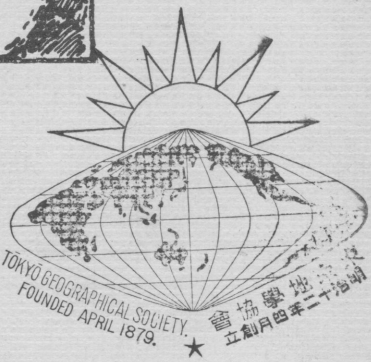
GUIDE-BOOK EXCURSION A–2

(Oct. 18th—25th, 1926)

GEOLOGY OF THE IKUSHUNBETS COAL-MINING DISTRICT



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JAPAN

THE IKUSHUNBETS COAL-MINING DISTRICT, HOKKAIDÔ

GEOLOGICAL GUIDE TO THE EXCURSION TO THE IKUSHUNBETS COAL-MINING DISTRICT, ISHIKARI COAL-FIELD, HOKKAIDÔ

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CONTENTS

INTRODUCTION

An excursion to the coal mining district of Ikushunbets in the Ishikari coal-field, Hokkaidô, has been arranged for such specialists as may desire to understand the general aspect of the Cretaceous deposits and fauna, and the Palaeogene coal-bearing deposits and flora, predominant in the two islands of Saghalien and Hokkaidô. The district is within two and a half hours from Sapporo by railway.

The main island of Hokkaidô (sometimes called Hokushû or Yezo) is the second largest of the islands of Japan (78,000 sq. km.). It is rhombic in its general outline, with a peninsula of fish-tail shape, and embraces the large square Bay of Uchiura, sometimes called Volcano Bay, on the southwest. The main part of the island and the peninsula are separated by a broad meridional zone of depression extending from the Plain of Ishikari to that of Tomakomai-Yûfuts and deeply buried under alluvial materials. On the peninsular area, there are many volcanoes, of which Koma-ga-také (1,093 m.), Esan (620 m.), Makkari-nupuri (1,943 m.), Usu (595 m.) and Tarumae (1,016 m.) are well known: except for the younger effusive rocks, it

is composed mostly of Neogene and partly of Palaeozoic sediments and a few granites.

The backbone of the main part of the island passes through it in a SSE-NNW direction from Cape Erimo to Cape Sôya and is sometimes called the Yezo Mountain Range. It consists of two parallel chains, which are not, however, differentiated as independent in the southern part. The southern part, called the Hidaka Range, culminates in Pipairo (2,017) m. and consists of central granite intruding and metamorphosing the surrounding Palaeozoic sedimentaries of the Chichibu System. The middle part is occupied by many volcanic eminences (Nutapkaushibé 2,259 m., Oputateshiké 1,980 m., Tokachidaké 1,935 m., etc.) and one other of basic igneous rocks intruding the Palaeozoic rocks (Ishikari-daké 2,039 m.). Northwards, the eastern chain becomes lower, with several peaks but little higher than 1,000 m., and extends to the coast of Esashi, in the province of Kitami.

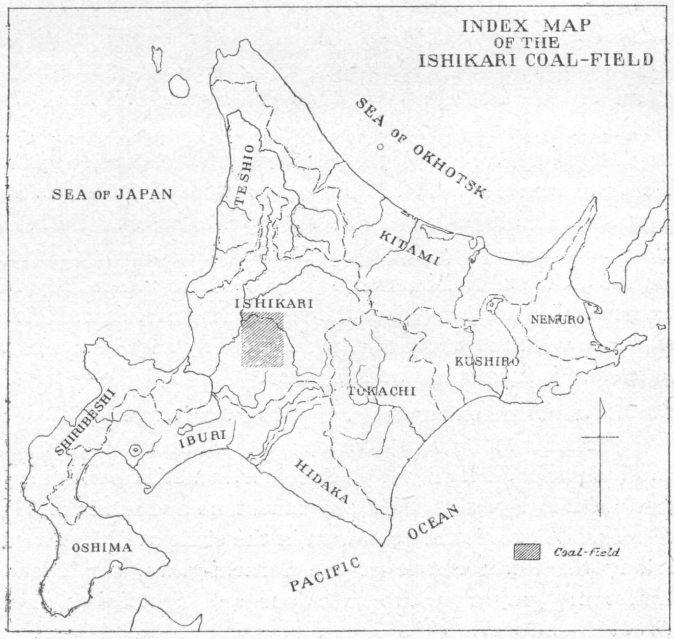
The western chain, which runs parallel to the eastern, is separated from it by the longitudinal valleys of the Teshio and Sorachi-gawa, and the two intermontane basins of Asahikawa and Furano. It is highest in its southern part, the Yûbari Mountains (the highest point, Ashibets-nupuri 1,920 m.), and is composed of Palaeozoic and Cretaceous sedimentaries and basic igneous rocks. The middle part, elevated along the west side of the Asahikawa basin, is crossed by the transverse valley of the upper course of the Ishikari-gawa—the gorge of Kamuikotan. Besides the Palaeozoic sedimentaries, there are exposed crystalline schists resembling those of the Sambagawa and Mikabu Series. Farther north, the western chain is much reduced in elevation, and is composed of Cretaceous and Tertiary rocks.

The Chishima volcanic line passes from east to west through the main part of the island of Hokkaidô. The volcanic group of the middle part of the Yezo Range belongs to this line. East of the median range, the line bears several notable cones such as Meäkan (1,617 m.), Oäkan (1,614 m.), Atosa-nupuri (460 m.) and Rausu (1,573 m.).

Between these elevations and the seacoast, stretches a gently undulating hilly region through which flow many large rivers, such as the Ishikari-gawa, Teshio-gawa, Tokachi-gawa, etc. Fertile plains are found along these rivers. The coast is often marked by a number of terraces, the uppermost one being sometimes more than 60 m. high.

The Cretaceous rocks occupy numerous detached areas, which are more or less meridionally arranged in two parallel zones along the western chain of the Yezo Range. The western of these two zones extends from the middle course of the Niikappu, in the province of Hidaka, through the western side of Yûbari to near Utashinai along the Sorachi-gawa, in the province of Ishikari. At one place interrupted by an extensive field of Tertiary sedimentaries in the Rumoë-Uriu district, it reappears in the mountain ridge on the district-boundary between Uriu and Rumoë, and continues northwards as far as Cape Sôya. The eastern zone, which stretches along the eastern side of Yûbari and of the broad valley of the Uriu-gawa, extends southward to the coast of Urakawa, province of Hidaka, and northwards to the coast of Kitami.

Cretaceous sediments are little known from the extensive area lying east of the Yezo Range, though they are reported to occur in various parts of the provinces of Tokachi, Kushiro and Kitami. A part of the island of Shikotan, in the Kurile Group, is also composed of rocks of the same age.



While the Cretaceous of Hokkaidô is essentially marine in origin, the Palaeogene formation is important in being productive of coal. The coal-bearing group closely follows the Cretaceous in distribution, lying between it and the overlying Neogene deposits, and is often structurally interwoven with them in a complicated manner. The important coal-fields are situated in a broad belt extending from Cape Sôya to the coast of Hidaka and thence along the western chain of the Yezo Range. The one that is best known geologically and most productive is the Ishikari coal-field, which is situated to the east of the main course of the Ishikari-gawa, extending for 80 km. north to south, between the Sorachi-gawa and the Yûbari-gawa, the two main tributaries of the Ishikari-gawa, and including the well-known collieries of Ashibets, Utashinai, Bibai, Pombets, Ikushunbets, Poronai, Miruto, Manji, Yûbari, Ôyûbari, Kaëdé and Noborikawa.

