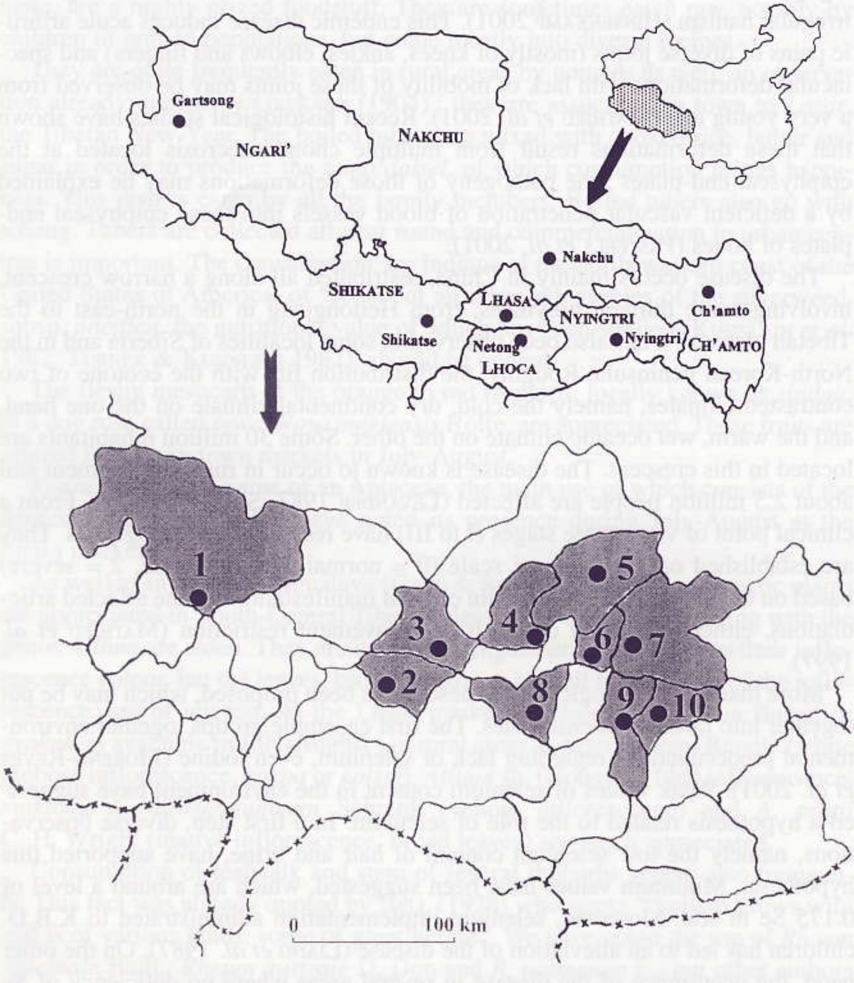

Fig. 1. — Location of Tibet Autonomous Region in the People's Republic of China. The seven prefectures and the ten counties (1. Shätongemön, 2. Rinpung, 3. Nyemo, 4. Tölung, 5. Lhüntrup, 6. Takste, 7. Mältro Gunkar, 8. Ghongkar, 9. Netong, 10. Zangri) where the ethno-ecological survey has been conducted.

disease, the Kashin-Beck. Located at the crossroads of two sciences, our approach needs, as a consequence, to introduce two items, that of the Kashin-Beck disease as well as that of ethno-ecology.

THE KASHIN-BECK DISEASE

Described for the first time in 1849, the Kashin-Beck Disease (K.B.D.), or "big bone disease", has been defined as a disabling osteoarticular disease involving growth and joint cartilage (VANDERPAS & NEVE 1999) and resulting in an irregular nanism (HINSENKAMP 2001). This endemic disease induces acute arthritic pains of diverse joints (mostly of knees, ankles, elbows and fingers) and spectacular deformations with lack of mobility of these joints may be observed from a very young age (MATHIEU *et al.* 2001). Recent histological studies have shown that these deformations result from multiple chondronecrosis located at the epiphyseal end-plates ; the pathogeny of those deformations may be explained by a deficient vascular penetration of blood vessels into these epiphyseal end-plates of bones (PASTEELS *et al.* 2001).

The disease occurs mainly in China, distributed all along a narrow crescent, involving some thirteen provinces, from Heilongjang in the north-east to the Tibetan plateau ; it has also been observed in some localities of Siberia and in the North-Korean peninsula. Roughly, the distribution fits with the ecotone of two contrasted climates, namely the cold, dry continental climate on the one hand, and the warm, wet oceanic climate on the other. Some 30 million inhabitants are located in this crescent. The disease is known to occur in rural environment and about 2.5 million people are affected (LEVANDER 1987, SOKOLOFF 1989). From a clinical point of view, three stages (I to III) have recently been recognized. They are established on a three-level scale (0 = normal, 1 = moderate, 2 = severe) based on the observation of the main clinical manifestations of the affected articulations, either pain, joint deformity or movement restriction (MATHIEU *et al.* 1997).

More than forty etiological hypotheses have been proposed, which may be put together into three main ensembles. The first ensemble groups together environmental preoccupations regarding lack of selenium, even iodine (MORENO-REYES *et al.* 2001). Weak values of selenium content in the environment have suggested a hypothesis related to the role of selenium. In a first step, diverse observations, namely the low selenium content of hair and urine, have supported this hypothesis. Minimum values have been suggested, which are around a level of 0.175 Se in soil. Moreover, selenium implementation administrated to K.B.D. children has led to an alleviation of the disease (LIANG *et al.* 1987). On the other hand, the occurrence of the disease in several areas where no deficiency of Se occurs in the environment invalidates this appealing hypothesis.

