G. Hassall.
October, 1980
ABSTRACT.

EL 2038, Mt. Shoobridge North, was granted to AAR Limited on the 15th August, 1979 for a period of twelve months.

During 1980 the area was geologically mapped at a scale of 1:25,000 with the aid of colour aerial photographs. Within the EL Lower Proterozoic rocks of the Zamu Dolerites and the Mt. Partridge, South Alligator and Finnis River Groups are present. The rocks have been domed and faulted by the intrusion of the early Carpentarian Fenton Granite. Ground radiometric and rock-chip sample surveys were conducted.

An application for a twelve month renewal has been submitted.
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Appendix 2. Thin Section Descriptions.
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Map 1. Geological Map EL 2038  Scale 1:25,000
Map 2. Sample Location Map EL 2038  Scale 1:25,000
1. **INTRODUCTION.**

This report describes the results of work carried out on EL 2038, Mt. Shoobridge North, during 1979/80.

Tenure was granted to AAR Limited for all minerals on the 15th August, 1979.

1.1 **Location and Access.**

EL 2038 is located approximately 120 kilometres south-south-east of Darwin (Figure 1). The area occurs within the Pine Creek 1:250,000 Geological Sheet area and the Tipperary 1:63,360 Geological Series area. A detailed description of the boundaries of the EL is as follows:-

All that piece or parcel of land in the Northern Territory of Australia containing an area of 5.14 square miles (13.30 sq. km) more or less, the boundary of which is described as follows:-

Commencing at the intersection of latitude 13 degrees 34 minutes with longitude 131 degrees 22 minutes thence proceeding to the intersection of latitude 13 degrees 34 minutes with longitude 131 degrees 26 minutes thence proceeding to the intersection of latitude 13 degrees 35 minutes with longitude 131 degrees 26 minutes thence proceeding to the intersection of latitude 13 degrees 35 minutes with longitude 131 degrees 22 minutes thence proceeding to the intersection of latitude 13 degrees 34 minutes with longitude 131 degrees 22 minutes.

Access to the eastern portion of the area is gained via the sealed Old Stuart Highway and side road to Douglas Springs. The sealed Douglas Springs road passes through the EL and this combined with numerous tracks in the area affords easy access.

The sealed road to Ooloo, also off the Old Stuart Highway, passes near the western boundary.
LOCATION MAP.

E.L. 2038 — MT. SHOOBRIDGE NORTH
1.2 Topography and Climate.

Within the EL the topography consists of low hills, with rocky outcrops, having a relief of up to 40 metres. The granitic areas are mainly flat to slightly undulating due to the development of lateritic soils. Outcrops of granite are rare. The river and creek valleys consist of granitic sand or 'black soil' plains.

Climate is sub-tropical. The monsoonal season occurs from November to April, during which most of the annual rain falls in torrential storms. Rain fall averages more than 1 200 mm annually. During this time humidity is constantly high and temperatures range from 30-40°C. For the remainder of the year the humidity is lower with variations in temperature ranging from 30°C during the day to 10°C or less at night.

1.3 Tenement Situation.

Exploration Licence 2038 was granted to AAR Limited on the 15th day of August 1979 for a period of twelve months with a minimum expenditure of $1,250. A detailed expenditure statement is presented as Appendix 1.

Implementation of exploration programmes in the Licence area is being undertaken by Mines Administration Pty. Ltd., a wholly owned subsidiary of AAR Limited.

An application for a twelve month renewal of the area has been submitted.

1.4 Previous Work.

The earliest geological investigations of the Pine Creek region resulted from the discovery of gold in 1872. A number of the mining fields and mines were mapped with the aid of aerial photographs by the Aerial, Geological and Geophysical Survey of Northern Australia between 1935 and 1939.
The BMR has carried out a number of regional mapping programmes which have included the EL. The area was studied at 1:63,360 scale in the Tipperary Inch to a Mile Geological Map Series (1959) and 1:250,000 scale in the Pine Creek Geological Sheet (Malone, 1962).

Walpole et al. (1968) compiled all existing literature and mapping pertaining to the Katherine-Darwin Region. More recently, mapping of the entire Pine Creek Geosyncline was completed at 1:500,000 scale (Needham et al., 1980).

During 1966, United Uranium initiated an exploration programme for base metals over an area which included the present EL (Sturm 1966). Work carried out included detailed examinations of all known mineral occurrences and a reconnaissance stream sediment sampling programme to locate additional prospects.

CRA carried out a regional mapping and soil and rock chip sampling programme on an area to the west of EL 2038 during 1978. Their work was oriented toward base metal exploration with major emphasis on the investigation of ironstones (Iksturms, 1979).