East of the Yezo Range, productive coal-fields also occur in the province of Kushiro.

CRETACEOUS DEPOSITS OF HOKKAIDÔ

Being very rich in fossils and especially in Ammonites, the Cretaceous deposits of Hokkaidô are the most distinguished of all the Mesozoic rocks in Japan. These are typically developed and better studied in the Ishikari coal-field than elsewhere in Hokkaidô. The stratigraphy has been studied by Messrs. H. Imai and H. Yabe; the fauna by Messrs. M. Yokoyama, K. Jimbo, S. Yehara, S. Shimizu, T. Nagao, S. Hanzawa and H. Yabe; and the flora by Dr. M. C. Stopes, and Messrs. K. Fujii, Y. Suzuki, A. N. Kryshtofovich and S. Endo.

The Cretaceous deposits were for the first time subdivided by Yabe in 1903, the subdivisions then proposed being essentially followed even now. These subdivisions, however, need certain modifications in accordance with the knowledge more recently acquired; and a new revised system is introduced at this place.

I. The Lower Ammonites Beds. 900 m. or more.

This is the lowest division; a thick complex of shale and sandy shale of dark gray or black colour, sometimes with intercalations of thin layers of dark gray sandstone and marl; marl nodules of moderate size are common in the shale at different places. Along the lower course of the Sorachi-gawa, small lenses of limestone, gray to white in colour and containing abundant *Orbitolina discoidea-conoidea* var. *ezoensis* Yabe and Hanzawa, and

corals are intercalated in the shale; the shale underlying the limestone lenses contains another species of *Orbitolina*, *O. japonica* Yabe and Hanzawa. The limestone is also noteworthy as containing *Praecaprotina yaegashii* (Yehara). The uppermost part of the Lower Ammonites Beds is thin bedded shale and sandstone in alternation, and is distinguished as the Zone of *Lytoceras ezoense* Yabe. *Inflaticeras imaii* Yabe and Shimizu and *Oxytropidoceras* sp. are obtained in the Lower Ammonites Beds of the Ponhorokabets near the Yûbari colliery; the fossiliferous bed is believed also to belong to the *L. ezoense* Zone.

The type localities of the Lower Ammonites Beds are the Ikushunbets just above the first gorge, upstream from the colliery of the same name, and the lower course of the Sorachigawa, above the waterfall. On the fossil evidence, the Lower Ammonites Beds have been found to be Aptian-Albian (Gault) in age.

List of Fossils from the Lower Ammonites Beds.
° indicates the common fossils, and
* Ms. nom.

Orbitolina-Limestone.
° *Orbitolina discoidea-conoidea* var. *ezoensis* Yabe and Hanzawa
° *O. japonica* Yabe and Hanzawa
Praecaprotina japonica (Yehara)

Lytoceras ezoense Zone.
Lytoceras ezoense Yabe
L. imperiale Yabe
Baculites gaudini Pictet
Turrilites cfr. *bergeri* Brongn.
Puzosia subcorbarica Yabe*
Inflaticeras imaii Yabe and Shimizu
Oxytropidoceras sp.

II. The *Trigonia* Sandstone. 240-480 m. averaging 300 m.

The preceding complex is overlain by another thick series mostly composed of fine-grained sandstone of a light greenish gray colour in the fresh state, soon becoming yellowish by weathering. It intercalates conglomerate and shale at various horizons, and the sandstone becomes locally conglomeratic. Very

fossiliferous in certain zones; cephalopods rare; lamellibranchs and gastropods abundant. Especially rich in several species of *Trigonia*, *Pectunculus hokkaidoensis* Yabe and Nagao, and *Thetironia affinis* Whiteaves var. *japonica* Yabe and Nagao. On a former occasion, Yabe distinguished the three faunal zones of

Acanthoceras asiatica (Jimbo) or *Trigonia longiloba* Jimbo,
Thetironia (originally mentioned as *Thetis*), and
Pectunculus hokkaidoensis Yabe and Nagao (originally mentioned simply as the *Pectunculus* Zone);

but it is now considered better to withdraw these, until they are confirmed by later, more precise stratigraphical work. Ammonites found in the *Trigonia* Sandstone are *Acanthoceras asiatica* (*A. rhotomagense* var. *asiatica* Jimbo), *Turrilites komotai* Yabe and *Desmoceras dawsoni* var. *japonica* Yabe, all of which indicate the Cenomanian age of the complex. The type locality of the *Trigonia* Sandstone is along the first gorge of the Ikushunbets just above the colliery of the same name.

List of Fossils from the *Trigonia* Sandstone.
° indicates the common species.

Pecten (*Syncyclonema*) cfr. *obovatus* Stol.
Nucula milnei Yok.
° *Pectunculus hokkaidoensis* Yabe and Nagao
Trigonoarca cfr. *tumida* Whiteaves
Cucullaea ezoensis Yabe and Nagao
C. aff. *truncata* Gabb
Modiola ezoensis Yabe and Nagao
Astarte aff. *striata* Sow.
Inoceramus cfr. *percostatus* Müller
I. *angulosus* Jimbo
I. *incertus* Jimbo
° *Trigonia longiloba* Jimbo
° *T.* *subovalis* Jimbo
° *T.* *subovalis* Jimbo var. minor Yabe and Nagao
° *T.* *hokkaidoana* Yehara
° *T.* *brevicula* Yehara
T. *ainuana* Yabe and Nagao
° *T.* cfr. *tryoniana* Gabb

Callista pseudoplana Yabe and Nagao
° *C. pseudoplana* Yabe and Nagao var. *alata* Yabe and Nagao
C. var. *elongata* Yabe and Nagao
Spisula (*Cymbophora?*) *subsulcata* Yabe and Nagao
° *Thetironia affinis* (Whiteaves) var. *japonica* Yabe and Nagao
Meekia cfr. *sella* Gabb
Volutoderma (*Rostellinda*) *biplicata* Yabe and Nagao
° *Margarita funiculata* Yok.
Cinulia sp.
Pugnellus sp.
Trochus vistulaeoides Yabe and Nagao
Tubulostium callosum Stol.

III. The Upper Ammonites Beds. 950 m.—1,550 m.

The Upper Ammonites Beds, which directly cover the *Trigonia* Sandstone, are again argillaceous, mostly composed of dark gray shale similar to, but in general of a lighter shade than, that of the Lower Ammonites Beds. Interbedded sandstone layers are not rare, being most frequent in the basal part. The shale is usually rich in marl nodules of various sizes and marine molluscan fossils, among which Ammonites and *Inoceramus* are dominant. The fossils are usually in an excellent state of preservation.

The Upper Ammonites Beds are subdivided into the following parts:

Mammites Zone (originally mentioned as the Upper *Acanthoceras* Zone)
Yezoites Beds (originally mentioned as the *Scaphites* Beds)
Parapachydiscus Beds (originally mentioned as the *Pachydiscus* Beds), comprising the
Mesopachydiscus haradai (Jimbo) Zone and
Neopachydiscus naumanni (Yokoyama) Zone.