The possible role of dietary water has also been taken into consideration. The local presence of toxic organic matters, more specifically of fulvic acid in drinking water, has been considered as a potential causal factor of K.B.D. Nevertheless, several factors are acting against an argument supporting the effect of the chemical nature of consumed water. First, one should be reminded of the large variability of the chemical composition of drinking water in the disease area. Nevertheless, La Grange *et al.* (2001) have reported, within the network under study by MSF-B in Tibet, a significantly lower content regarding organic matter in the analysis of diverse drinking waters of unaffected families ; moreover, the conservation form could induce appreciable differences in composition.

Finally, the presence of mycotoxins in the basic food diet is a third axis of thought. In fact, the climatic conditions in Tibet during the growing season of barley, favour both the high water content of field soils and grain. Depending on the valleys concerned, the harvest takes place during the monsoon season or during the drier autumn climate. The storage of wet grain during winter favours the development of the barley grains of fungi producing mycotoxins (Chasseur *et al.* 1996). The mycological analysis of barley grain samples within families suffering or not from K.B.D. shows that four species are linked to a risk of developing K.B.D. : *Alternaria* Nees ex Fr., *Cladosporium* Link ex Fr., *Drechslera* Ito and *Trichotecium roseum* (Pers) (Chasseur *et al.* 2001). Mycotoxins and lack of Se play together a multifactorial role in the Kashin-Beck disease etiology. The first could produce free radicals which, by lack of Se, oxide the chondrocyte membanes, inducing lesions and necrosis.

The interest devoted to the mycotoxin hypothesis as a cause of the disease is really pertinent as other osteoarticular diseases are linked to the presence of fungi in the diet, namely the articular disease of Mseleni by man (Marasas & Van Rensburg 1986) and the tibial dyschondroplasy of chickens (Walser *et al.* 1982).

Ethno-Ecology

Ethno-ecology is a young science. Its first use goes back to 1954, during a study carried out by Conklin and dealing with the Hanunoo, a Philippine people. Ethno-ecology may be defined as the extension of two disciplines, ethnography and ecology. Other authors consider that it is the natural confluence of four precursor rivers : ethnology, agro-ecology, ethnography and environmental geography (Malaisse 1997). It brings together the description of the different nations, from their material and cultural manifestation (ethnology) to the science of the environment (ecology) (Toledo 1992, Malaisse 2001, Martin 2001).

Morlon (1992) has pointed out "qu'un agronome qui travaille dans une région ne peut manquer, un jour ou l'autre, de chercher à mieux comprendre l'agriculture et les paysans. Il ne s'agit pas d'entasser le plus grand nombre d'observations, mais de les organiser pour leur donner un sens dans une vision d'ensemble cohérente ...". This is our aim regarding our contribution to MSF-B Kashin-Beck Programme in Tibet, a team that is willing to help rural populations confronted with an environmental disease.

In order to help, to relieve and to inform, we first have to know and to recognize, to understand the other. So, it is the country dwellers that we have to observe, to encourage to speak, that we have to listen to, then understand, with whom, finally, we have to communicate. It is from their environmental knowledge that it is necessary to make progress. This change of attitude, which we have to gain, this mentality revolution, is today a must before any field action ; and ethno-ecology is the way to harshness and suppleness. Moreover, there are ecosystem-like concepts in several traditional societies ; ancient wisdom integrates humans into a system where land is alive (BERKES *et al.* 1998).

Our approach is not a fundamental study conducted in the laboratory ; it is not enough to be a spectator, we need to be participants as well ; it is an applied step, carried in the field ; ...we need to be engrossed in the culture we hope to apprehend in order to gain better local human welfare in the future.

Geographical Frame

ECOCLIMATOLOGY

Two main factors control the climatic characteristics of Tibet : the topographic configuration and the atmospheric circulation. A south-east-north-west orientated cross-section indicates a clear line with regard to mean annual rainfall, which varies between more than 2,000 mm during the tropical monsoon and less than 50 mm. During winter, western winds are dominant ; in summer, the southern and south-eastern parts of the plateau are subjected to warm, wet monsoon winds. The climate is very dry during winter. SCHWEINFURTH (1956, 1984) and CHANG (1981) have described the dry valleys of the Tibetan Himalayas. The Tsangpo valley appears as a subzone at the margin of two continental plates. There, annual precipitation is usually between 300 and 500 mm (fig. 2). The mean annual temperature is between 4 °C and 8 °C. The mean temperature during the warmest month varies between 10 °C and 16 °C. Sunshine is abundant and the growing season is longer than in the higher colder meadows. Around Lhasa, rains are frequent from late June to early September (MALAISSE *et al.* 2001).

GEOLOGICAL FEATURES

The Tibetan plateau, often called the "roof of the world", is a collage of continental fragments that were added successively to the Eurasian plate during the Paleozoic and Mesozoic ages. Paleomagnetic data indicate that these fragments were at southern latitudes during Paleozoic age. The sutures between these microplates are marked by scattered ophiolitic material trapped between the crystal blocks during accretion. From north to south, the main Tibetan crystal blocks are the Kunlun, Songban-Ganzi, Qiangtang, and Lhasa terrains. The