2. REGIONAL GEOGRAPHY

Exploration Licence 2038 is located near the centre of the Pine Creek Geosyncline. The regional geology of the Pine Creek Geosyncline has been described in detail by Needham et al. (1980) and will be discussed only briefly in this report.

By correlating a Tuffaceous sequence Needham et al., (op cit) have now defined the Pine Creek Geosyncline as a single intracratonic basin containing a thick sequence of mainly pelitic and psammitic Lower Proterozoic sedimentary rocks with interlayered tuff units resting on an Archean granitic basement. Cover rocks, of Carpentarian and younger age, unconformably overlie all of these rocks and conceal the basin margins (Table 1).

2.1 Archean Basement.

The Archean Basement is represented by the domes of the Rum Jungle/Waterhouse and Nanambu Complexes. Possible Archean rocks
<table>
<thead>
<tr>
<th>AGE</th>
<th>GROUP</th>
<th>FORMATION</th>
<th>LITHOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cretaceous</td>
<td>Bathurst-Island F.</td>
<td>Fine to medium grained marine sandstones.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tindall Limestone.</td>
<td>Crystalline limestone.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Antrim Plateau Volc.</td>
<td>Massive vesicular basalt, minor agglomerate.</td>
</tr>
<tr>
<td>Lower</td>
<td>Depot Creek Sandstone,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proterozoic</td>
<td>Katherine River Gp.</td>
<td>Kombolgie Form.</td>
<td>Medium to coarse quartz sandstone, minor andesite basalt and</td>
</tr>
<tr>
<td>(Carpentarian)</td>
<td></td>
<td></td>
<td>rhyolite.</td>
</tr>
<tr>
<td></td>
<td>Kapalga Form.</td>
<td></td>
<td>Ferruginous siltstone, chert bands.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gerowie Tuff.</td>
<td>Black-green cherty tuff, green argillite, green tuffaceous</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>greywacke.</td>
</tr>
<tr>
<td></td>
<td>Koolpin Form.</td>
<td></td>
<td>Ferruginous siltstone with chert bands, pyritic carbonaceous</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>shale, silicified dolomite minor jasper.</td>
</tr>
<tr>
<td></td>
<td>Mount Partridge Gp.</td>
<td>Nourlangie Schist</td>
<td>Quartz mica schist, mica quartz schist, minor quartzite.</td>
</tr>
<tr>
<td></td>
<td>Wildman Siltstone.</td>
<td></td>
<td>Siltstone, in places carbonaceous at depth, red and cream</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>laminated siltstone, minor quartzite and quartz greywacke.</td>
</tr>
<tr>
<td>Age</td>
<td>Group</td>
<td>Formation</td>
<td>Lithology</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------</td>
<td>----------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Mount Partridge Gp. (Contd)</td>
<td>Acacia Gap Sandstone Member.</td>
<td>Quartz sandstone and feldspatic sandstone with pyritic carbonaceous siltstone and quartz siltstone interbeds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mount Hooper Sandstone.</td>
<td>Medium quartz sandstone and quartzite with some chert fragments, siltstone, phyllite, feldspatic quartzite, pebbly in places, chert pebble conglomerate cross-bedded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mundogic Sandstone.</td>
<td>Coarse medium quartz sandstone and orthoquartzite, commonly pebbly quartz pebble conglomerate, siltstone cross-bedded scoured and graded beds. Minor schist amphibolitic in places.</td>
<td></td>
</tr>
<tr>
<td>Namooa Group</td>
<td>Stage Creek Volcanics</td>
<td>Mafic volcanic breccia hawaiite, tuff, tuffaceous shale, tuffaceous greywacke.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cahill Formation.</td>
<td>Mica feldspar quartz schist, quartz mica schist, with garnet, amphibole and kyanite in places, carbonaceous schist, crystalline dolomite-magnesite, and calc-silicate gneiss near base.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Masson Formation.</td>
<td>Ferruginous shale (mostly pyritic and carbonaceous at depth) fine-coarse calcareous and volcanic greywacke, calcarenite, sandstone, limestone.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crater Formation.</td>
<td>Feldspatic sandstone, pebble conglomerate, siltstone, pyritic in part, basal ferruginous conglomerate in places.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Celia Dolomite</td>
<td>Dolomite, magnesite, silicified or with algal structures in places, tremolite schist, minor sandstone, arkose, carbonaceous sediments.</td>
<td></td>
</tr>
<tr>
<td>AGE</td>
<td>GROUP</td>
<td>FORMATION</td>
<td>LITHOLOGY</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------------</td>
<td>-----------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Batchelor Group, (Contd)</td>
<td>Beestons Formation</td>
<td>Arkose, feldspathic sandstone, conglomerate, siltstone.</td>
</tr>
<tr>
<td></td>
<td>Kakadu Group</td>
<td>Munmarlary Quartzite</td>
<td>Gneissic massive to friable orthoquartzite, minor schist.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mount Howship Gneiss</td>
<td>Very coarse white feldspathic leucogneiss, minor schist, rare garnet and amphibole.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kudjumarndi Quartzite</td>
<td>Orthoquartzite, quartz gneiss, minor schist, rare cross-bedding, rare amphibole.</td>
</tr>
<tr>
<td></td>
<td>Mount Basedow Gneiss</td>
<td></td>
<td>White-grey-pink coarse muscovite biotite gneiss, granitoind gneiss minor schist.</td>
</tr>
<tr>
<td>Archaean</td>
<td>Rum Jungle Complex</td>
<td></td>
<td>Gneiss, migmatite, leucocratic granite, biotite - chlorite schist, amphibolite and quartzite.</td>
</tr>
<tr>
<td></td>
<td>Waterhouse Complex</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nanambu Complex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Carpentarian)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Proterozoic</td>
<td>Zamu Dolerite.</td>
<td></td>
<td>Differentiated continental tholeiitic basalt sills, olivine dolerite, metamorphosed to amphibolite in places.</td>
</tr>
</tbody>
</table>
outcrop in the Woolner area. All the complexes consist mainly of gneisses, migmatites and leucocratic granites with minor schists, metasediments and banded iron formations. All the Archean basement rocks have anomalous uranium concentrations and are possible source rocks for the deposits in the Pine Creek Geosyncline.