The *Mammites* Zone is characterised by *Mammites* sp., the *Yezoites* Beds, by several species of *Yezoites*, *Puzosia*, *Turrilites* and *Hamites*, and by *Mortoniceras orientale* Yabe, and the *Parapachydiscus* Beds, by numerous species of *Parapachydiscus*. While the *Neopachydiscus naumanni* Zone of the *Parapachydiscus* Beds is certainly Upper Senonian in age, being characterised by several species of *Neopachydiscus*, the *Mesopachydiscus* Zone is Lower Senonian, having *Inoceramus schmidti* Michael, *Helcion gigantea* Schmidt, *Placenticeras subtilistriatum* Jimbo, and several species

belonging to *Meso-*, *Epi-*, *Pseudo-* and *Anapachydiscus*. We are now of the belief that the *Yezoites* Beds and the lower part of the *Parapachydiscus* Beds intercalating the *Mesopachydiscus* Zone are almost contemporaneous, the two being in somewhat different facies. The marl nodules in the *Yezoites* Beds frequently include fragments of terrestrial plants, twigs and leaves, partly carbonised and partly calcified. The *Mammites* Zone is Turonian in age.

The type localities of the *Yezoites* Beds are along the upper course of the Yûbari-gawa above the junction of the Shi-yûbari and Pankemo-yûbari, and the upper course of the Opiraushibets in the province of Teshio, while those of the *Parapachydiscus* Beds are the Urakawa district in the province of Hidaka and the drainage area of the Abeshinai, a tributary of the Teshio-gawa. It is noteworthy that the *Parapachydiscus* Beds are almost entirely absent in the Ishikari coal-field, where the *Yezoites* Beds apparently replace the lower part of the complex, and the Hakobuchi Sandstone, the upper part.

The Hakobuchi Sandstone (the type locality being Hakobuchi, a sandstone gorge of the Yûbari-gawa, just above the Ô-yûbari colliery of the Mitsubishi Mining Company and below the junction of the Shi-yûbari and Pankemo-yûbari) is a thick complex composed of medium to fine-grained sandstone prevalently of a green colour, and intercalating conglomerate, sandy shale and shale beds at several horizons. Very characteristic of the complex are the beds of flinty shale and sandy shale, whitish in colour with a more or less bluish tint. Taken as a whole, this complex is liable to be easily confounded with the *Trigonia* Sandstone already mentioned above, owing not only to similarity in lithological character, both being arenaceous to rudaceous (in marked contradistinction to the Lower Ammonites Beds as well as the Upper Ammonites Beds in normal development), but also to the presence of *Trigonia subovalis* Jimbo var. *minor* Yabe and Nagao, which is a common species of the *Trigonia* Sandstone. On the other hand, the Hakobuchi Sandstone is likely to be mistaken for the coal-bearing Ishikari Series of Palaeogene age because of the intercalation of thin coal seams and thin plant beds at several horizons. It is one of the important contributions by Mr. H. Imai to the geology of the Ishikari coal-field,

that the Hakobuchi Sandstone is distinguished as an independent complex, overlying the *Yezoites* Beds and unconformably underlying the base of the Ishikari Series.

The plant beds in the Sandstone usually contain numerous *Nilssonia* leaves, together with those belonging to ferns, cycads, conifers and dicotyledons. Mr. S. Endo distinguished four species of ferns, seven of cycad-like plants, two of conifers and four of dicotyledons, as the following list shows:

Pteris frigida Hr.
Asplenium dicksonianum Hr. (?)
Phyllites sp. cfr. *Adiantum formosum* Hr.
Pecopteris torellii Hr. (?)
Glossozamites (?) *imaii* Endo
Phyllites sp. cfr. *Sphenozamites rogersianus* Fontaine
Cycadeoidea nipponica Endo
Nilssonia cfr. *orientalis* Hr.
N. cfr. *johnstrupi* Hr.
N. *serotina* Hr.
Libocedrus sabiniana Hr.
Sequoia heterophylla Velenovsky
Populus denticulata Hr.
P. *arctica* Hr. (?)
Rhamnites apiculatus Lesq.
Protophyllum obovatum Newb.

Marine shells are but seldom found in other parts of the Sandstone ; *Trigonia subovalis* var. *minor*, *Rhynchonella* sp. and *Cucullaea* sp., however, occur.

In the Ishikari coal-field, Mr. Imai estimated the thickness of the Hakobuchi Sandstone as 350 m. and that of the underlying *Yezoites* Beds as 600 m.—1,200 m.

List of Fossils from the Upper Ammonites Beds.
o indicates common species and * MS. nom.

Mammites Beds.

Acanthoceras (*Kossmatia*) *pseudodeverianum* Jimbo
A. (*K.*) *japonicum* Yabe*
A. (*K.*) *yubarense* Yabe*
Mammites sp.

Fagesia kotoi (Yabe)
F. ? *unicum* (Yabe)
Scaphites Beds and *Parapachydiscus* Beds
Pleosporites shiraianus Suzuki
Petrosphaeria japonica Stopes and Fujii
Schizaeopteris mesozoica Stopes and Fujii
Fasciostereopteris tansleii Stopes and Fujii
Pteris frigida Heer
Asplenium dicksonianum Hr. (?)
Cfr. *Adiantum formosum* Hr.
Pecopteris torellii Hr. (?)
Glossozamites (?) *imaii* Endo
Cfr. *Sphenozamites rogersianus* Fontaine
Cycadeoidea nipponica Endo
Nilssonia cfr. *orientalis* Hr.
N. cfr. *johnstruppi* Hr.
○ *N.* *serotina* Hr.
N. sp.
Nipponophyllum cordaitiforme Stopes and Fujii
Yezonia vulgaris Stopes and Fujii
Yezostrobus oliveri Stopes and Fujii
Araucarioxylon tankoense Stopes and Fujii
Cedroxylon matsumurae Stopes and Fujii
C. *yendoi* Stopes and Fujii
Cunnighamiostrobus yubarensis Stopes and Fujii
Cryptomeriopsis antiqua Stopes and Fujii
C. *mesozoica* Suzuki
Abicaulis yezoensis Suzuki
○ *Libocedrus sabiniana* Hr.
○ *Sequoia heterophylla* Velenovsky
Saururopsis niponensis Stopes and Fujii
Jugloxylon hamaoanum Stopes and Fujii
Sabiocaulis sakuraii Stopes and Fujii
Populocaulis yezoensis Stopes and Fujii
Fagoxylon hokkaidense Stopes and Fujii
Cretovarium japonicum Stopes and Fujii
Populus denticulata Hr.
P. *arctica* Hr. (?)
Rhamnites apiculatus Lesq.