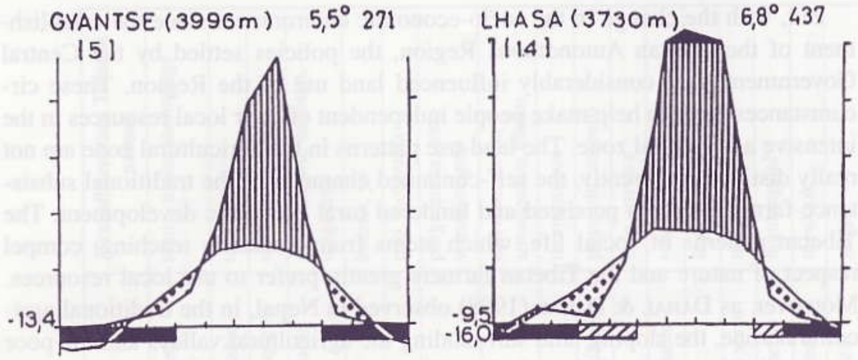

Fig. 2. — Ombrothermic diagrams of Gyatse and Lhasa (after WALTER & LIETH 1960).

plateau is underlain by a continental crust which is 65 km thick ; it is usually about 30 km thick. Elevation of the plateau began in the early Miocene age and probably reached its present elevation about 8 million years ago (LIU 1981).

AGRO-ECOLOGY

On the Tibetan plateau, distinct land use patterns have been identified. They consist of three vertical ethno-ecological zones : (1) the urban zone (Lhasa, Shikatze, Lhoca,..., typical Chinese cities) ; (2) the agricultural zone, which is confined to the valleys along the rivers, the farmlands occupying 1.5 % of the total land of the county ; (3) the pastoral zone, comprised of alpine and sub-alpine meadows, covers 80 % of the total area of the county.

Based on statistical data, variation in land use patterns is related to two vertical agro-ecological tendencies in the agricultural zone (HAUBRUGE *et al.* 2002) :

— Intensive agricultural zone where farmlands have been established only on the alluvial fans and river terraces. Spring wheat is the major crop, and pigs are found in every household, along with cows.
— Traditional agricultural zone, comprised of the sloping land surrounding the agricultural valleys. The staple crop is highland barley, which is cultivated on steep, but fertile valleys. Herds consist mainly of yak, sheep and horse.

In Tibet, as in most other parts of the world, natural resources such as agricultural lands and water resources are viewed primarily as sources of useful commodities. Before 1958, land use appears to have been characterized by relative stability and self-sufficiency, based largely on a single barley crop, mainly on irrigated terraces, combined with nomadic pasture. This highland agro-husbandry tradition survived uninterrupted.

But, with the change in the socio-economic environment since the establishment of the Tibetan Autonomous Region, the policies settled by the Central Government have considerably influenced land use in the Region. These circumstances seem to help make people independent of their local resources in the intensive agricultural zone. The land-use patterns in the agricultural zone are not really distinct. Apparently, the self-contained character of the traditional subsistence-farming system persisted and hindered rural economic development. The Tibetan patterns of social life, which stems from Lamaism teaching, compel respect of nature and the Tibetan farmers greatly prefer to use local resources. Moreover, as Dahal & Dahal (1998) observed in Nepal, in the traditional agricultural zone, the sloping land surrounding the agricultural valleys and the poor communication system help to isolate Tibetan farmers from the rest of the world to make people independent of external influences.

In the Autonomous Region of Tibet, both high altitude and extremely severe climatic conditions affect the availability of natural resources and land use (Haubruge *et al.* 2000). Nevertheless, some Tibetan barley species and cultivars are tolerant of this severe environment, and have constituted the staple diet of farmers for more than 4,000 years AC revealed by archaeological research in the Sera temple near Lhasa (Vavilov 1926, Daniggelis 1995). The barley crop is grown in the short humid summer season (June to August) and is harvested early (in August or September) before it matures. Due to their high moisture ranging from 15.7 % to 17.5 % the grains are particularly susceptible to mould (Chasseur *et al.* 1997). After a field-drying period, ears are beaten with flails and every year naked grains are poorly stored in the same baskets, yak skin or yak-hair bags.

The main storage food sources in the two agricultural zones are barley and wheat. Of the total quantity of grain sown or planted, 55 % of the fields are barley, 20 % wheat, 14 % colza, 7 % peas, 2 % potatoes or radish and 1 % peas. Barley grains are present in 82 % of the Tibetan families, wheat in 34 % (Suetens *et al.* 2001). Barley grains are usually roasted and ground to flour (*tsampa*) which is eaten with butter tea, and are also used to make *chang*, the traditional local alcohol (Haubruge *et al.* 2001).

Although dogs, cats, ducks, chickens and geese are present in all villages, yaks, sheep and horses represent the main animals in the total agricultural zone. In the intensive agricultural zone, black pigs are often found in households ; these pigs are not local-bred but originally brought from Russia (Daniggelis 1995).

The yak is one of the main participants in Tibetan economy ; it is most favourably adapted to the high altitude and cold climate. Animal products from the yak are hair (tents, clothes), milk (children drink, butter, cheese), dried meat, skin (clothes, leather bags, shoes, leather ropes), bones (manufactured glue) and dung (fuel for heating and cooking).

The diet consists mainly of grain with vegetables and a little meat. The dietary pattern changes according to the seasons. In the summer, Tibetan farmers eat a lot of tsampa, stinging nettles and other wild green vegetables and mushrooms. During the winter months, more meat, tsampa and noodles are eaten. Butter is used only for special days. If butter is available, it is used to make butter tea and drunk in the morning. Otherwise, farmers usually drink black tea. A typical meal pattern is as follows : (i) breakfast, tsampa balls and black tea ; (ii) lunch, tsampa balls and boiled potatoes ; (iii) dinner, barley noodles with turnips. Sometimes wheat flour is fried in rape seed oil and eaten. Meat is rarely eaten in agricultural zones and is usually added to noodles for flavour. Milk is rarely drunk and a little dried cheese is eaten.