2.2 Lower Proterozoic Sedimentary Rocks.

The oldest known Lower Proterozoic rocks are those of the Batchelor and Kakadu Groups which rest unconformably on Archean basement. The Batchelor Group, which surrounds the Rum Jungle/Waterhouse complex contains arkosic rudites, psammites, conglomerates, and minor shales of the Beetsons and Crater Formations interbedded with massive crystalline carbonates of the Celia and Coomalie Dolomites. The Kakadu Group is best developed and adjacent to the Nanambu Complex and is comprised mainly of meta-arkose and paragneiss.

These two basal groups are overlain by the pelites and psammites of the Namoona Group. The dominant unit in this group is the Masson Formation which extends from west of the Rum Jungle/Waterhouse Complex almost to the South Alligator River. Further east it is thought to be equivalent to the lower member of the Cahill Formation, a partly calcareous and carbonaceous sequence of micaceous quartz-feldspathic schist, with lenses of massive carbonate. These two units are the hosts to the major uranium deposits in the Rum Jungle and Alligator River areas. In the centre of the geosyncline the Masson Formation is unconformably overlain by the Stag Creek Volcanics. Elsewhere the Masson Formation is overlain by the sandsstone-siltstone assemblage of the Mount Partridge Group which contains the Mundogie Sandstone Mount Hooper Sandstone and Wildman Siltstone and correlates with the Acacia Gap Sandstone in the Rum Jungle Area. East of the South Alligator River the Mundogie Sandstone correlates with feldspathic quartz schist of the upper Cahill Formation and the overlying Wildman Siltstone correlates with the Nourlangie Schist.
Overlying the older rocks is the South Alligator Group which comprises the Koolpin Formation, Gerowie Tuff and Kapalga Formation. Together with the Koolpin Formation, the overlying Gerowie Tuff provides the main evidence for correlating the strata of the western and central parts of the geosyncline. The Kapalga Formation is the youngest unit in the South Alligator Group and represents a transitional sequence between the South Alligator Group and the overlying Finniss River Group.

The Finniss River Group is the youngest Lower Proterozoic Group and consists of a monotonous sequence of siltstone, slate, shale and greywacke. The Finniss River Group is made up of the Burrell Creek Formation, the Fisher Creek Siltstone and the Chilling Sandstone. The Burrell Creek Formation grades laterally and upwards into the Chilling Sandstone. The Fisher Creek Siltstone is present in the South Alligator Valley area and is a correlative of the Burrell Creek Formation.

At or near the end of sedimentation in the Lower Proterozoic the rocks were intruded by a suite of dolerites, mainly sills, known as the Zamu Dolerites. At approximately 1 800 m.y. the sills and sedimentary rocks were deformed and regionally metamorphosed. Both the grade of metamorphism and degree of deformation increased towards the north east of the geosyncline. The metamorphics were then intruded and in places domed by early Carpentarian granite plutons. This was followed by the intrusion of a series of tholeitic lopoliths known as the Oenpelli Dolerites.