Protophyllum obovatum Newb.
Kingena sp.
Rhynchonella sp.
R. cfr. *plicatiloides* Stol.
Pecten sp.
P. cfr. *gardanus* Stol.
P. (*Propeamusium*) *cooperi* Waring var. *radiatus* Yabe and Nagao
Cucullaea cfr. *sachalinensis* Schmidt
C. sp.
○ *Inoceramus ezoensis* Yok.
○ *I.* aff. *lobatus* Münster
○ *I.* *schmidti* Mich.
Lucina cfr. *fallax* Forbes
Trigonia sawatai Yehara
T. *subovalis* Jimbo var. *minor* Yabe and Nagao
○ *Helcion giganteus* Schmidt
Capulus casidarius Yok.
Tessarolax japonicus Yabe and Nagao
○ *Phylloceras ramosum* Meek
○ *P.* *ezoense* Yok.
P. *nera* Forbes
○ *Gaudryceras tenuiliratum* Yabe
○ *G.* *tenuiliratum* Yabe var. *ornatum* Yabe
○ *G.* var. *intermedium* Yabe
G. var. *infrequentis* Yabe
G. *crassicostatum* Jimbo
G. *striatum* Jimbo
G. *striatum* Jimbo var. *pictum* Yabe
G. *denseplicatum* Jimbo
G. *yamashitai* Yabe
G. *yokoyamai* Yabe
G. *limatum* Yabe
G. *limatum* Yabe var. *obscurum* Yabe
○ *Tetragonites glabrus* Jimbo
T. *crassus* Jimbo
○ *T.* *sphaeronotus* Jimbo
○ *T.* *popetensis* Yabe
○ *T.* cfr. *epigonus* Kossmat
Baculites teres Forbes

Baculites asper Morton
B. aff. *bohemicus* Fritch
° *Hamites* (*Polyptychoceras*) *pseudogaultinus* Yok.
° *H.* (*P.*) *haradanus* Yok.
° *H.* (*P.*) *subundulatus* Yok.
° *H.* (*P.*) *yubarensis* Yabe*
H. (*P.*) *obstrictus* Jimbo
° *H.* (*P.*) cfr. *vancouvarensis* Whiteaves
° *H.* (*Anisoceras*) *indicus* Forbes
° *H.* (*A.*) *largesulcatus* Forbes
H. (*A.*) *notabilis* Whiteaves
° *H.* (*A.*) aff. *subcompressus* Forbes
° *H.* (?) n. sp. (*H.* cfr. *rugatus* Yok.)
H. (*Oxybeloceras*?) *quadrinodosus* Jimbo
H. (*O.*) *sanushibensis* Yabe*
Bostrychoceras otsukai Yabe
B. cfr. *indicum* Stol.
B. *otsukai* Yabe var. *multicostata* Yabe
B. *japonicum* Yabe
Helicoceras? *scalare* Yabe
H. ? *venustum* Yabe
Heteroceras? *orientale* Yabe
Hyphantoceras oshimai Yabe
Nipponites mirabilis Yabe
° *Desmoceras* (*Kotoceras*) *damesi* Jimbo
D. (*K.*) *laeve* Yabe*
D. (*K.*) *semicostatum* Yabe*
D. ? *selwynianum* Whiteaves
D. ? *poronaicum* Yabe*
Hauericeras angustum Yabe
H. *gardeni* Baily
Kossmaticeras kotoi (Jimbo)
K. *pusillum* (Yabe)*
K. *iburiense* (Yabe)*
° *K.* *ishikawai* (Jimbo)
K. *japonicum* (Yabe)*
K. (*Madrasites*) *pachystomum* (Kossmat)
K. (*M.*) *theobaldianum* (Stol.)
Parapachydiscus (*Pseudopachydiscus*) *kossmati* (Yabe)

Parapachydiscus (*Pseudopachydiscus*) *jimboi* (Kossmat)
○ *P.* (*Mesopachydiscus*) *haradai* (Jimbo)
P. (*M.*) *teshioensis* (Jimbo)
○ *P.* (*Neopachydiscus*) *naumanni* (Yok.)
P. (*N.*) *ariyalurensis* (Stol.)
P. (*N.* ?) *subtililobatus* (Jimbo)
P. (*N.*) *sphaericus* (Yabe *P. naumanni* Yok. pars.)
P. (*N.* ?) *kitamiensis* (Yabe)*
P. (*N.* ?) *ezoensis* (Yabe)*
P. (*Epipachydiscus*) *mamiyai* Yabe and Shimizu
P. (*E.* ?) *abeshinaiensis* (Yabe)
P. (*Anapachydiscus*) *fascicostatus* (Yabe)
P. (*A.* ?) *koluturensis* (Stol.)
P. (*A.* ?) *sutneri* (Yok.)
P. (*Menuites*) *rotalinoides* (Yabe)
Puzosia yubarensis (Jimbo)
○ *P.* *planulatiformis* (Jimbo)
○ *P.* *indopacifica* Kossmat
P. *alterna* Yabe*
○ *P.* *ezoensis* Yabe*
P. *elegans* Yabe*
P. *japonica* Yabe*
Prionotropis teshioensis Yabe and Shimizu
Prionocyclus aequicostatus Yabe and Shimizu
○ *Barroisiceras minimum* Yabe
Mortoniceras orientale Yabe
M. *namii* Yabe and Shimizu
M. *sanushubense* Yabe and Shimizu
Gauthiericeras rarum Yabe
Peroniceras ninakawai Yabe and Shimizu
○ *Placenticeras subtilistriatum* Jimbo
Neocrioceras spinigerum Jimbo
Scaphites yokoyamai Jimbo
S. *pseudoaequalis* Yabe
S. *yonekurai* Yabe
S. *gracilis* Yabe
○ *S.* (*Yezoites*) *planus* Yabe
○ *S.* (*Y.*) *puerculus* Jimbo
S. (*Y.*) *puerculus* Jimbo var. *teshioensis* Yabe
S. (*Y.*) *perrini* Anderson

Eucorystes japonicus Jimbo
Linuparus cfr. *vancouvarensis* Whiteaves
Lamna appendiculata (Ag.)
Odontaspis cfr. *complanata* (Egerton)
Oxyrhina (*Meristodon*) sp.

Finally, it must be specially noticed that the Cretaceous deposits are always perfectly conformable to one another and evidently represent a continuous sedimentation, though the *Trigonia* Sandstone indicates a temporary rising of the sea bottom. As the *Trigonia* Sandstone and Lower Ammonites Beds are known to develop in Hokkaidô nowhere else than in the Ishikari coal-field and the Upper Ammonites Beds are extensively developed in and outside of it, the Senonian transgression, we believe, certainly took place also in Hokkaidô, just as in the more southern part of the Japanese Archipelago.

THE PALAEOGENE COAL-BEARING GROUP OF THE ISHIKARI COAL-FIELD (THE ISHIKARI SERIES)

The Cretaceous deposits are unconformably overlain by a thick complex of Palaeogene deposits, called the Ishikari Series by Yabe some 25 years ago. Mr. H. Imai lately undertook a detailed stratigraphical study of the series and finally established the following subdivisions:

1. The Noborikawa Group.

   This is the lowest coal-bearing member of the Ishikari Series; composed of thin-bedded sandstone, sandy shale and shale in alternation, and intercalating a number of coal seams which are usually thin and of inferior quality, but become thicker and better in the southern part of the Ishikari coal-field and especially in the Noborikawa Colliery; very variable in total thickness, measuring only 29 m. along the Yûbari-gawa below the junction of the Shi-yûbari and Pankemo-yûbari, but more than 150 m. at the Noborikawa Colliery. Plant remains not rare.

2. The Horokabets Shale.

   A black shale bed about 60 m. thick, with interbedded thin marl layers; plant fossils are not rare, but usually so badly preserved as to be indeterminable. *Glyptostrobus europeus* Hr., *Salvinia* sp., *Taxus* sp.