Methodology

The area studied stretches over three prefectures (Shikatse, Lhasa and Lhoca), ten counties and thirty-four villages (tab. 1, fig. 1). MSF programmes have been allowed to compile, progressively, a pertinent information core dealing with the environment of the rural milieu in south-central Tibet. Nevertheless, the need for a more detailed knowledge study was retained according to the multiplicity of agro-environmental hypotheses suggested regarding the Kashin-Beck Disease etiology (Haubruge *et al.* 2000).

The present study is aimed to offer updated information. Consequently, not only ancestral knowledge but also mutations in progress are integrated. The latter may be of importance, notably in response to more narrow contacts with Chinese culture during the past fifty years.

To reach this goal, detailed surveys were made of the villages, local markets, natural habitats, and informal and formal interviews conducted with the local people. Regarding formal interviews, an ethno-ecological questionnaire was set up and tested. Afterwards it was used upon 40 families, relevant to 20 villages (tab. 1, fig. 1). One or two individuals were interviewed in each family, altogether some 66 people were involved. After quoting the usual characteristics concerning the interlocutors, namely sex and age (23 to 76 years' old), the questionnaire successively referred to *(i)* main and secondary crops, *(ii)* alternative foods, *(iii)* firewood and incense, *(iv)* weather forecasting and meteorology, *(v)* agricultural calendar, *(vi)* husbandry (or breeding), etc. A field visit completed the conversation started in the house and permitted the collection of some reference material as well as their recognition. The choice of families for interview was conducted from a stratified sampling.

While some questions received no answer or brought out weak comments, others gave descriptions which appeared of great interest. We have condensed the relative diversity of the information collected into a short synthesis, structured upon five main items, namely : ethnoclimatology, ethno-agriculture, ethnohusbandry, ethnomycology and ethnobotany.

Table 1
Villages' network investigated during the ethno-ecological survey
in the study area of MSF-B in Tibet Autonomous Region

Prefecture	County	Village	Alt. (m)	Latitude	Longitude	Pop.	Fam.
Lhoca	Netong						
		Sangga		29°21'59	91°49'45	250	62
		Lhakang		29°22'45	91°49'42	210	42
		Damtchu				105	27
		Nangga	3625	29°21'47	91°50'15	160	39
		Kiepa				360	84
		Tokang				165	41
		Namong		29°23'53	91°50'49	160	42
		Tchuding	3810	29°23'20	91°51'20	180	39
	Zangri						
		Biba		29°21'01	92°02'10	130	23
		Djamey		29°24'09	92°19'36	155	30
	Ghongkar	Kampatonde		29°15'30	90°37'22	?	?
Shigatse	Rinpung						
		Youngda		29°10'41	89°53'26	61	7
		Saka	3940	29°09'41	89°53'58	98	14
		Targye	3960	29°08'15	89°53'42	167	27
		Shartcho	4010	29°08'30	89°53'39	92	12
	Shätonge-mön						
		Thao		29°30'09	88°31'40	133	18
		Lhaka		29°39'59	88°37'38	310	54
		Demaku		29°30'32	88°32'00	120	24
		Lunduptse		29°34'33	88°34'48	500	100
Lhasa	Nyemo						
		Lundukang		29°24'35	90°10'59	227	45
		Lume		29°24'35	90°11'23	320	59
		Luteu		29°24'39	90°12'21	245	42
		Toshong		29°28'07	90°15'48	160	28
		Tchunti		29°29'30	90°15'50	80	15
		Batchen		29°30'07	90°15'45	115	21
		Sheu				231	58
	Mältro	Gontchuting				265	40
	Gunkar						
	Lhüntrup						
		Tsingda		30°19'19	91°38'19	210	31
		Tchake		30°08'50	91°22'17	32	45
		Narme				268	57
	Takste						
		Lamotse		29°39'05	91°22'54	154	30
		Poronkang		29°38'37	91°24'17	216	41
	Tölung						
		Dham		29°55'11	90°42'49	778	158
		Tshupsang		30°00'35	'90°44'40	820	139

The present paper focuses on results obtained regarding landscape units' recognition and alternative foods.

Results

Landscape Units

Landscape, integration of geopedomorphologic structure as well as phytocenosis, is a synthetic expression of ecosystem diversity. This approach has constantly demonstrated valuable support, not only as a typological basis of ecosystem differentiation but also as a useful tool in order to follow up dynamic ecosystems' modifications.

Therefore, a clear understanding of local knowledge regarding landscape units is a priority (Malaisse 1998).

Two main characteristics clearly emerge from the information gathered : the importance and diversity of the mountain environment on the one hand, the interest devoted by peasants to the various field locations on the other. Figure 3 shows data collected. As far as mountains are concerned, distinction is made between vegetation cover, forest versus short green scrub or grass vegetation, and geological bedrock versus sand. Special features of geomorphology, such as narrow gorges and piedmont falls of broken rocks are also recognized. In most places the presence of trees is in contrast with the more open man-made landscape. It is therefore not surprising that a small parcel of trees planted as well as wooded massifs are recognized and named. Finally, location of lawns permits a distinction between overgrazed lawns located near watercourses (*naka*) and those located on firm soils (*pangshong*).

Regarding fields, a first step allows one to differentiate between those located at the bottom of flat areas of valleys and those distributed in the mountain slopes. This is of importance as it implies contrasting water conditions from temporary waterlogged soils on the one hand, to well-drained systems on the other.