3. RESULTS OF FIELD INVESTIGATIONS, 1980

Geological Mapping of EL 2038 at a scale of 1:25,000 using colour aerial photographs commenced on the 8th July, 1980. Base maps and an air-photo interpretation had been completed in January, 1980 by Hunting Geology and Geophysics (Australia) Pty. Ltd.

In conjunction with the mapping a foot-borne radiometric survey and a rock-chip sampling programme were conducted.
3.1 Geology.

Lower Proterozoic Sedimentary Rocks.

Within the EL Lower Proterozoic sedimentary rocks of the Mt. Partridge, South Alligator and Finnis River Groups are present. The oldest rocks outcropping belong to the Wildman Siltstone, a unit in the Mt. Partridge Group. The Wildman Siltstone has been divided into three members, all of which outcrop within the EL - Pld 4, Pla and Pld 5, by Needham et al. (1980).

Pld 4 outcrops in the western section of the project area as a grey to black, fine grained, well sorted, carbonaceous, micaceous meta-siltstone exhibiting crenulation cleavage. Interbedded with the Pld 4 meta-siltstones are minor amounts of Pla quartz sandstone/quartzite. This rock is whitish, equigranular, medium to coarse grained and consists of sub-angular quartz grains with minor mica flakes.

In the eastern portion of EL 2038 Pld 4 outcrops as a coarse grained, porphyroblastic, micaceous, slightly haematitic schist. Interbeds of Pla are much more common. Lithologically Pla is as for in the western section except for the presence of minor haematite giving the quartz sandstone a purple - red colour in places.

Pld 5 overlies Pld 4 and consists of interbedded 'sugary' quartzite - fine to medium grained, slightly haematitic - and minor micaceous, slightly carbonaceous and haematitic siltstones. These siltstones are fine grained, well sorted and thinly bedded with the quartzites.

Conformably overlying Pld 5 is the Koolpin Formation which is the oldest formation of the South Alligator Group. Within the EL this formation is comprised of haematitic, carbonaceous siltstones exhibiting crenulation cleavage and massive ironstone with interbedded chert layers and ferruginous siltstones.
The Gerowie Tuff overlies the Koolpin Formation and outcrops in the extreme north-west corner of EL 2038. The formation consists of interbedded cherts, quartzites and minor siltstones. The chert is blue black in colour on fresh surfaces and whitish on weathered surfaces. It is very indurate and has a conchoidal fracture. The quartzites are medium grained with minor haematite bands. The greyish siltstones are fine, even grained rocks and are quite soft.

The Kapalga Formation, youngest formation of the South Alligator Group outcrops in the eastern section of the EL where it is in fault contact with Pld 4. It consists of thinly bedded fine grained, well sorted, haematitic siltstones and contorted chert bands and nodules.

Overlying the Kapalga Formation is the oldest formation in the Finniss River Group - the Burrell Creek Formation which consists of retrograded cordierite schists and hornfelses. The hornfelses contain closely packed ovoid sericite aggregates with interstitial muscovite and quartz. The rock has a spotty fabric with geothite patches after ?pyrite. The spotted schists have green biotite spots with sericite envelopes in a schistose matrix of muscovite, quartz and geothite. The spots were probably cordierite now retrograded. Thin section descriptions of 3 rock-chip samples are given as Appendix 2.

Igneous Rocks.

The oldest igneous rocks outcropping in the project area are fine to coarse grained dolerite sills belonging to the Zamu Dolerites. The sills have been folded with the surrounding sedimentary rocks.

Several pegmatite veins intrude the Lower Proterozoic sedimentary rocks. Mineralogically the veins consist of large books of muscovite and tourmaline crystals in a quartz groundmass. The largest vein outcropping in the area intrudes the Koolpin Formation and possibly was emplaced along a pre-existing fault. This theory is substantiated by the discontinuity of a NE-SW trending fault after it intersects the pegmatite vein.
The early Carpentarian Fenton Granite outcrops in the central portion of the EL. Intrusion of the granite has caused doming and associated faulting of the overlying Lower Proterozoic sedimentary rocks. The granite has been lateritized and rarely outcrops within the EL. Where it is exposed the granite consists mainly of a coarse-grained porphyritic hornblende-biotite adamellite with minor coarse grained hornblende-biotite grandodiorite which is foliated in places.