3. The Yûbari Group.

This is the lower coal-bearing member; sandstones alternating with many important coal seams; varying in thickness from 60 m. in the southern part to 600 m. in the northern. Plant remains not common: also fresh-water Mollusca such as *Vivipara* and *Unio*. According to the provisional determination of Mr. Endo, the plants belong to *Glyptostrobus ungeri* Hr., *Taxodium*, *Sequoia*, *Fraxinus macrophylla* Hr. ?, *Salix varians* Göpp., *Betula* sp., *Fagus castanaefolia* Ung., *Populus arctica* Hr., *P.* spp., *Vibrunum cuneatum* Newb. (?), *Castanea ungeri* Hr., *Laurus* sp., *Pteris* sp., *Osmunda heerii* Gaudin.

4. The Wakkanappe Shale.

Marine shale of gray to dark gray colour, rarely with intercalations of thin sandstone bands and large marl nodules; 60 m. thick but often less. Remains of thin-shelled marine mollusca occur but rarely; also *Venericardia* sp.

5. The Wakkanappe Sandstone.

120 m. thick; composed of sandstone, sandy shale and shale. Sandstone usually gray to dark gray in colour, sometimes with bluish or greenish tint, fine-grained and fragile, sometimes coarse and containing quartz pebbles, often calcareous and full of sand pipes; shale gray to dark gray in colour, often thin-bedded and intercalated with sandstone. Marl nodules sometimes found in sandstone and shale. There are numerous *Ostrea* zones intercalated in this group; it also contains at places numerous marine Mollusca, especially bivalves. This molluscan fauna has not yet been worked over; but it is at least certain that a form of *Crassatellites* abounds which is almost indistinguishable from a species found in the Ashiya Group of Kyûshû.

6. The Bibai Group.

The middle coal-bearing member; composed of sandstone and shale in alternation and having several important coal seams. 150 m. thick. Plant remains common: *Sabal nipponica* Kryshtofovich, *Glyptostrobus*, *Sequoia*, *Taxodium*, *Nelumbium*, *Salvinia*, etc.

7. The Lower *Corbicula* Beds.

300-450 m. thick; complex of shale, sandy shale and sandstone, intercalating coal seams, thin marl layers and shell beds,

and sometimes containing huge marl nodules. Coal seams usually thin and worthless; but at places of workable quality and thickness. *Ostrea* and *Corbicula* abundant in shell beds; also a particular species of *Modiola*.

8. The *Woodwardia* Zone.

Ca. 60 m. thick; complex, characterised by a whitish or grayish sandstone or sandy shale, which is hard and compact, and often flinty; also thin platy sandstone, shale and thin coal seams. This zone contains a rich and characteristic flora, the prevailing types, according to Mr. Endo, being those given in the following list.

List of Plants from the Woodwardia Zone, following the Provisional Determination by Mr. S. Endo.
* indicates the common species.

Aspidium oerstedi Heer
Asplenium cfr. *tenellum* Knowlton
Osmunda affinis Lesquereux
O. sp.
Onoclea hebraidica Gardner
Woodwardia latiloba Lesq.
* *W.* cfr. *maxoni* Knowlton
W. *münsteriana* (Sternb. & Presl)
Ginkgo cfr. *adiantoides* (Unger)
Glyptostrobus ungeri Hr.
Sequoia langsdorfii (Brongniart)
* *Taxodium distichum miocenum* Hr.
Alisma paucinervis Hr.
Iris latifolia Hr.
Musophyllum complicatum Lesq.
M. sp. (cfr. *Musa basjoo* Sieb.)
* *Acer arcticum* Hr.
* *Alnus kefersteinii* (Göppert)
* *Büttneria aequifolia* (Göppert)
Carya antiquorum Newbwrry
Castanea ungeri Hr.
Celastrus ? *borealis* Hr.
Cinnamomum lanceolatum (Unger)
Corylus insignis Hr.

* *Corylus macquarrii* (Forbes)
* *Ficus occidentalis* Lesq.
* *Grevia crenata* (Unger)
G. crenulata Hr.
Hedera macclurii Hr.
Juglans sp.
Laurus schmidtiana Hr.
Legminosites sp.
* *Nyssa arctica* Hr.
Paliurus colombi Hr.
* *Platanus aceroides* Göpp.
* *P.* cfr. *guillelmae* Göpp.
* *Populus arctica* Hr.
P. cuneata Newberry
* *P. latior* A. Br.
P. mutabilis Hr.
P. speciosa Ward
P. subrotundata Lesq.
* *P. richardsoni* Hr.
* *P. zaddachi* Hr.
Prunus serrulata Hr. ?
* *Vibrunum nordenskioldi* Hr.
Zizyphus cfr. *falcatus* Berry
* *Z. meekii* Lesq.
Z. meigsii Berry

9. The Ikushunbets Group.

This is the upper coal-bearing member, consisting mostly of alternations of dark gray to gray sandstone and shale, which are somewhat different in aspect from those of the *Woodwardia* Zone: conglomerate rarely intercalated. There are more than 10 coal seams in the complex, of which 4 to 7 are workable, each measuring 1 to 2 meters or more. Plant remains are common, though less so than in the *Woodwardia* Zone, and specifically indistinguishable from those of the latter. The Ikushunbets Group and *Woodwardia* Zone are stratigraphically very intimate, and the former can be included in the latter as its uppermost part, being only 40-100 m. in thickness: only in the Ikushunbets district, does the Ikushunbets Group attain a considerable development, 300-360 m., and might better be regarded as a distinct complex.

10. The Upper *Corbicula* Beds.

Quite similar to the Lower *Corbicula* Beds in lithological, palaeontological and stratigraphical nature; varying in its total thickness from 60 m. to 300 m.

11. The Ashibets Group.

The uppermost coal-bearing member, very similar to the *Woodwardia* Zone and Ikushunbets Group in lithological nature, but characterised by its sandstone frequently being coarse- to medium-grained and sometimes tufaceous; 270-500 m. thick. Plant fossils common; also with fresh-water Mollusca like *Vivipara* and *Unio*. Characteristic of this group are *Liquidambar formosana* Hance, *Trapa borealis* Hr., *Comptoniphyllum japonicum* Nathorst, *Nelumbium* sp., *Sequoia* and *Taxodium*. This complex is especially well-developed in the Ashibets district, where it contains more than 10 coal seams of which 2 are workable.

None of these subdivisions of the Ishikari Series are constant in thickness, but vary in one direction or another as already stated. There is, however, no sign of any marked stratigraphical break in them.

The Ishikari Series is overlain in considerable unconformity by the Poronai Series, which is presumably Lower Neogene in age.

THE NEOGENE DEPOSITS OF THE ISHIKARI COAL-FIELD

Of the Neogene deposits of the Ishikari coal-field, the following two are important:

The Poronai Series.

The Kawabata Series.

1. The Poronai Series, a name proposed by Yabe in 1901 for a complex of dark gray shale intercalating thin marl layers and containing numerous marl nodules; glauconitic and sandy at the base. The basal sandy part varies greatly in thickness from place to place; the total thickness of the series is estimated by Mr. Imai to be 600-900 m. Characterised by the peculiar fauna listed below and by "Gennoishi," a calcite pseudomorph.

List of Fossils from the Poronai Series

Lagena gottschei Yok.
Anomalina floscularia Yok.
Rotalia lymani Yok.
Rotalia nitida Reuss

Pulvinulina (?) *singularis* Yok.
P. *japonica* Yok.
Bolivina euplectela Yok.
Bullimina capitata Yok.
B. *polymorphinoides* Yok.
B. *baccata* Yok.
B. *schwageri* Yok.
B. *ezoensis* Yok.
B. sp.
Pleurostomella peregrina Yok.
Polymorphina seminulina Yok.
Frondicularia scolopendralia Yok.
Frondicularia sp.
Nucula poronaica Yok.
Nucula picturata Yok.
Venericardia compressa Yok.
Lucina poronaiensis Yok.
Thyasira bisecta Conrad
Tapes ezoensis Yok.
Turritella wadana Yok.