Alternative Foods

A first set of wild edible plants has been listed (tab. 2). There are a total of 35 species. Twenty-two of them are represented on figures 4 and 5 ; they are numbered in decreasing order, according to their quotation during interviews. They will be shortly commented on.

Young shoots and leaves of diverse nettles, including *Urtica dioica* L., *U. tibetica* W.T. Wang, *U. triangularis* H.-M. and *U. hyperborea* Jacquem. ex Wedd., are wanted in spring and consumed after boiling in water as spinach, the so-called *sapo*, or also air-dried in view of further consumption as soup, called *suptuk* in South-Central Tibet. Their first use has been quoted regarding other populations within the Himalayan range, notably for the Tamang (Toffin &

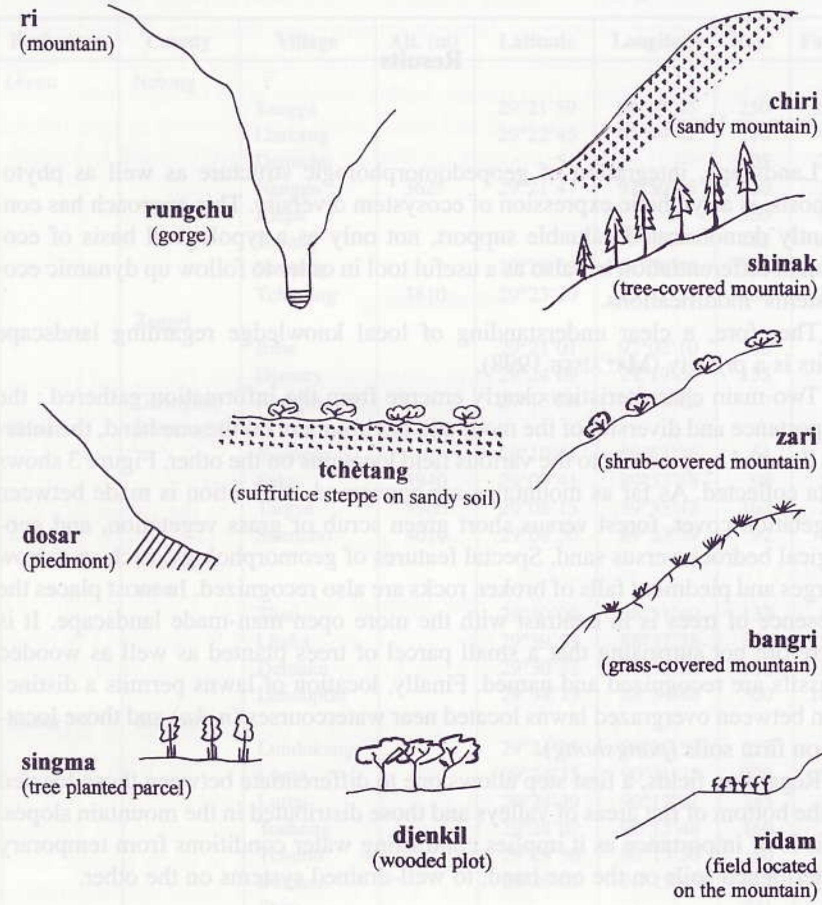

Fig. 3. — Main landscape units recognized by Ü peasants.

Table 2

Wild edible plants of South-Central Tibet according to Ü and Tsang

Family	Species	Voucher (L & M)	Organ	Use	Translitteration Tibetan names
Apiaceae	*Chaerophyllum* sp.	278, 435	fruit, young leaf	spice for meat, with needle	koniu, toniu, sharotange
Apiaceae	cf. *Angelica* sp.	342, 443	young upper part	green vegetable	tchâ
Apiaceae	?	434	upper part	squach for spice	shakoktengyal
Asteraceae	*Sonchus brachyotus* DC.	535	young leaf	green vegetable	gyegoungwa, hagoum, umgouma
Asteraceae	*Taraxacum* sp. 1	277	young leaf	soupe	kouma, yo
Asteraceae	*Taraxacum tibeticum* Hand.-Mzt.	499	young leaf	soupe	ngo, mokouma
Asteraceae	*Jurinaea dolomiaea* Boiss.	341, 466, 442	receptacle	eaten raw	purge numa, tora, warokyongma
Berberidaceae	*Berberis* sp.	489	fruit	eaten raw	marzem, tarwa, simadoukou,tèkom
Berberidaceae	*Podophyllum hexandrum* Royle	410	fruit pulp	eaten raw	momsoussou
Borraginaceae	*Myosotis* sp.	366, 481	root	eaten by children	pawalulu, atuputo
Campanulaceae	*Codonopsis convolvulacea* Kurz	M 15.346	tuber		bala, myewa
Campanulaceae	*Codonopsis thalictrifolia* Wallich	507	above ground part	green vegetable	soukpa mèto
Chenopodiaceae	*Chenopodium album* L.	452	leaf limb	soup	légo, noubrè
Lamiaceae	*Dracocephalum tanguticum* Maxim.	534	above ground part	powered as spice	ngopyiang
Lamiaceae	*Nepeta* sp.	448, 498	inflorescence	spice for cheese	lugulangstal
Liliaceae	*Allium* sp.	464	upper part	spice for meat	mouktok
Liliaceae	*Allium fasciculatum* Rendle	440	upper part	spice for meat	gogpa