**Structure.**

Doming of the overlying Lower Proterozoic Sedimentary and igneous rocks has been caused by the intrusion of the Fenton Granite. Associated NW-SE and NE-SW trending faults occur. A major N-S fault which has caused the juxtaposition of Pld 4 and the Kapalga Formation is located in the eastern section of Mt. Shoobridge North.

3.2 **Geochemistry.**

Seven rock-chip samples were collected and assayed for Cu, Pb, Zn, U and W. Two samples were also analysed for As and Au. Results are given as Appendix 3. Some relevant statistical data is presented below as Table 2.

<table>
<thead>
<tr>
<th>Table 2.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>Range</td>
</tr>
<tr>
<td>Mean</td>
</tr>
</tbody>
</table>

* All values in ppm.

Sample Mt. S 5 was not included in the calculations as it is anomalous and would create inaccurate statistical results. Values of 0.20% Cu, 0.10% Pb and 75 ppm U were recorded for this sample.
3.3 Geophysics.

In conjunction with geological mapping a ground radiometric survey was conducted using a hand-held GIS-3 Spectrometer. A total of 22.5 line kilometres of gridding was completed on 250 x 250 metre centres. Readings were taken every 20 metres along the east-west lines. A grid plan and the results are presented as Appendix 4.

4. CONCLUSIONS.

Geological mapping of EL 2038, Mt. Shoobridge North, has delineated the following Lower Proterozoic rock groups and formations:

(b) South Alligator Group: Koolpin Formation, Gerowie Tuff, Kapalga Formation.
(c) Finniss River Group: Burrell Creek Formation.
(d) Zamu Dolerites.

The rocks have been domed and fractured by the intrusion of the early Carpentarian Fenton Granite. Pegmatite veins have also been intruded.

Seven rock-chip samples were collected and assayed for Cu, Pb, Zn, U and W. As well, two samples were analysed for As and Au. Samples Mt. S. 5 contained anomalous concentrations of Cu, Pb and U. A ground radiometric survey totalling 22.5 line kilometres was completed.
5. REFERENCES.


APPENDIX 1
BRISBANE
2nd September, 1980

MINES ADMINISTRATION PTY LIMITED

STATEMENT OF EXPENDITURE
EL 2038 MT. SHOBRIDGE (NORTH)

YEAR ENDED 14.8.80

REF : AC/MDE

$  

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries and Wages</td>
<td>926</td>
</tr>
<tr>
<td>Consultants Fees</td>
<td>1,144</td>
</tr>
<tr>
<td>Travel and Accommodation</td>
<td>228</td>
</tr>
<tr>
<td>Communications</td>
<td>7</td>
</tr>
<tr>
<td>Drafting Air Photography, Printing, etc.</td>
<td>155</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2,460</strong></td>
</tr>
</tbody>
</table>

G. B. Monk,
Accountant.
APPENDIX 2
## Thin Section Descriptions

<table>
<thead>
<tr>
<th>SAMPLE NO.</th>
<th>ROCK TYPE - COMPOSITION</th>
<th>FABRIC</th>
<th>MINOR MINERALS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT.S. 4</td>
<td>Spotted Schist. Small, elongate greenbiotite spots with sericite envelopes, in schistose matrix of muscovite flakes, fine interstitial quartz, goethite.</td>
<td>Good schistosity, with lineation of elongate spots. Fine-grained. Coarser quartzose bands (clastic). Crosscutting quartz veins.</td>
<td></td>
<td>Spots were probably cordierite or similar aluminosilicate, now retrograde. Quartz bands are relict beds, parallel with schistosity.</td>
</tr>
<tr>
<td>MT.S. 6</td>
<td>Quartz-Hematite Rock. Alternating crenulated bands of quartz (pseudomorphous) and fine, compact hematite (replacive); all metasomatic.</td>
<td>Present banding reflects original compositional banding. Relict fibrous textures. Fine granular apatite stringers. Chlorite veinlets (oxidised, yellow).</td>
<td></td>
<td>Possibly originally a banded calcsilicate (with ?amphibole ?epidote bands), now completely silicified, hematitised.</td>
</tr>
<tr>
<td>SAMPLE NO.</td>
<td>Cu.</td>
<td>Pb</td>
<td>Zn</td>
<td>U</td>
</tr>
<tr>
<td>------------</td>
<td>-----</td>
<td>-----</td>
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</tr>
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<td>Mt. S. 1</td>
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<td>15</td>
<td>2</td>
<td>4</td>
</tr>
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<td>20</td>
<td>4</td>
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<td>Mt. S. 4</td>
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