There are also a few species belonging to *Yoldia*, *Pecten*, *Tellina*, *Neptunea*, *Buccinum*, etc. Of these fossils, the most common are *Venericardia compressa*, *Nucula picturata*, *N. poronaica*, one or two species of *Yoldia*, *Turritella wadana* and *Bullimina*. In general, the fauna of the Poronai Shale is rich in number of individuals, but poor in species.

The Poronai Series is not limited in its distribution to the Ishikari coal-field, but extends to the provinces of Teshio, Kitami, Tokachi, Kushiro and Hidaka.

2. The Kawabata Series. The two series of Poronai and Kawabata are connected by a transition group, 60-90 m. thick; the Poronai shale is here interbedded with sandstone in thin layers. The typical Kawabata, more than 900 m. thick, consists of thin-bedded sandstone and shale in regular alternation; more or less thick-bedded near the base; also intercalating conglomerate with pebbles of Palaeozoic rocks, granite, diorite and augite andesite. Many fossil shells are enclosed in the shale and sandstone at various horizons; the molluscan fauna has a decidedly younger aspect than that of the Poronai Series.

THE GEOLOGICAL STRUCTURE OF THE ISHIKARI COAL-FIELD

Though the detailed geological structure of the Ishikari coal-field is certainly extremely complicated and there are many features still puzzling to us, yet its grand aspect is easy to grasp.

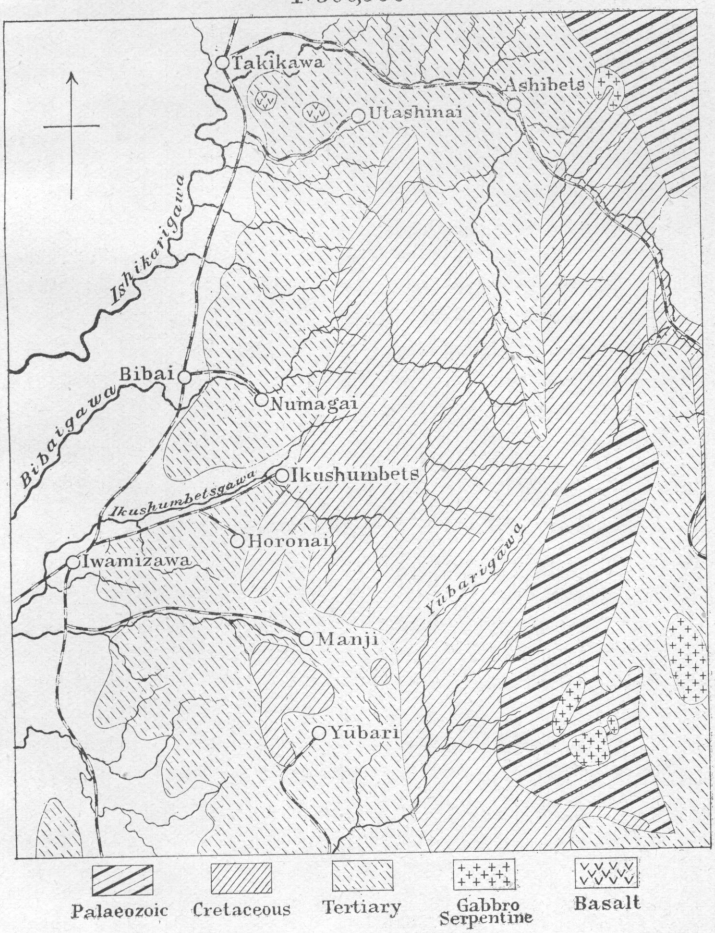
The river Ikushunbets, with its average E-W trend, divides the coal-field into two unequal portions. In the northern part there is Mt. Bibai extending from north to south and attaining 814 m.; geologically, this is an anticline, with the Lower Ammonites Beds at its core and successively overlain by the *Trigonia* Sandstone, the Upper Ammonites Beds, and the Ishikari and Poronai Series successively on both wings. The Tertiary rocks of the western wing are variously dislocated by folding and faulting, such as we are familiar with in mining districts between Utashinai in the north and Bibai in the south; whereas those of the eastern wing form a single syncline, which is bordered by a meridional fault, some 4 km. east of the valley of Ashibets. To the east of the dislocation line, there are again exposed the Cretaceous rocks of west dip, and from there on come into sight the Upper Ammonites Beds, *Trigonia* Sandstone and Lower Ammonites Beds with *Orbitolina* limestone in regular order from west to east.

The crest line of the Mt. Bibai anticline sinks northward; on the other hand, southward and near the Ikushunbets, it divides into two. While the western anticline, extending SSW beyond the river to the Horomui, is acute and asymmetrical, with its west wing vertical or inverted and the east wing rather gentle, the eastern anticline is rather broad and flat, having entirely lost its cover of Tertiary rocks. South of the Ikushunbets, the two anticlines embrace a rather broad syncline or synclinorium, opening to the south. This is composed of Tertiary rocks which show multiple series of folds and faults. The broad dome of the Cretaceous rocks lying west of the Manji Colliery and the narrow anticline of the same along the Ponhorokabets, a tributary of the Shihorokabets, in the Yûbari mining district, are the southern continuation of the western anticline, gradually becoming broader and at the same time much lower.

The synclinorium of Tertiary rocks in the southern Ishikari coal-field, alluded to above, is bordered on the east by the Cretaceous rocks along a line which extends from the lower course of the Penkehoroka-yûbari, a right tributary of the Shi-yûbari, due southward into the drainage area of the Mukawa, in the province of Iburi, for a distance

Geological Sketch Map of the Ishikari Coal-Field

1:500,000



of over 20 km. Along the geological-boundary line, both the Cretaceous and Tertiary rocks are inverted or upturned; downstream along the transverse valley of the Yûbari-gawa, there is a series of excellent exposures of the Ishikari and Poronai Series showing a number of recumbent folds and overthrusts, or, taken altogether an imbricate structure, of east dip. The most complicated structure in the entire Ishikari coal-field, is, however, developed along another line, marking the northeastern border of the synclinorium of the Tertiary rocks and extending from the lower course of the Penke-horokayûbari along the water-shed between the Horomui and Ikushunbets rivers to the upper valley of the Bannosawa, a left tributary of the Ikushunbets. In the drainage areas of the Penke- and Panke-horokayûbari, Messrs. Imai and Yabe found a flat sheet of Cretaceous rocks lying upon the much folded and faulted Ishikari and Poronai Series, a typical "Decke."

In the Ikushunbets mining district to be visited in the present excursion, the upturned Poronai shale is followed successively eastward by the Ikushunbets Group of the Ishikari Series, the Upper Ammonites Beds, *Trigonia* Sandstone and Lower Ammonites Beds, all in the same disposition. However, the two members of the Upper Ammonites Beds, the Hakobuchi Sandstone and *Yezoites* Beds are entirely squeezed out and not exposed along the Ikushunbets, while a part of the *Yezoites* Beds are found intact between the *Trigonia* Sandstone and the Ishikari Series at a short distance north and south of the river course. The Upper Ammonites Beds, on the other hand, are well developed on the eastern wing of the anticline.