Table 2 – continuation

Family	Species	Voucher (L & M)	Organ	Use	Translitteration Tibetan names
Liliaceae	*Allium macranthum* Baker	445	upper part	spice for meat	gyagok, zinpo
Liliaceae	*Allium prattii* C.H. Wright	509	upper part	spice	dzinak
Liliaceae	*Allium* cf. *atrosanguineum* Schrenk	513	upper part	spice	lugra
Liliaceae	*Asparagus* sp.	402	young stem	stem, vegetable	nangkatampel
Malvaceae	*Malva verticillata* L.	357, 449, 530	leaf limb	soup	tchambahalu
Ophioglossaceae	*Ophioglossum reticulatum* L.	371	entire plant	soup	touchoung
Plantaginaceae	*Plantago depressa* Wild.	450	young leaf	soup	alathabo, popkera
Polygonaceae	*Fagopyrum tataricum* (L.) Gaertn.	355, 451, 537	leaf limb, grain (flour)	soup bread	thau, pô
Polygonaceae	*Bistorta macrophylla* (D. Don) Soják	506	root	boiled	mèmbou
Polygonaceae	*Rheum officinale* Baill.	460	leafstalk, stem	raw or stewed	tchoum
Polygonaceae	*Rheum palmatum* L.	508	leafstalk	raw or stewed	tchoum
Polygonaceae	*Rheum* aff. *australe* D. Don	441	leafstalk	raw or stewed	numdi, choujou
Polygonaceae	*Rheum spiciforme* Royle	334	leafstalk	raw or stewed	choujou
Rosaceae	*Potentilla anserina* L. subsp. *anserina*	335	tuber	toma daisel preparation	troma, toma
Rosaceae	*Rosa omeiensis* Rolfe	433	fruit pulp	eaten raw	sindou, simbou
Scrophulariaceae	*Lancea tibetica* Hook. f. & Thoms.	500	leaf	green vegetable	didigongou
Urticaceae	*Urtica dioica* L.	483	young leaf	vegetable, soup	sapo
Urticaceae	*Urtica tibetica* W. T. Wang	514	young leaf	vegetable, soup	sapo
Urticaceae	*Urtica triangularis* Hand.-Mazz.	504	young leaf	vegetable, soup	sapo

Reference : collection (L=Leteinturier, M=Malaisse) deposited at Belgium National Botanic Garden [BR].

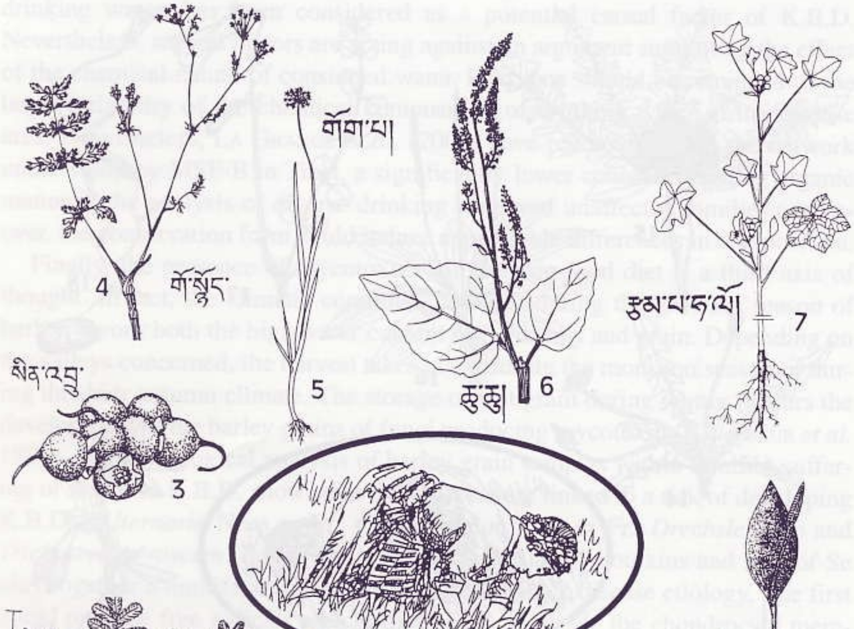

Fig. 4. — Main alternative foods eaten by South-Central Tibet Ü peasants : 1. *Urtica dioica* L (a : habit ; b : vegetable ; c : soup) ; 2. *Potentilla anserina* L. ; 3. *Rosa omeiensis* Rolfe ; 4. *Chaerophyllum* sp. (L & M 278) ; 5. *Allium fasciculatum* Rendle ; 6. *Rheum australe* D. Don ; 7. *Malva verticillata* L. ; 8. *Ophioglossum reticulatum* L. ; 9. *Allium prattii* C.H. Wright ; 10. *Podophyllum hexandrum* Royle.

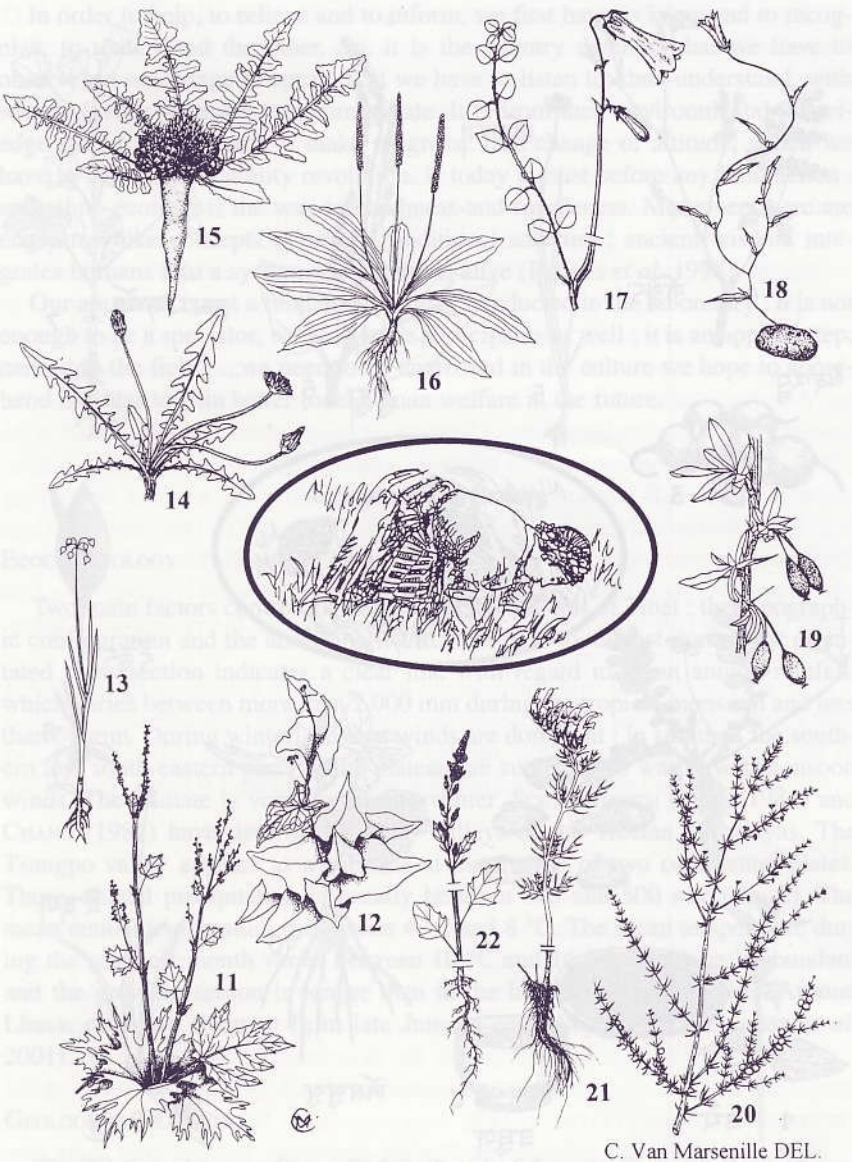

Fig. 5. — Other alternative foods eaten by South-Central Tibet Ü peasants : 11. *Rheum palmatum* L. ; 12. *Fagopyrum tataricum* (L.) Gaertn. ; 13. *Allium macranthum* Baker ; 14. *Taraxacum tibeticum* Hand.-Mazz. ; 15. *Jurinaea dolomiaea* Boiss. ; 16. *Plantago depressa* Wild. ; 17. *Codonopsis thalictrifolia* Wallich ; 18. *Codonopsis convolvulacea* Kurz. ; 19. *Berberis dictyophylla* Franch. ; 20. *Asparagus* sp. (L & M 489) ; 21. *Dracocephalum tanguticum* Maxim. ; 22. *Chenopodium album* L.

Wiart 1985), the Sherpas of the Rolwaling valley in Nepal (Sacherer 1979), in Garhwal Himalaya (Gaul & Semwal 1983) as well as Sikkim Himalaya (Sundriyal & Sundriyal 2001) ; it is still observed elsewhere, notably in Kenya (Maundu *et al.* 1999), where the fried leaves of *Urtica massaica* Mildbr. are appreciated by diverse populations. Consumption of a thick nettle-based soup is also quoted from Nepal (Sacherer 1979). Leaves lose their urticant property after a few minutes' immersion in boiled water.

Potentilla anserina is a perennial herbaceous plant, whose dark brown tubers, *toma*, are a highly prized foodstuff. They are sometimes eaten raw, notably by children of nomad populations, but come mostly into diverse recipes.

They are quite frequently eaten in rural areas by nomads as well, an observation already quoted by Grenard (1904) ; they are associated in town to *Losar*, the Tibetan New-Year. The boiled tubers are mixed with cooked rice, butter and sugar in order to produce the *toma daisel*, of which consumption brings happiness. This dish is eaten by all the family members. Boiled tubers also go with *tchang*. Tubers are collected all year round and commercialization in urban centres is important. The consumption, by Indians of the north-western coast of the United States of America, of "roots" of an other sub-species of the silverweed, subsp. *pacifica*, the nutritional value of which has been studied (Kuhnlein *et al.* 1982, Turner & Kuhnlein 1982), should be quoted.

The fleshy mesocarp of the orange to red rosehips, locally known as *sindou*, of a dog rose called *sewa*, *Rosa omeiensis* Rolfe, are appreciated. These fruits are offered for sale in town markets in July-August.

Koniu is the local name of an Apiaceae, the main use of which consists of the fruit serving as spice. We have noted its presence during July-August at the Lhasa markets.

As well as in Garhwal Himalaya (Gaul & Semwal 1983), several garlic plants are appreciated in South-Central Tibet. At least six wild species dealing with the genus *Allium* are eaten. They are mainly distinguishable according to their inflorescence colour, but the leaves, broad or narrow, as well as the shape of the inflorescence, are of interest. At the Lhasa markets, *Allium macranthum* Baker, or *gyakok*, is available in July-August ; in rural areas *A. fasciculatum* Rendle (white globose inflorescence, *kokpa* or *kotste*), *Allium* sp. (elongated lilac inflorescence, *muktok*), *A. atrosanguineum* Schrenk (yellow inflorescence) and *A. pratii* C. H. Wright (mauve inflorescence, broad leaves) are much appreciated.