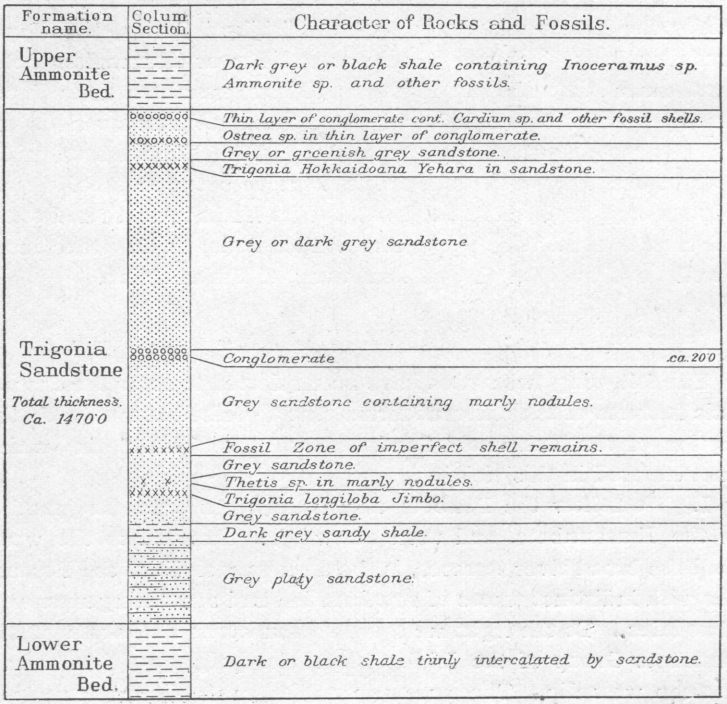
ITINERARY

The following two routes have been selected to show the characteristic features of the different formations described above, with the exception of the Hakobuchi Sandstone and Kawabata Series, which are not exposed in this vicinity.

I. We follow the Ponbets first northwards from its junction with the Ikushunbets, and then eastwards. Exposed to the west, beyond the broad river terraces, is the dark gray shale of the Poronai Series with indistinct traces of stratification and containing numerous marl nodules. To the right are seen the sandstone and shale of the Ikushunbets Group of the Ishikari Series in upright position or in a very steep west dip. There are intercalated in the Group more than

20 coal seams, of which 10 are more than 1 m. thick and workable. Beneath it lies the *Woodwardia* Zone which is here much reduced in thickness, measuring some 10 m.; a black shale exposed along the left bank is rich in plant leaves. Upstream, the Ishikari Series is succeeded by a thick dark gray shale of the Upper Ammonites Beds with W 80° dip, about 120 m. thick; a thin greenish sandstone layer at the top of the shale encloses rarely *Cucullaea* sp. and is believed also to belong to the Cretaceous, while just at the boundary between it and the *Woodwardia* Zone it is covered with detritus. The shale of the Upper Ammonites Beds contains *Inoceramus*, a few ammonites and other fossils, and is conformably underlain by the *Trigonia* Sandstone, (about 440 m. thick) and the Lower Ammonites Beds successively. The details are given in the following columnar section.

Columnar Section of the Trigonia Sandstone exposed along the Pombets-gawa, near the Pombets Colliery, Sorachi-gun. Scale 1:6000.

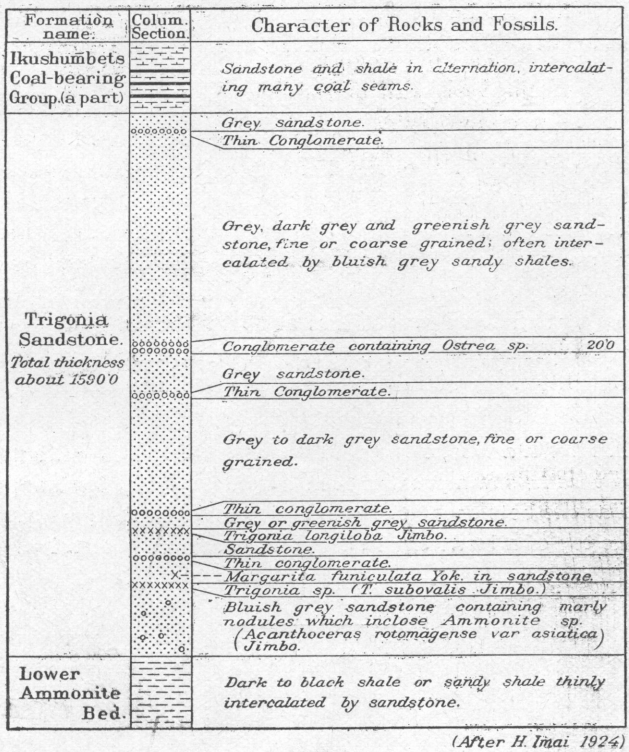


(After H. Imai 1924)

II. We follow the Ikushunbets southwestwards from the Ikushunbets Colliery. The Poronai Series, Ikushunbets Group, *Trigonia* Sandstone and Lower Ammonites Beds are well-exposed along the valley-walls, all inverted and inclining steeply eastwards. The Poronai Series is sandy and glauconitic near the base; the Ikushunbets Group apparently overlying the Poronai Series is some 550 m. thick at this place, intercalating more than 10 coal seams, of which 7 are thicker than 1 m. and workable. The next older *Woodwardia* Zone as well as the Upper Ammonites Beds, exposed along the Ponbets, are entirely excluded at this place, and the Ikushunbets Group is directly overlain by the *Trigonia* Sandstone. The river cuts a deep gorge through the sandstones of the two groups, which are quite intact; their precise boundary is hardly discernible.

Columnar Section of the Trigonia Sandstone exposed along the Ikushumbets-gawa, near Ikushumbets Colliery.

Scale, 1:6000.



(After H. Imai 1924)

The *Trigonia* Sandstone is 450 m. thick and very rich in fossils in its lower part (stratigraphically), *Trigonia*, *Thetironia* and *Pectunculus* being most common. Just above the gorge, it is apparently overlain by a complex of thin-bedded shale and sandstone in alternation,—the *Lytoceras ezoense* Zone of the Lower Ammonites Beds.

The Lower Ammonites Beds, which here constitute the core of a large recumbent anticline, continue to be exposed along the valley upstream for a distance of about 1.5 km.; whereas the second gorge of the river is occupied by the *Trigonia* Sandstone; the dip of the eastern wing is rather low, being 60°–30°. The Upper Ammonites Beds exposed upstream are very fossiliferous, and numerous marl nodules derived from the complex and containing beautifully preserved ammonites and other fossils are found as float on the river bed.

POSTSCRIPT

To Tokachi-dake on p. 2. A disastrous accident took place on the occasion of the eruption of Tokachi-dake on the evening of May 24, this year. The direct effect of the explosion was not of much significance; the west wall of the small central cone was destroyed, giving place to a new explosion craterlet, about 100 m. long and 50 m. wide; the waters of the crater lake, mingled with heated material from the destroyed crater wall, produced a mud flow which rushed down the steep western slope of the mountain into the narrow valley of the Furano-gawa. The mud flow was soon augmented by melting snow and swept everything before it soil, rock debris, trees, etc. After having run down over 20 km. in about half an hour, it reached the plain of Kami-Furano, covering it with debris, and annihilating the village of Kami-Furano. More than 150 persons were lost.