Consumption of leafstalk and stem of several rhubarbs appear also frequently. This fact was already quoted by Bell (1928) who wrote "rhubarb grows wild and is of various kinds, some of great height". We have noted the use of *Rheum officinale* Baill., *Rheum australe* D. Don and *R. palmatum* L., but other authors have quoted *R. emodi* Wall (Jest 1972 in Sacherer 1979) and *R. moorcroftianum* Royle (Gaul & Semwal 1983).

Ophioglossum reticulatum L., or *touchoung*, is a small fern featured in the preparation of soup. Its use as spinach has been reported from towns of Uttar

Pradesh and Madhya Pradesh in India (Sharma 2000), whilst in Indonesia it is eaten as green salad or cooked as vegetable (Piggott & Piggott 1996, Wee 1997).

Malva verticillata L. is an appreciated potherb. The plant is well known in Europe, where it is cultivated as a salad plant (Polunin & Stainton 1997). The same use is reported for the young leaves of a plantain, *Plantago depressa* Wild. as well as for those of *Fagopyrum tataricum* (L.) Gaertn., whose grain provides a nutty-tasting flour which reminds one of buckwheat, once widely cultivated in Europe (Mabey 1997). Fat-hen or *Chenopodium album* L., a common weed in Tibet, is a well-known peasant potherb all over the world. Its mealy leaves have been harvested in Western Europe (Couplan & Styner 1994), Russia, Canada, America, Africa and India (Low 1992), Garhwal Himalaya (Gaul & Semwal 1983) and the same is done by Ü peasants.

The fleshy pulp of the red crimson berries of *Podophyllum hexandrum* Royle (syn. : *P. emodi* Wallich ex Hook. f. & Thonn.), or *momsoussou* are searched for by children. One should also be reminded that the root of this plant is used in medicine against cancer (presence of podophylline).

Young leaves of at least two dandelions (*Taraxacum* spp.), called *kouma*, are currently eaten in villages. The sale in town is of little importance and is seasonal. Eating leaves of dandelion has been quoted in other countries, for instance Garhwal Himalaya (Gaul & Semwal 1983) and Sikkim Hiamlaya (Sundriyal & Sundriyal 2001), but also Europe (Couplan & Styner 1994).

The above ground part of *Codonopsis thalictrifolia* provides a vegetable, whilst the corms of *C. convolvulacea* Kurz are eaten in winter, cooked in water or raw. This information matches up with the consumption of *C. affinis* Hook. ex Thoms. corms in Central Nepal (Toffin & Wiart 1985).

Several barberries occur in the area under study ; ripe fruits of some are eaten. They have a slightly acid taste. The dark crimson fruits of *Berberis asiatica* Roxb. are eaten in Nepal (Toffin & Wiart 1985, Polunin & Stainton 1997), those of *B. asiatica* and *B. chitora* in Sikkim Himalaya (Sundriyal, pers. com.).

The consumption of young shoots, even of tubers of *Asparagus curillus* Buch.-Ham, is quoted for the western part of the Himalayan range, namely in Garhwal Himalaya (Gaul & Semwal 1983).

Discussion

The present paper provides an environmental frame within the MSF-Belgium Kashin-Beck disease programme. It has focused on two particular aspects of local peasant's knowledge, namely landscape units' recognition and alternative foods. Primary data are presented for both items.

As far as landscape units are concerned, in a similar way as our study, a more developed approach has been carried out on Tamang knowledge in the Ankhu

Khola — Trisuli region of Nepal by TOFFIN *et al.* (1986). An undeniable similarity of interest is obvious ; it concerns landforms, hydrology and agriculture. Moreover, landscape tradition appears as a valuable key to progress, for instance regarding Mongolian nomadism (GERMERAAD & ENEBISCH 1996).

The use as food of some 35 plants is listed and commented upon. At least some ten other items have been listed ; they need either reference voucher specimens or further confirmation on their uses. Surprisingly, tubers of *Arisaema*, which are appreciated in Nepal, are not eaten in South-Central Tibet, even if *A. flavum* (Forsk) Schott is frequent on rocky slopes (MALAISSE *et al.* 2001). The plant is not considered as edible by Ü peasants, as suggested by its denomination of *touk*, which means *poison*. Nevertheless, underground organs are supplied as food to pigs.

It should be noted that our survey was conducted within some 40 families only, relevant to 20 villages ; that is to say a poll within 2.8 % of the 1,449 families encountered. A next step must consist in an enlargement of the area involved. In fact, as SACHERER (1979) already pointed out, it seems that each Himalayan valley must be explored individually regarding its potential ethnobotanical resources. This is confirmed when comparisons are made with studies conducted in other parts of the Himalaya region (JEST 1972, JOSHI 1991, MANANDHAR 1989, POHLE 1990, SHRESTHA 1988). For instance, the comparison of the items of our list with those drawn up by GAUL & SEMWAL (1983) in Garhwal Himalaya, by Sundriyal (pers. com.) in Sikkim Himalaya and by SACHERER (1983) in Himalayan Nepal indicates only six, five and four common species respectively, *i.e Podophyllum hexandrum*, diverse *Allium* spp., *Urtica dioica* and *Chenopodium album.*

In the same way, as far as economic development through the use of natural resources and their management is involved, it should be remembered that such an approach demands a sound knowledge of nature itself (MALLA 1976). Moreover, enquiries conducted on various periods of the year may yield diverse information linked to seasonal activities. For instance, *Potentilla anserina* score would have increased around Losar period.

From several comments of interlocutors it appears that the importance of alternative foods was greater in the past. The introduction of some exotic cultures, which bring greater food security, such as potatoes, has favoured the regression of the use and knowledge regarding those items. The same observation has been reported by SACHERER (1979) concerning the Sherpas of Himalayan Nepal.

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