Mr. M. Watanabe, to whom I owe the above information, further reported that he saw a peculiar rock body with a very fresh appearance exposed at the bottom of the newly formed craterlet, which is very likely the top of a lava plug in the initial stage of protrusion.

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Fig. 1. East-West Profile across the water-shed between the upper course of the Bibai-gawa and the main course of the Ashibets, showing the order of succession of the Pectinacous and the Tertiary formations, drawn somewhat diagramatically. 1:50,000 After K. Imai, 1924.

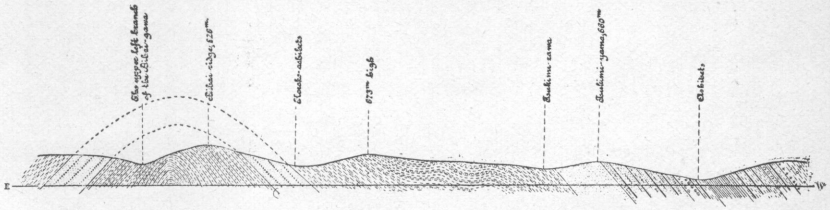


Fig. 2. NW-SE Profile along the Valley of Shushumbets above the Shushumbets Colliery. 1:20,000 After K. Imai, 1924

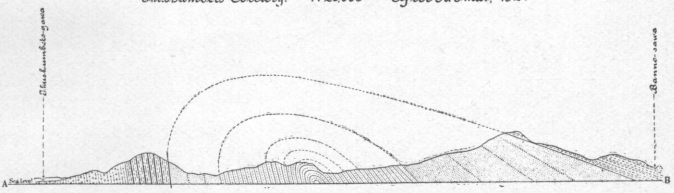
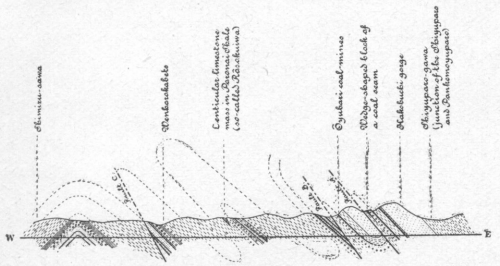
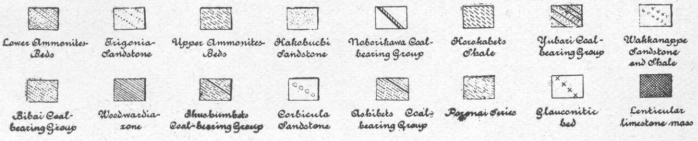


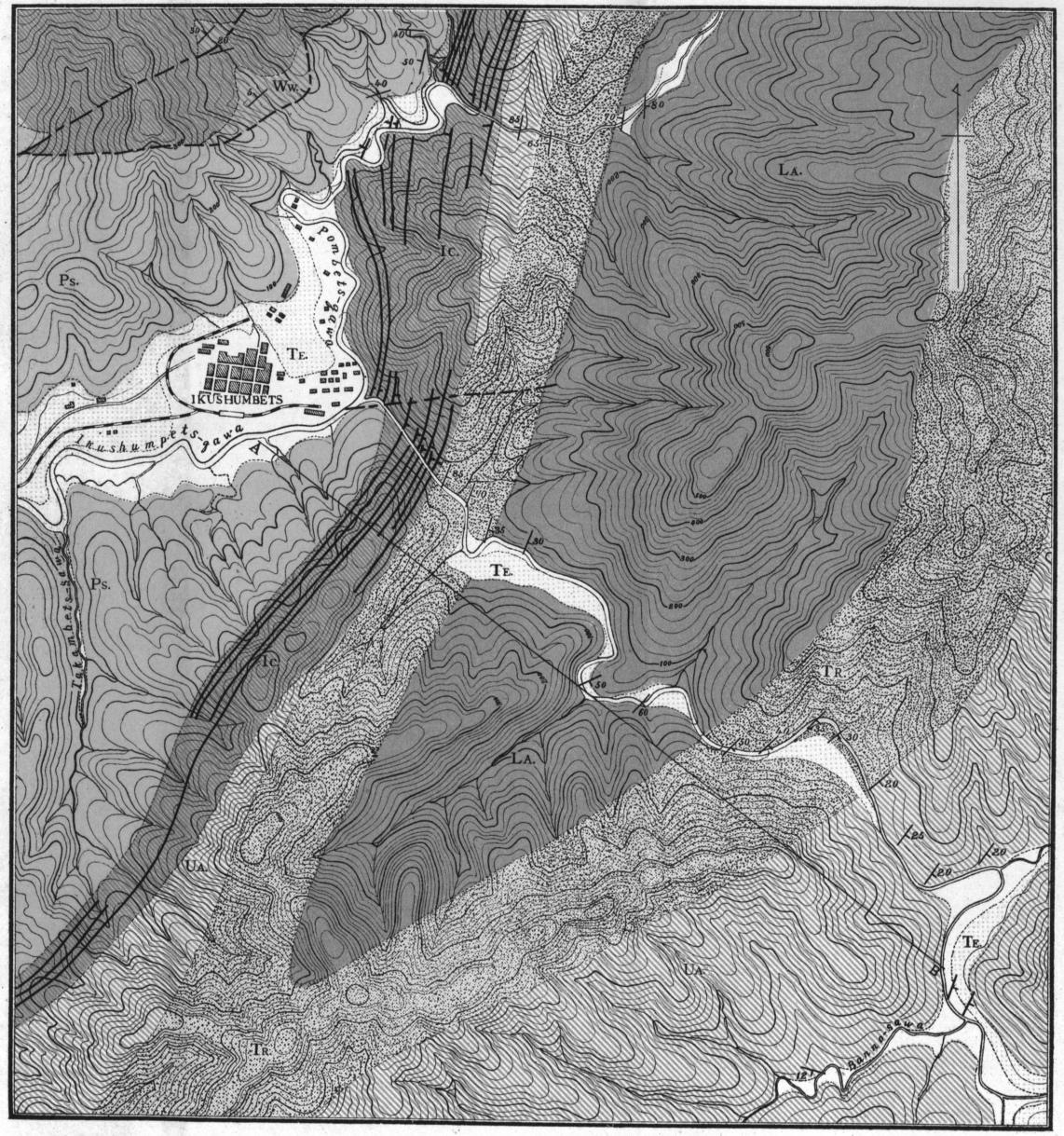
Fig. 3. Profile along the right bank of the Yubarigawa from the so-called Hakobuchi gorge near Oyubari to Shimizusawa, showing the relation of the Pronai Series and the underlying formations. 1:50,000 After K. Imai 1924.





GEOLOGICAL MAP OF THE ENVIRONS OF IKUSHUNBETS, THE ISHIKARI COAL FIELD, HOKKAIDÔ.

PLATE I.



LEGEND.

Ts	The Terrace Deposits.	
La	The Lower-Ammonites Bed.	Cretaceous.
Tr	The Trigonia Sandstone.	
Ua	The Upper-Ammonites Bed.	
Ww	The Woodwardia Zone.	Older-Tertiary. (The Ishikari-Series)
Ic	The Ikushunbets Coal-Bearing Group.	
Ps	The Poronai Series.	Younger-Tertiary.

——— Fault Line. ——— Coal Seam.

SCALE 1 : 40,000.

CONTOUR INTERVAL 20 METERS.

AFTER H. IMAI, 1924.

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